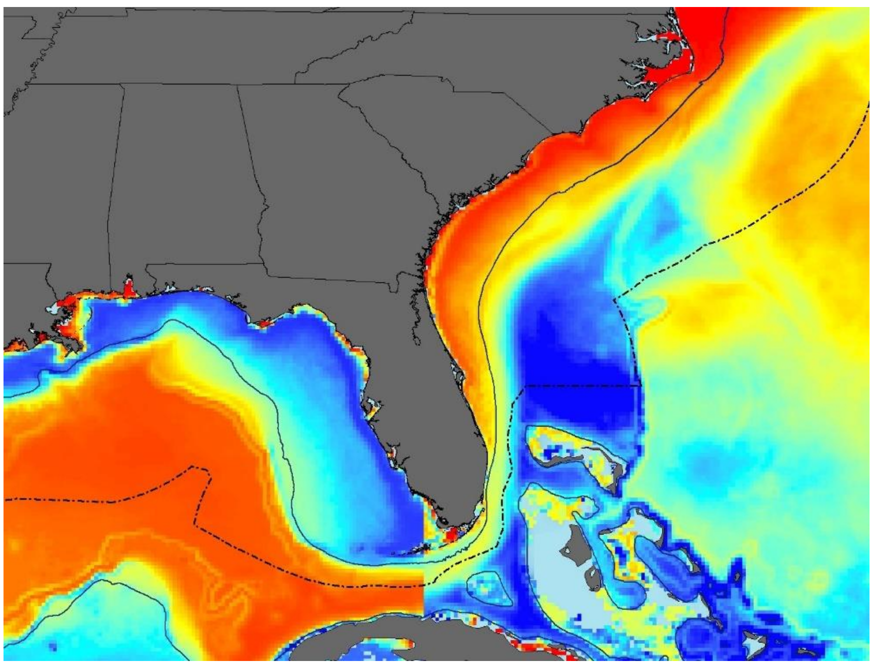
DRAFT AMENDMENT 15
TO THE
2006 CONSOLIDATED ATLANTIC HIGHLY MIGRATORY SPECIES FISHERY MANAGEMENT PLAN

Including:
A Draft Environmental Impact Statement,
A Draft Regulatory Impact Review,
An Initial Regulatory Flexibility Analysis,
A Draft Social Impact Assessment



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Highly Migratory Species Management Division
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Cover Sheet

RESPONSIBLE FEDERAL AGENCY: U.S. Department of Commerce (DOC); National Marine Fisheries Service (NMFS or NOAA Fisheries)

TITLE: Draft Amendment 15 to the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan

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ABSTRACT:
Draft Amendment 15 has two broad components: 1) modification, data collection, and assessment of four commercial longline spatial management areas; and 2) administration and funding of the highly migratory species (HMS) pelagic longline electronic monitoring (EM) program.

The first considers modification, data collection, and analysis of four current spatial management areas that restrict or prohibit commercial fishing (Mid-Atlantic shark, Charleston Bump, East Florida Coast, and DeSoto Canyon closed areas). These closed areas have been in place for up to 20 years and the prohibition on fishing during all or part of the year has led to a commensurate decrease in fishery-dependent data, complicating efforts to assess the effectiveness of the areas in meeting conservation and management goals. To address the lack of fishery-dependent data inside the closed areas and to assess their effectiveness, Amendment 15 considers a three-part approach. First, potential modifications to the boundaries and/or timing of the closed areas are considered based on the delineation of high and low-bycatch-risk areas identified using a new spatial modeling tool, HMS Predictive Spatial Modeling (PRiSM). HMS PRiSM combines observer-collected catch data with environmental variables (e.g., sea surface temperature, salinity) to create a model that predicts catch of modeled species even in areas where data have not been collected since implementation of the closed areas. Modeling results can also be used to identify areas with low and high bycatch risk, based on the model-produced probability of interactions. HMS PRiSM allows for boundaries of closed areas to be modified to allow bycatch risk-appropriate data collection based on predicted interactions with bycatch species. In other words, areas with a high bycatch risk may require more precautionary data collection approaches than lower-bycatch-risk areas. NOAA Fisheries acknowledges that incidental catch is different than "bycatch," which has a specific definition under the Magnuson-Stevens Act, see 16 U.S.C. 1802(2). However, for ease of communication in this rule, unless otherwise noted, "bycatch species" generally refer to all non-target catch species, including incidentally-caught species that fishermen may or may not retain. Second, Amendment 15 would consider data collection programs in the high and low-bycatch-risk areas. Potential data collection programs include voluntary research fishery programs, monitoring areas, and exempted fishing permit research. Third, Amendment 15 would develop a process for routine evaluation of spatial management areas to identify whether conservation and management goals are being met.

The second component considers cost allocation of the HMS pelagic longline EM program. NOAA Fisheries historically has paid all costs associated with the program, however, NOAA Fisheries Policy 04-115-02 (Cost Allocation in EM Programs for Federally Managed U.S. Fisheries) provides guidance that a portion of those costs should be paid for by fishery participants. Amendment 15 considers alternatives to transition sampling costs to industry, while the Agency retains the responsibility for administrative costs.

Chapter 0 EXECUTIVE SUMMARY

Atlantic highly migratory species (HMS) are managed under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and the Atlantic Tunas Convention Act (ATCA). The authority to issue regulations under the Magnuson-Stevens Act and ATCA has been delegated from the Secretary of Commerce to the Assistant Administrator for Fisheries. Current regulations can be found in 50 CFR part 635 and are fully described in the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan (2006 Consolidated HMS FMP) and its amendments.

Overall, to comply with the Magnuson-Stevens Act and ATCA, NOAA Fisheries uses a variety of conservation and management measures to maintain appropriate levels of catch consistent with applicable science-based quotas or other management goals, to minimize bycatch to the extent practicable, and to limit interactions with protected species as required. NOAA Fisheries acknowledges that incidental catch is different than “bycatch,” which has a specific definition under the Magnuson-Stevens Act, see 16 U.S.C. 1802(2). However, for ease of communication in this rule, unless otherwise noted, “bycatch species” generally refer to all non-target catch species, including incidentally-caught species that fishermen may or may not retain. HMS management measures include permitting requirements, regional and seasonal quotas, reporting and monitoring requirements, gear restrictions, closed areas, minimum fish sizes, trip limits, and other measures. Of particular relevance to this document are management measures commonly referred to as “closed areas” (including “time/area closures”), “gear restricted areas,” “monitoring areas,” or “spatial management areas,” which refer to a range of fisheries conservation and management measures that are based on geographic area. These are referred to in this document as “spatial management measures.” Closed areas are typically discrete geographic areas where certain types of fishing are restricted or prohibited (usually by restricting a particular type of gear) for limited periods or the entire year. Closed areas can be particularly effective at reducing or eliminating fishing interactions between particular species and gears.

Since 1999, NOAA Fisheries has implemented a number of closed areas that reduce or prohibit fishing for certain HMS or that restrict the use of certain HMS gear types. After implementation of any management measure, there is a need to determine whether the measure is achieving its objective and whether the balance of associated costs and benefits over time is appropriate. The need to assess the effectiveness of spatial management measures is heightened due to the static nature of the existing spatial management measures, the highly dynamic nature of HMS fisheries, and the highly dynamic nature of the ocean environment. When each of the areas was implemented, NOAA Fisheries stated its intent to monitor and reconfigure them in the future. NOAA Fisheries is following through with that intent in this document, Amendment 15 to the 2006 Consolidated HMS FMP.

Amendment 15 has two broad components:

- Modification, data collection, and assessment of four commercial longline spatial management areas.
- Administration and funding of the HMS pelagic longline EM program.

MODIFICATION, DATA COLLECTION, AND ASSESSMENT OF SPATIAL MANAGEMENT AREAS

Spatial management areas, including closed areas, time/area closures, and gear restricted areas, are an important tool for meeting many fishery management goals. Spatial management areas restrict or prohibit some types of fishing effort in certain areas and during certain times of the year. Often, these areas are implemented to limit the rate and level of target, incidental, and bycatch of fishery resources and protected species. Spatial management areas can also be implemented to reduce gear conflicts among fishing sectors.

However, decreased fishing effort leads to a commensurate decrease in fishery-dependent data collection. Fishery-dependent data, including observer reports and logbooks, are data that are collected during normal fishing operations. Data collected in this manner is often the most cost effective, highly relevant to assessing normal fishing impacts, and generates large amounts of information. The lack of fishery-dependent data complicates efforts to assess the effectiveness of spatial management areas.

Despite limited data, spatial management areas, like all fishery management measures, need to be periodically assessed to ensure they are still meeting conservation and management goals. Regular assessment of spatial management areas is particularly critical in the context of changing ocean conditions and changing distribution of marine species. HMS and other pelagic species such as sea turtles often prefer a narrow range of ocean conditions such as specific temperature and salinity levels. They also may follow prey species that prefer those ocean conditions or other conditions associated with high primary productivity such as high chlorophyll concentrations. Due to changing ocean conditions and species' distribution, static spatial management areas that may have been appropriately placed many years ago may not be protecting the right species in the right places at the right time.

Thus, continual assessment of, and data collection in, spatial management areas is critical to ensure conservation and management goals are being achieved. Figure 0.1 shows a map of the four spatial management areas considered in Amendment 15: Mid-Atlantic shark, Charleston Bump, East Florida Coast, and DeSoto Canyon closed areas

Please note that NOAA Fisheries recognizes the current importance many of these closed areas have to the recreational community and the communities that rely on recreational fishing. NOAA Fisheries also recognizes the historical importance of these closed areas to the pelagic and bottom longline fleets, and understands that allowing some access might assist in reinvigorating both of these fisheries. Furthermore, NOAA Fisheries understands that these closed areas have played an important role in rebuilding overfished species, conserving protected species, and maintaining sustainable fish stocks. As such, in considering each spatial management alternative, NOAA Fisheries strives to balance the needs of all users with the conservation and management requirements, including the 10 National Standards, of the Magnuson-Stevens Act and ATCA.

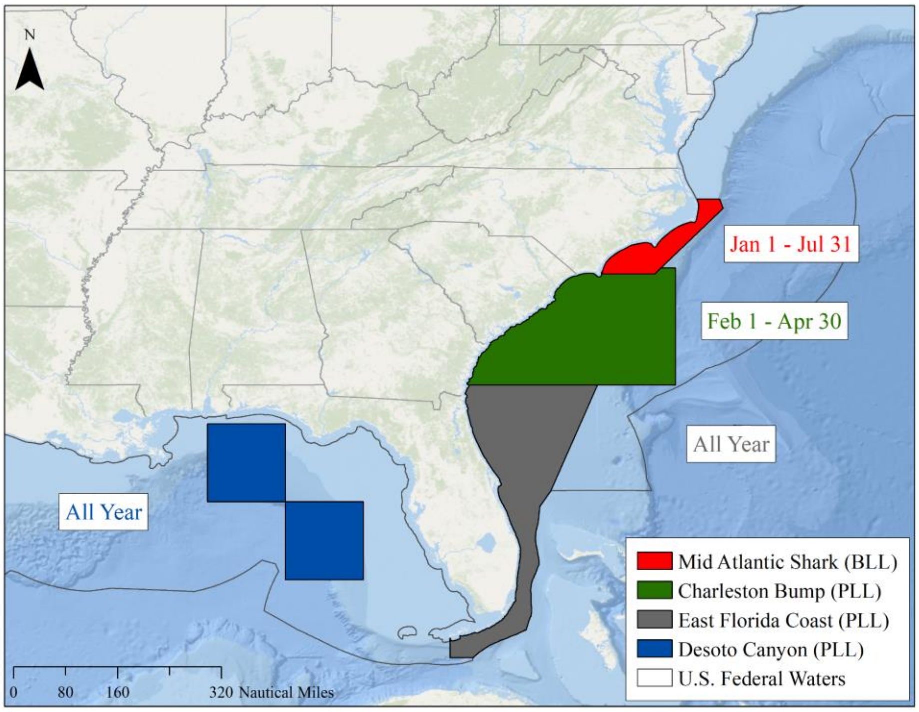

Figure 0.1 Four longline spatial management areas considered in Amendment 15.

HMS Predictive Spatial Modeling (PRiSM)

To address the lack of catch information inside spatial management areas, NOAA Fisheries developed a spatial modeling tool, HMS PRiSM, to predict where and when fishery interactions are likely to occur. Fishery interaction predictions based on the HMS PRiSM model are foundational to Amendment 15's approach to assessing and modifying spatial management areas. HMS PRiSM combines fishery observer-collected catch data with environmental variables (e.g., sea surface temperature, salinity, chlorophyll-A, bathymetry) to create a model that predicts where the commercial fleet is likely to catch certain species even in areas where commercial fisheries data has not been collected, or has only had limited observations collected, since implementation of the closed areas. We (NOAA Fisheries) modeled the following species, which are referred to as "modeled species," in Amendment 15: sandbar sharks (*Carcharhinus plumbeus)*, dusky sharks (*Carcharhinus obscurus)*, and scalloped hammerhead sharks (*Sphyrna lewini)* in the bottom longline fishery; and leatherback sea turtles (*Dermochelys coriacea)*, loggerhead sea turtles (*Caretta caretta)*, billfish species, and shortfin mako sharks (*Isurus oxyrinchus)* in the pelagic longline fishery. HMS PRiSM fishery interaction predictions provide important information on where commercial bycatch is likely to occur and helps direct data collection efforts to avoid jeopardizing conservation goals. The model does not use other catch or location data (e.g., tagging data or fishery-independent location data) because the intent is to model when and where the commercial fishery is likely to interact with species, not to model when and where the species can be found generally.

Approach and Draft Environmental Impact Statement (DEIS) Organization

To assess and consider modifications to spatial management areas, Amendment 15 considers a three-part approach, each with a separate set of alternatives.

First, potential modifications to the boundaries and/or timing of the spatial management areas are considered based on delineation of high- and low-bycatch-risk areas identified using HMS PRiSM ("A" Alternatives). Boundaries would be modified to incorporate high-bycatch-risk areas. In general, low-bycatch-risk areas outside the boundaries of the high-bycatch-risk area and still within the current closed area would not be open to normal commercial fishing; rather, a data collection program would be implemented in the area. Second, Amendment 15 considers data collection programs in the high- and low-bycatch-risk areas ("B" Alternatives). Considered data collection programs include voluntary research fishery programs, monitoring areas, and exempted fishing permit research. Data collection programs for each area would be selected based on the risk of bycatch to mitigate conservation and management impacts. Third, Amendment 15 considers the timing of when to evaluate whether the spatial management areas are effective in meeting their respective management goals to ensure that spatial management areas are routinely assessed ("C" Alternatives). For each of the four spatial management areas, a preferred alternative package (D1, D2, D3, and D4) is presented, which combines the preferred A, B, and C Alternatives for each area. Figure 0.2 provides a schematic of this organization. Chapter 3 details the range of all A, B, and C Alternatives and sub-alternatives. The D preferred alternative packages combine the preferred alternatives from the A, B, and C Alternative groups.

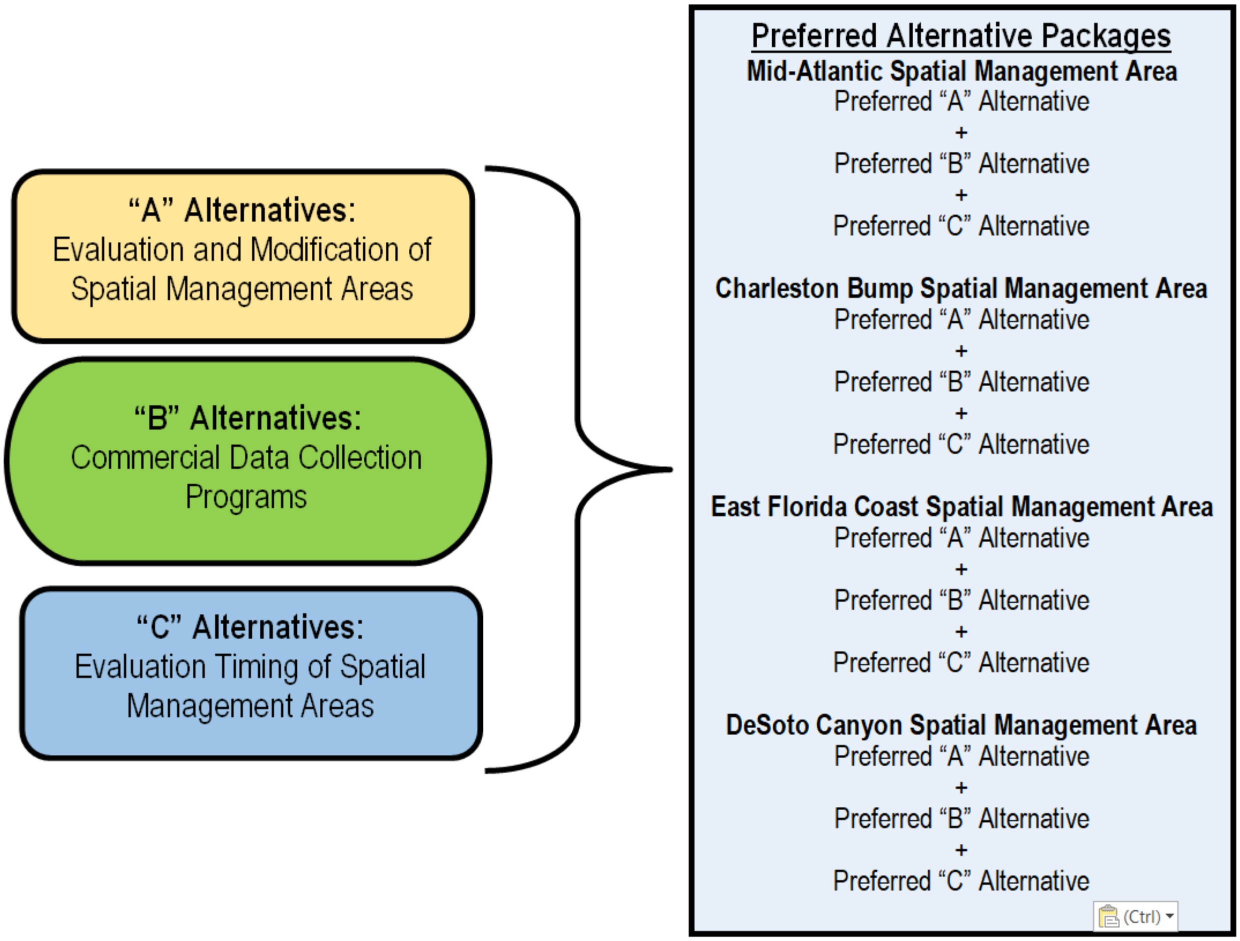

Figure 0.2 Combination of alternative into preferred alternative packages

"D" Preferred Spatial Management Alternative Packages

For each of the four spatial management areas, a single spatial and/or temporal modification was preferred, as detailed in each section below. Additionally, three data collection method alternatives and two evaluation timing alternatives were preferred in some or all of the spatial management areas. To facilitate the public's review, NOAA Fisheries here describes the preferred A, B and C alternatives for each area in a "preferred alternative package."

For all of the packages, the preferred evaluation timing alternatives are the same: spatial management area would be evaluated every 3 years (Alternative C2), or earlier, if specific concerns arise, which may include but are not limited to unexpectedly high or low bycatch, high or low data collection efforts, fishing effort that is overly clustered temporally or spatially, changed conditions within the fishery as a whole, or changed status of relevant stocks Alternative C4). These preferred alternatives (C2 and C4) increase transparency by committing to a regular evaluation schedule while providing flexibility to evaluate areas as needed.

Preferred Mid-Atlantic Spatial Management Area Package (D1)

This Preferred Mid-Atlantic Spatial Management Area package would modify the geographic boundary and timing of the current Mid-Atlantic shark closed area, where the use of bottom longline gear is prohibited, with the exception of data collection. This package would not modify the current data collection program that exists. Specifically, this package combines Sub-Alternative A1d, which would extend the eastern boundary of current Mid-Atlantic shark closed area to the 350-m shelf break and shift the months from January 1 through July 31 to November 1 through May 31, with the No Action "B" (data collection) Alternative (B1). Current data collection programs in the area would continue and include fishery-independent surveys, and observer data collected from participants in the shark research fishery, who can use bottom longline in the area to target sharks (when operating under the research fishery). *See* Table 0.1, Figure 0.3.

Table 0.1 Mid-Atlantic Spatial Management Area - Preferred Alternative Package

Alternatives	Preferred Alternative
"A" - Evaluation and Modification of Areas	Alternative A1d - Extend eastern boundary; Shift closed timing to November 1 – May 31
"B" - Commercial Data Collection	High-Bycatch-Risk Area: Alternative B1 - No Action
	Low-Bycatch-Risk Area: No low-bycatch-risk area defined
"C"- Evaluation Timing	Alternative C2 - Evaluate every 3 years
	Alternative C4 - Triggered evaluation

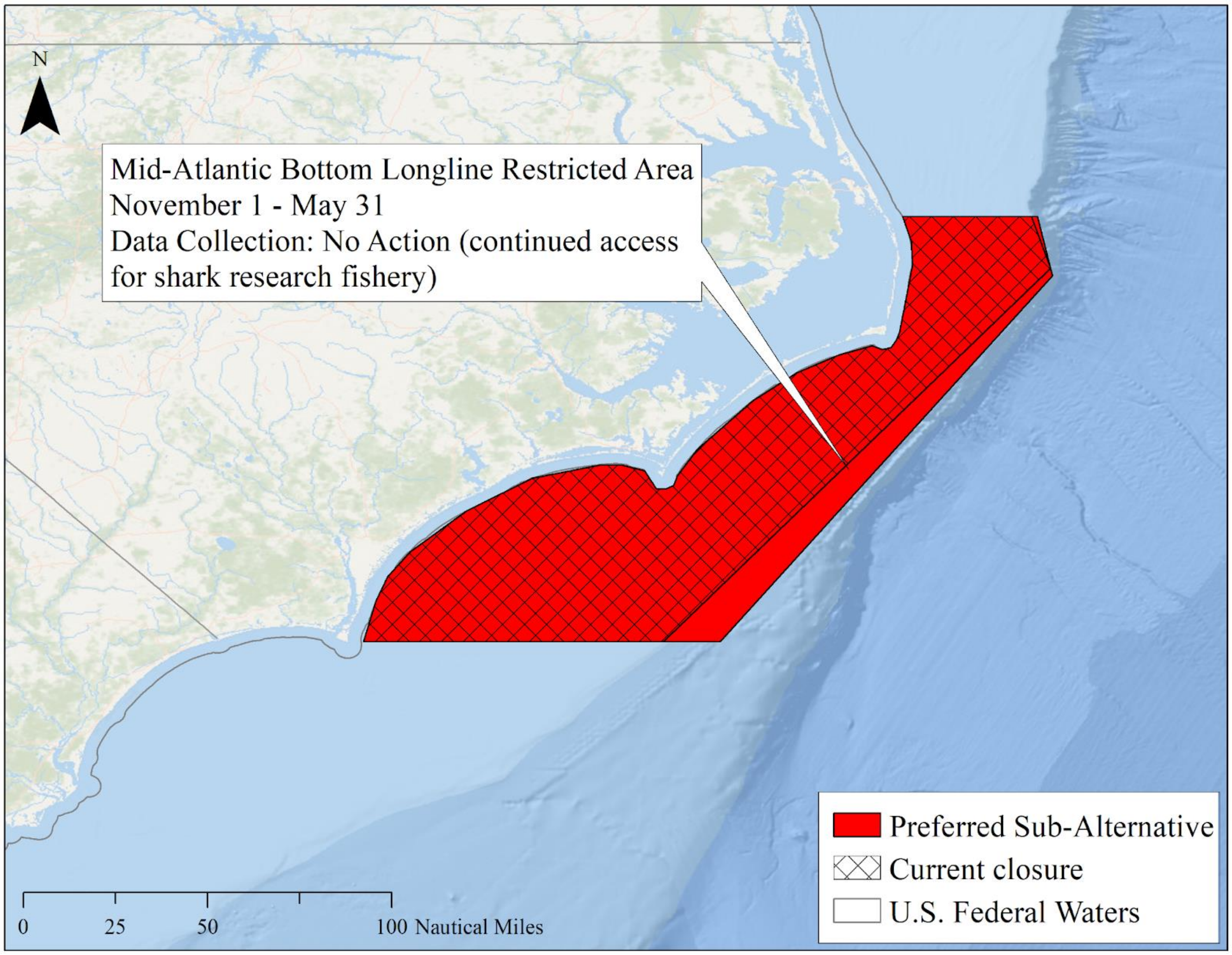

Figure 0.3 Preferred Mid-Atlantic Spatial Management Area Package

Rationale:
As fully described in Chapter 3, given the greater fishery interaction risk along the 350-m shelf break, the extension of the eastern boundary of the closure to the 350-m shelf break should provide greater protections for the three species (sandbar, dusky, and scalloped hammerhead sharks). The timing of the closure would be shifted to align with the time period that has the highest likelihood of fishery interactions.

The Mid-Atlantic shark area closure is unique compared to the other three spatial management areas considered in this action because it is specific to bottom longline gear and because some data can be collected in the area through the shark research fishery. Thus, new data collection programs may not be necessary. Furthermore, due to the low level of shark bottom longline effort in the region, calculated effort and bycatch caps are very low and would not be appropriate for data collection programs that may rely on either, specifically monitoring area or spatial management exempted fishing permit (EFP). As such, NOAA Fisheries prefers Alternative B1, No Action, for data collection programs across the entire Mid-Atlantic spatial management area.

Preferred Charleston Bump Spatial Management Area Package (D2)

This Preferred Charleston Bump Spatial Management Area package would modify the geographic boundary and the duration of the current Charleston Bump closed area, (i.e., closed to the use of pelagic longline gear, with the exception of data collection). This preferred alternative package would include two different data collection alternatives, and require evaluation of the area according to a set schedule (Table 0.2, Figure 0.4).

Specifically, this package prefers Sub-Alternative A2c, which would shift the current eastern boundary to the west. The redefined area would create a boundary that nearly bisects the current Charleston Bump closed area, with a line that runs from the northeastern corner of the current closure, southwest to a point near the Charleston Bump bathymetric feature on the southern boundary. The area inshore of the boundary would be designated high-bycatch-risk area and offshore of that boundary would be designated low-bycatch-risk area. The inshore high-bycatch-risk area would be closed to pelagic longline fishing year-round, with the exception of data collection. In the high risk bycatch area, data collection would be conducted via issuance of EFPs (Alternative B4). The offshore low-bycatch-risk area would be classified as a monitoring area (Alternative B3) from February 1 through April 30 each year (and open as normal the rest of the year), with effort caps (Sub-Alternative B3a) and EM (Sub-Alternative B3e). Alternative B4 (Cooperative research via EFP) is also preferred in the low-bycatch-risk area to facilitate additional data collection.

South Atlantic Pelagic Longline Restricted Area: For ease of communication, enforcement, and compliance, the preferred modification of the Charleston Bump closed area would combine the Charleston Bump high-bycatch-risk area with the high-bycatch-risk area of the preferred modification of the East Florida Coast closed area to create the "South Atlantic Pelagic Longline Restricted Area." The modified boundaries of the two areas match-up and both would be closed year-round, creating a spatially and temporally contiguous closed area. Combining the two areas into a single named area simplifies communication, enforcement, and compliance.

Table 0.2 Charleston Bump Spatial Management Area - Preferred Alternative Package

Alternative	**Preferred Alternative**
"A" - Evaluation and Modification of Areas	Alternative A2c -Shift eastern boundary to diagonal bisect; Inshore portion high-bycatch-risk area year-round; Offshore portion low-bycatch-risk area February 1 - April 30
"B" - Commercial Data Collection	High-Bycatch-Risk Area: Alternative B4 - Cooperative research via EFP
	Low-Bycatch-Risk Area: B3 - Monitoring Area; Sub-Alternative B3a (effort caps: 69 sets between February 1 and April 30) and Sub-Alternative B3e (electronic monitoring) **Note that the Charleston Bump Monitoring Area would be open to normal pelagic longline fishing May 1 - January 31.** And Alternative B4 - Cooperative research via EFP
"C"- Evaluation Timing	Alternative C2 - Evaluate every 3 years
	Alternative C4 - Triggered evaluation

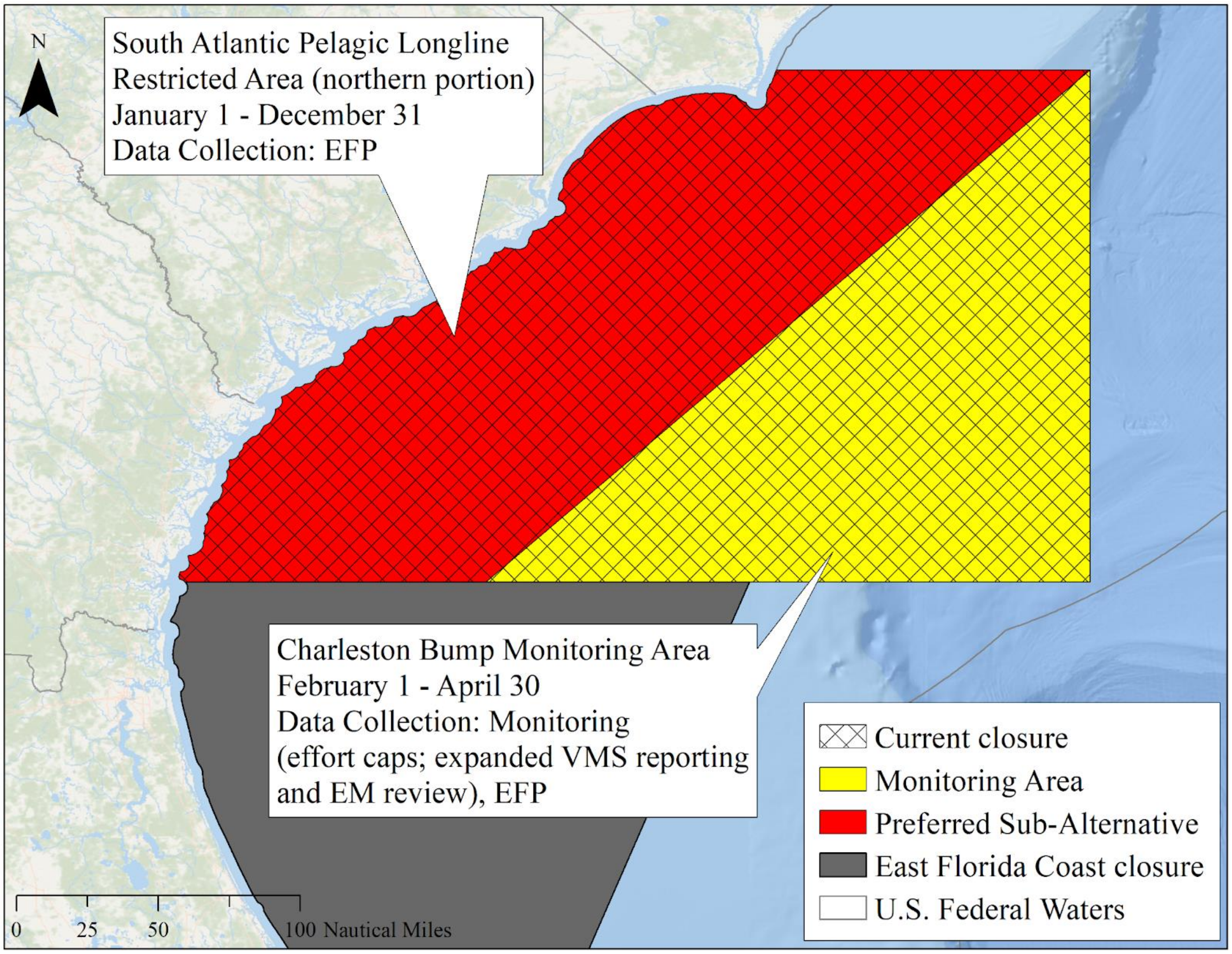

Figure 0.4 Preferred Charleston Bump Spatial Management Area Package

Rationale:
As detailed in Section 3.1, this spatial and temporal modification should provide increased conservation protection for the modeled bycatch species.

The inshore high bycatch portion includes approximately half of the 400-m shelf break, including the Charleston Bump bathymetric feature in the southern portion of the spatial management area, and is the site of increased fishing activity for commercial (non-pelagic longline and also pelagic longline when there area is open outside of the current Charleston Bump closure dates) and recreational fisheries. The offshore portion was found to be a low-bycatch-risk area based on HMS PRiSM results. The preferred data collection programs would differ between the high- and low-bycatch-risk areas to account for the risk of interactions of particular bycatch species. In the high-bycatch-risk area, a research EFP with standardized conditions would provide more timely accounting for effort and bycatch and caps at levels designed to prevent adverse ecological impacts. The standardized EFP criteria include additional safeguards such as reporting, observer, and EM requirements.

In the low-bycatch-risk area, NOAA Fisheries prefers implementation of a monitoring area under Alternative B3 and would include the sub-alternative criteria of B3a (effort caps), B3e (electronic monitoring). Effort caps are more readily monitored inseason than bycatch caps while providing similar protections against excessive bycatch. EM would facilitate data collection. Alternative B4 (Cooperative research via EFP) is also preferred in the low-bycatch-risk area to facilitate additional data collection.

Preferred East Florida Coast Spatial Management Area Package (D3)

This Preferred East Florida Coast Spatial Management Area package would modify the geographic boundary of the current East Florida Coast Closed Area, (i.e., closed to the use of pelagic longline gear, with the exception of data collection). This preferred alternative package would include two different data collection alternatives, and require evaluation of the area according to a set schedule (Table 0.3, Figure 0.5).

Specifically, this package includes Sub-Alternative A3d, which would shift the current northeastern boundary to the west to 79° 32’ 46” W. long. The area inshore of the boundary would be designated a high-bycatch-risk area and offshore of that boundary would be designated a low-bycatch-risk area. The inshore high-bycatch-risk area would be closed to pelagic longline fishing year-round, with the exception of data collection. In the high-risk bycatch area, data collection would be conducted via issuance of EFPs (Alternative B4). The offshore low-bycatch-risk area would be classified as a monitoring area year-round. The area would be monitored via effort caps (Sub-Alternative B3a) and electronic monitoring (Sub-Alternative B3e). Alternative B4 (cooperative research via EFP) is also preferred in the low-bycatch-risk area to facilitate additional data collection.

South Atlantic Pelagic Longline Restricted Area: For ease of communication, enforcement, and compliance, the preferred modification of the East Florida Coast closed area would combine the East Florida Coast high-bycatch-risk area with the high-bycatch-risk area of the preferred modification of the Charleston Bump closed area to create the “South Atlantic Pelagic Longline Restricted Area.” The modified boundaries of the two areas match-up and both would be closed year-round, creating a spatially and temporally contiguous closed area. Combining the two areas into a single named area simplifies communication, enforcement, and compliance.

Table 0.3 East Florida Coast Spatial Management Area - Preferred Alternative Package

Alternatives	Preferred Alternative
"A" - Evaluation and Modification of Areas	Alternative A3d -Shift northeastern boundary to 79° 32' 46" W. long; Maintain year-round timing of high- and low-bycatch-risk areas
"B" - Commercial Data Collection	High-Bycatch-Risk Area: Alternative B4 - Cooperative research via EFP
	Low-Bycatch-Risk Area: Alternative B3 - Monitoring Area; Sub-Alternative B3a (effort caps: 124 sets/year) and Sub-Alternative B3e (electronic monitoring) And Alternative B4 - Cooperative research via EFP
"C"- Evaluation Timing	Alternative C2 - Evaluate every 3 years
	Alternative C4 - Triggered evaluation

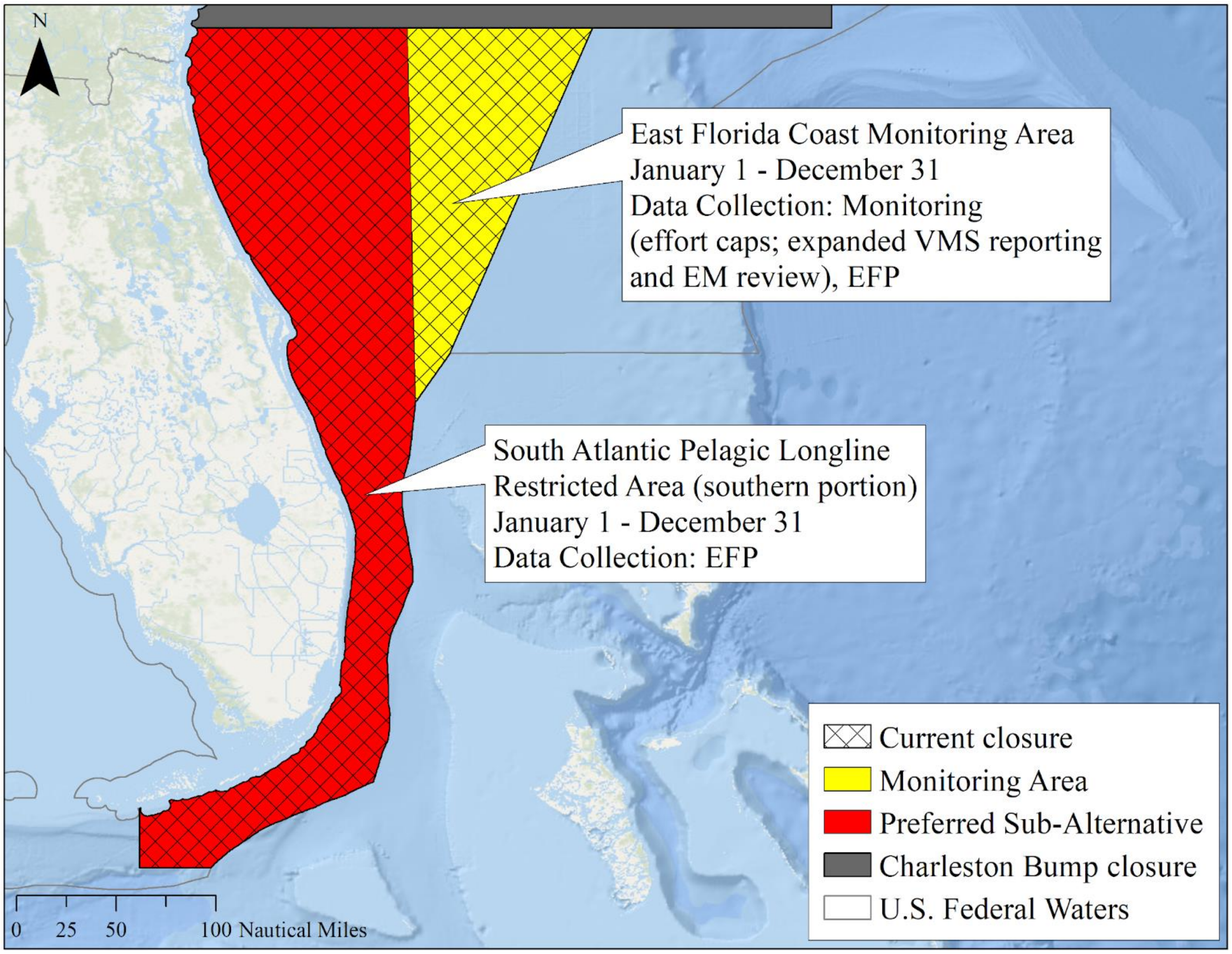

Figure 0.5 Preferred East Florida Coast Spatial Management Area Package

Rationale:
Sub-Alternative A3d should provide increased protection for the modeled bycatch species. The modification would allow for increased data collection throughout the area. The preferred data collection programs would differ between the high- and low-bycatch-risk areas. In the high-bycatch-risk areas, cooperative research via an EFP would provide a more precautionary approach and timely accounting and safeguards including reporting, observer, and EM requirements.

In the low-bycatch-risk areas, a monitoring area (Alternative B3) would include the Sub-Alternative criteria of B3a (effort caps), B3e (electronic monitoring). Effort caps are more readily monitored inseason than bycatch caps while providing similar protections against excessive bycatch. Alternative B4 (cooperative research via EFP) is also preferred in the low-bycatch-risk area to facilitate additional data collection.

Preferred DeSoto Canyon Spatial Management Area Package (D4)

This Preferred DeSoto Canyon Spatial Management Area package would modify the geographic boundary of the current DeSoto Canyon Closed Area, (i.e., closed to the use of pelagic longline gear, with the exception of data collection). This preferred alternative package would include a method of data collection for the high-bycatch-risk area, and require evaluation of the area according to a set schedule (Table 0.4, Figure 0.6).

Specifically, this package includes Sub-Alternative A4d, which would redefine the spatial boundaries of the current closed area, and maintain a year-round prohibition on the use of pelagic longline gear, with the exception of data collection via an EFP. The areas of the current closure that are outside the modified area would reopen to normal commercial pelagic longline fishing.

Table 0.4 DeSoto Canyon Spatial Management Area - Preferred Alternative Package

Alternatives	**Preferred Alternative**
"A" - Evaluation and Modification of Areas	Alternative A4d - Parallelogram; Year-round high-bycatch-risk area
"B" - Commercial Data Collection	High-Bycatch-Risk Area: Alternative B4 - Cooperative research via EFP
	Low-Bycatch-Risk Area: Alternative B1 – No Action. The area would open to normal commercial pelagic longline fishing.
"C"- Evaluation Timing	Alternative C2 - Evaluate every 3 years
	Alternative C4 - Triggered evaluation

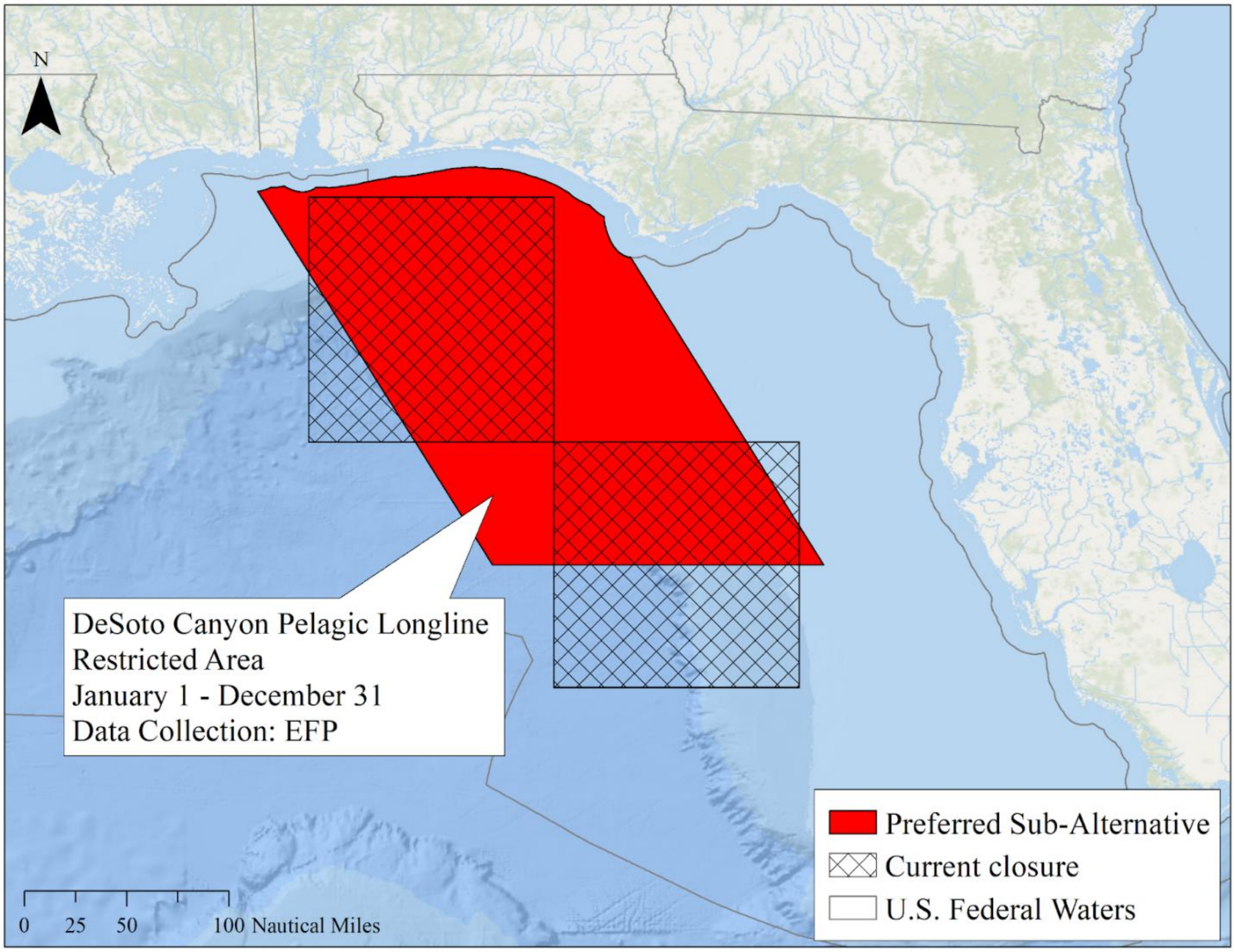

Figure 0.6 Preferred DeSoto Canyon Spatial Management Area Package

Rationale:
Sub-Alternative A4d is intended to provide increased protections for bycatch species based on HMS PRiSM results. The high-bycatch-risk area would be defined as a parallelogram that covers most of the existing DeSoto Canyon closure and would extend outside of the current footprint in the medial area. Adjusting the shape of the closure would more optimally protect areas where greater fishery interaction risk is estimated to occur closer to the coast and along the shelf break. The modification would re-open the southern half of the southern box, the lower western corner of the northern box, and the top eastern corner of the southern box to normal commercial pelagic longline fishing.

Because the preferred spatial modification extends outside the boundaries of the existing closure, the preferred data collection program is only Alternative B4 (cooperative research via an EFP), and does not include a monitoring area, in order to simplify data collection. Definition of a low-bycatch-risk area, with an associated monitoring program would be complex, because Sub-Alternative A4d would create three discontiguous low-bycatch-risk areas, two of which encompass small corners of the existing closure but that do not overlap with the DeSoto Canyon bathymetric feature. Furthermore, HMS PRiSM results indicate that the southern portion of the current DeSoto Canyon may not be as important for bycatch protections as the areas in the north. Thus, no data collection alternative is chosen in the low-bycatch-risk areas.

Spatial Management Area Regulatory Provisions ("E" Alternatives)

Existing regulations at 50 CFR part 635.34(d) contain considerations for framework adjustments to add, change, or modify time/area closures and gear restricted areas. However, there are no provisions for regular review of areas. The "E" Alternatives consider: no action (E1), and adding regulatory factors for review of spatial management areas (E2). The need to assess the effectiveness of spatial management measures is critical due to the static nature of the spatial management measures, the highly dynamic nature of HMS fisheries, and the highly dynamic nature of the ocean environment.

Preferred Alternative E2: Add Regulatory Provisions for Review of Spatial Management Areas

Under this alternative, NMFS would add the below regulatory provisions to 50 CFR 635.35(c).

When reviewing a spatial management area, NMFS may consider, but is not limited to consideration of, the following relevant factors:

(i) Fishery metrics such as landings, discards, catch rates, and effort.

(ii) The usefulness of information from catches for biological sampling and monitoring status of target and non-target species.

(iii) Fishery social and economic data regarding fishing vessels and shoreside business, including revenue, costs, and profitability.

(iv) Effects of catch rates on target and non-target species in other regions or on fishing opportunities in other regions or fisheries.

(v) Fishing practices, including tactics, strategy, and gear.

(vi) Biological, ecological, and life history data and research on primary bycatch and target species.

(vii) Variations in seasonal distribution, abundance, or migration patterns of the relevant species.

(viii) Resilience to climate change impacts, including changes in species distribution, fishing effort location, and vulnerable fishing communities.

(ix) Oceanographic data and research including sea surface temperature, chlorophyll a concentrations and bathymetry.

(x) Variations in oceanographic features such as currents, fronts, and sea surface temperature.

(xi) Other design and technical considerations such as ecosystem modeling parameters (e.g., ocean currents, bottom topography), safety, enforceability (e.g., regular shapes), gear conflicts, timing of evaluation, access to the area for data collection, conservation and management objectives, environmental justice, state or other jurisdictional boundaries, efficiency in the size of area (given the highly variable and mobile nature of the HMS fisheries), and non-fishery activity (e.g., transportation, energy production).

(xii) Other considerations as may be applicable to the specific management goals of any particular spatial management area.

ELECTRONIC MONITORING PROGRAM ("F" ALTERNATIVES)

Amendment 15 considers changes to the administration and funding of the HMS pelagic longline electronic monitoring (EM) program ("F" Alternatives), which was put in place in Amendment 7 and effective in 2015. On May 7, 2019, NOAA Fisheries issued Procedure 04-115-02 "*Cost Allocation in Electronic Monitoring Programs for Federally Managed Fisheries.*" The cost allocation policy document outlines guidance and directives for EM cost allocation framework between fishery participants and the Agency.

Amendment 15 considers ways to bring the EM program into alignment with the 2019 cost allocation policy and considers changes to the current HMS pelagic longline EM program in light of the cost policy and knowledge gained about the program from 2015 through the present. Three alternatives were analyzed, including No Action (Alternative F1) and an alternative eliminating the HMS pelagic longline EM program (Alternative F3). The preferred alternative, Alternative F2, would transfer the responsibility of funding the sampling portions of the program (as defined in the 2019 NOAA EM Cost Allocation Policy) from NOAA Fisheries to the industry. The funding transition would be phased in over 3 years. Administrative costs associated with the program would remain with NOAA Fisheries. Alternative F2 consists of four interconnected components (vendor requirements, vessel owner requirements, vessel monitoring plans, and modification of EM Individual Bluefin Tuna Quota (IBQ) spatial/temporal requirements) designed to transfer sampling costs in a clear and straightforward manner while reducing administrative burdens on the Agency, minimizing costs for the industry, and continuing to meet EM program conservation and reporting goals. These four components are briefly described below.

NOAA Fisheries notes that many requirements of the current EM regulations would not be substantively changed under Alternative F2. Requirements for vessel monitoring plans are in current 50 C.F.R. § 635.9(e) and for EM system components in § 635.9(c). Vessel owner and operator requirements are currently set forth § 635.9(b)(2) and (e). Data maintenance, storage and viewing text is in § 635.9(d)).

Vendor Requirements

NOAA Fisheries would solicit vendors to perform the tasks such as installing and maintaining EM equipment, reviewing EM video data, and providing NOAA Fisheries with quarterly reports, consistent with vendor technical performance standards. NOAA Fisheries, would approve vendors that meet certain requirements, including meeting the technical performance standards provided in Table 0.5, and publish a list of certified vendors in the Federal Register, which would be made available to vessel owners. NOAA Fisheries would reserve the right to remove vendors from its list of approved vendors if they fail to meet EM vendor responsibilities and duties or have a conflict of interest.

Table 0.5 Vendor Technical Performance Standards

Technical ability and capacity
Vendor must install and maintain EM equipment; receive and access video data; store video and metadata for length of time required under performance standards; and identify species in performance standard list.
Video Review
At the end of each quarter, vendors must review 10% of the sets submitted (randomly selected) and at least one set from each vessel; and 100% of sets submitted from vessels that fished in Monitoring Areas (described in "D" packages above Review under this requirement is separate from any enhanced review requirements considered in the "B" Alternatives for data collection in spatial management areas. Vendor must review sets in time to meet the deadline for quarterly report requirements detailed below. Sets are not selected for review based on a SEFSC sampling plan as is currently done, but selected randomly from EM Data Review Areas (*see Modification of EM Spatial/Temporal Requirements*).
Video must be reviewed by competent staff trained in species identification and data processing and handling procedures. The EM vendor is responsible for training, and maintaining the skills of, staff who carry out EM field and data services.
Must agree to additional video review at the request of NOAA Fisheries to verify catch reports, and agree to provide information that NMFS needs for other conservation and management purposes, including regulatory enforcement.
Work with vessel owners
Must assist with the development of a VMP for each vessel, as detailed in the VMP section.
Data integrity and storage
Must store and archive video and metadata for 2 years after the date received.
Communication with NOAA Fisheries

Must submit reports to NOAA Fisheries within 3 months of the end of each quarter that must include the following information: • List of vessels, trips, and sets submitted for review. • List of vessels that did not submit any trips or sets for review • Location, date, and time of all sets submitted for review. • Identification of sets reviewed. • Species caught and amounts (retained and discarded) from sets reviewed and disposition (dead or alive) of catch that is discarded. Sets outside Monitoring Areas (described in "D" packages above) must include bluefin tuna and shortfin mako sharks. Sets from Monitoring Areas must include all species. • Information of technical difficulties including poor video, no video, unreviewable video, misaligned camera angles and any other issues that prevent effective video review of catch. • Information on how technical difficulties were addressed on the vessel and during the video review process. • Metadata from all submitted trips and sets must accompany quarterly reports.
Must promptly notify NOAA Fisheries of any other issues (e.g., inability to obtain video data from a vessel) that may prevent proper functioning of the EM program.

Vessel Owner and/or Operator Requirements

The vessel owner and/or operator subject to the relevant EM regulations would need to comply with the requirements outlined in Table 0.6, or as applicable under the "B" Alternatives for data collection in spatial management areas, , and implement and comply with the approved VMP. Non-compliance with these requirements could result in enforcement action against the vessel owner or, if appropriate, such as in the case of vendor-identified non-compliance, against the vendor.

Table 0.6 Vessel Owner Requirements

Cost responsibility and equipment
Vessel owners would be responsible for obtaining required EM services and for EM sampling costs. It would be up to the vessel owner and approved EM vendor to agree upon a cost structure, e.g., flat cost per set submitted, an invoice for only those sets reviewed, or an annual subscription.
Equipment currently installed on pelagic longline vessels would remain the property of NOAA Fisheries, however, vessel owners and operators could continue to use currently-installed equipment until no longer operable. Any replacement or repair of equipment or system components would be the responsibility of the vessel owner. Equipment or components that are no longer operational or useful must be surrendered to NOAA Fisheries.
Operational requirements
Before embarking on a trip, vessel owners and/or operators must: • Have onboard and available for inspection an approved VMP (would is only valid when there is an existing, signed contract between vessel owner and vendor for EM services). • Have implemented all of the requirements of the VMP by the dates noted in the VMP.

Before deploying pelagic longline sets in Monitoring Areas (described in "D" packages above) or EM Data Review Areas (see Section 3.6.2.4), a vessel owner and/or operator must declare such intent through pre-trip or in-trip hail out using VMS.
Vessels may not embark on a trip outside of an EM Data Review Area if the EM system is not functioning properly, as determined by captain inspection, pre-trip system test, notification from vendor about poor or missing video, or other indications.
Vessels must abide by the relevant EM requirements triggered by the gear or location. Requirements in current 50 C.F.R. 635.9 on EM system components, activating EM, ensuring proper continuous functioning of the EM system, and handling of fish remain the same.
Reporting
Vessel owners and/or operators of a vessel fishing with pelagic longline gear within Monitoring Areas must report through VMS within 12 hours of the completion of each pelagic longline set: date and area of the set, number of hooks, actual length of the following species that are retained and approximate length of species that are discarded dead or alive: bluefin tuna, blue marlin, white marlin, roundscale spearfish, sailfish, leatherback sea turtles, loggerhead sea turtles, and shortfin mako sharks.
Vessels must also comply with other applicable notification, catch, and effort reporting requirements that may apply when fishing in Monitoring Areas.

Vessel Monitoring Plans

Existing 50 C.F.R. 635.9(e) sets forth required content for VMPs. Under preferred Alternative F2, approved EM vendors would be required to develop VMPs with vessel owners with whom they had contracts. NOAA Fisheries or a NOAA Fisheries-designated entity would approve VMPs that meet the management requirements of the EM program. A VMP would only be valid when there is an existing, signed contract between the vendor and vessel owner. Before embarking on a trip, the vessel operator must have an approved VMP onboard. If the vessel owner switches vendors, the VMP must be updated and a new one approved before the vessel can embark on a trip. Once the VMP is approved, the vessel owner would have a set amount of time to install any new, required equipment as specified in the VMP.

Modification of EM IBQ Spatial/Temporal Requirements

Amendment 15 would change when and where HMS pelagic longline fishermen are required to use EM and submit video data. Currently, vessel operators must comply with EM requirements regardless of time or location of fishing. Amendment 15 would limit the requirement to certain areas and times. For all areas outside of the spatial management areas discussed in "A" Alternatives and the "D" Preferred Alternative Packages, NOAA Fisheries has identified areas where EM data would be most useful to meet bluefin tuna catch reporting compliance goals. NOAA Fisheries designated these spatial/temporal areas as "EM Data Review Areas" (Figure 0.7). Vessels would be required to activate EM and submit video when operating in EM Data Review Areas during all or a portion of a trip. Trips that engage in fishing in multiple areas must abide by the more restrictive requirement (e.g., if any fishing occurs in an area that requires EM, the entire trip must use EM and all videos must be submitted even when fishing in areas that do not require EM). Because these areas are largely designed around the current EM video review sampling plan, no impact to monitoring compliance with the IBQ program is expected. *See* Section 3.6.2.4 for detailed explanation).

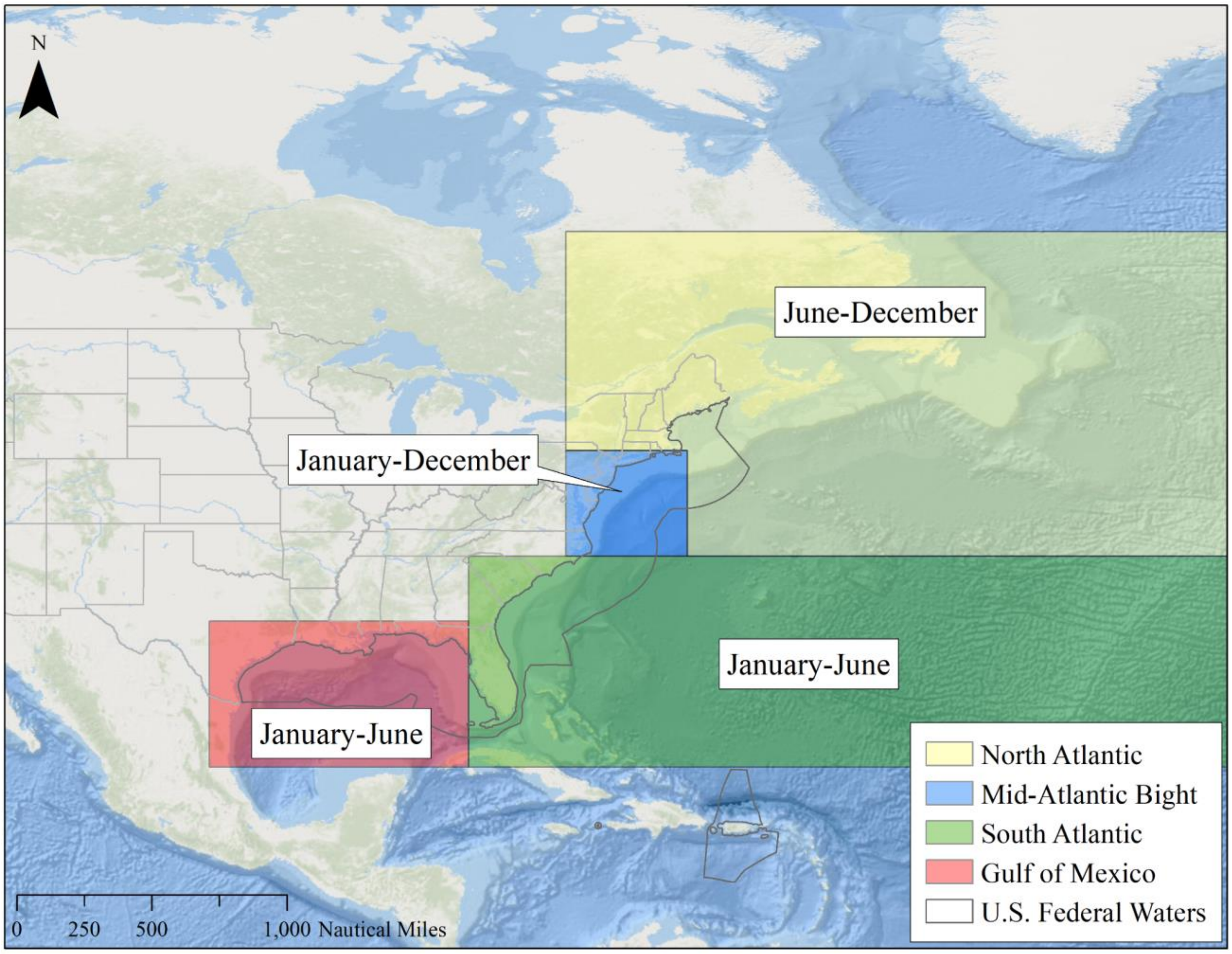

Figure 0.7 EM Data Review Areas

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TERMINOLOGY

The methodology used in Amendment 15, including HMS PRiSM and metrics, introduce terminology that has not been used before in documents produced by the HMS Management Division and, thus, may not be familiar to some constituents. This section provides definitions or descriptions of terminology unique to Amendment 15 to provide a reference while reading this document. The list of terminology is not exhaustive and does not include words, phrases, or terms that are more regularly used in HMS Management Division documents. The list also does not include terms commonly used in spatial modeling since those terms may need more extensive background information, training, or course work in spatial modeling to fully explain.

General

Bycatch: "Bycatch" has a specific meaning for species conserved and managed under the Magnuson-Stevens Act, which is different from incidental catch. In addition, the Endangered Species Act and Marine Mammal Protection Act address protected species interactions. See Section 4.10 for further explanation. However, for ease of communication in this document, unless otherwise noted, "bycatch species" generally refer to all non-target catch species, including incidentally-caught species that fishermen may or may not retain, and also to protected species.

Spatial management areas/measures: a range of different fisheries conservation and management measures that are based on geographic area, including "closed areas," "time/area closures," "gear restricted areas," and "monitoring areas."

HMS PRiSM Inputs

Fishery domain: Spatial extent of HMS PRiSM output predictions. Rather than predict over entire ocean basins, output predictions were limited to the area where 95 percent of the fishery occurs. This area is called the fishery domain. The fishery domains are separate for the U.S. pelagic and bottom longline fisheries.

Modeled species: The species that were included in the HMS PRiSM models to obtain fishery interaction predictions. A list of modeled species is available in Section 2.3.

Recent mean conditions: Once HMS PRiSM identifies relationships between fishery interactions and environmental conditions, those relationships can then be applied to any time period (with the associated environmental data) to predict fishery interactions. For the purposes of Amendment 15, those relationships were applied to a recent time period to assess spatial management areas in the context of current environmental conditions. The recent time period used for current environmental conditions was 2017 through 2019. 2019 was selected as the terminal year for this portion of the analysis to ensure full data sets for all data inputs.

HMS PRiSM Output Products

Occurrence (interaction) probability: Spatial outputs generated by a species' model and recent mean monthly conditions at the resolution of 1/12° grid cells. Occurrence probabilities can range from 0 to 1, where the closer to 1 an occurrence probability is the more likely a species is to interact with that gear at that location and the closer to 0 the less likely a species is to interact with that gear at that location. Occurrence probabilities were outputted for each month.

Interaction probability maps: The maps displaying the monthly occurrence (interaction) probabilities for each species.

High-bycatch-risk area value: A value assigned to each modeled species that weighs each species based on the level of management importance. Species that may be in need of greater protection due to stock status, ESA status, or community importance would be given a greater high-bycatch-risk area value than other species. For species with a greater high-bycatch-risk value, a greater range of occurrence probability values for a given species would be considered "high risk." In other words, if NOAA Fisheries determines it is important to consider protecting the area where the top 25 percent of occurrence probabilities occurred, then the high-bycatch-risk area value would be 25 percent. The higher the high-bycatch-risk area value, the more area NOAA Fisheries would consider protecting for a given species.

Occurrence probability threshold: The occurrence probability value used to determine what areas are considered high bycatch risk and low bycatch risk for each modeled species. For a given month, any grid cell with an occurrence probability greater than or equal to the occurrence probability threshold would be considered high-bycatch-risk area, while any grid cell with an occurrence probability less than the occurrence probability threshold would be considered low-bycatch-risk area. This value is calculated from the high-bycatch-risk area value and all occurrence probabilities across all months.

High-bycatch-risk area: The area (grid cell) where a specific modeled species would be considered having a high probability of interacting with the fishery. This area was identified for each month where any grid cell with an occurrence probability greater than or equal to the occurrence probability threshold occurred.

Low-bycatch-risk area: The area (grid cell) where a specific modeled species would be considered having a low probability of interacting with the fishery. This area was identified for each month where any grid cell with an occurrence probability less than to the occurrence probability threshold occurred.

High-bycatch-risk area maps: The maps displayed the monthly high-bycatch-risk area for each species.

Metric Scores

Occurrence rate in fishery: The number of sets a species occurred in divided by the number of total sets over a given time period.

Species/individual metric score: The score calculated for an individual species for a single metric (Section 2.7).

Total metric score: The sum of the four metric scores (Section 2.7) for an individual species. A separate species metric score was calculated for each modeled species for each spatial management area, including all modification options to areas and selected modification sub-alternatives in the "A" Alternatives.

Overall metric score: The sum of all total metric scores across modeled species for a spatial management area, including considered modifications. The overall metric score provides a single value that incorporates all modeled species and all four metrics.

Option: Spatial and/or temporal modifications to a given closed area. We evaluated between 9 and 16 different options across the 4 closed areas, each including one option which is the current existing closed area definition (spatial and temporal). Based on the metric scoring and evaluation of the options, we then selected several options across the full range of scores to be alternatives for full analysis.

Impact Analyses

Reference area: The larger geographic area with which to compare and/or estimate spatial management area catch rates. Reference areas have similar ocean and environmental conditions and provide actual catch data to estimate impacts in areas with low or no catch data. Three reference areas were identified; one in the Gulf of Mexico, one in the South Atlantic, and one in the Mid-Atlantic (Section 3.2.3.1).

Scope: (in the context of spatial/temporal measurement): size of the area (expressed as nm2) multiplied by the number of months to provide a measure of spatial management areas that incorporates both time and space.

Sub-Alternative A0x and Sub-Alternative A0x*: The two delineated areas inside each current closed area analyzed in Chapter 5. Generally "high-bycatch-risk areas" and "low-bycatch-risk areas," respectively. This terminology is used in Chapter 5 when analyzing the impacts of modifications to spatial management areas. Inside each current closed area, Amendment 15 considers designating portions as "high-bycatch-risk areas" and "low-bycatch-risk areas." Differentiating these two areas when discussing the impacts of modifications is complicated, necessitating a clear and consistent way to label each area, while also maintaining specificity to the analyzed sub-alternative. The modification sub-alternative label (e.g., Sub-Alternative A0x) generally refers to the high-bycatch-risk area within the current closed area footprint. Adding an asterisk (*) to the sub-alternative name denotes the area outside the high-bycatch-risk area, but within the footprint of the current closed area, and is generally the low-bycatch-risk area. The “0” represents the closed area, where for example A1 represents the Mid-Atlantic Shark Closed Area. The “x” represents the specific sub-alternative letter, where for example, A1a represents the status quo sub-alternative for the Mid-Atlantic Shark Closed Area.

Chapter 1 INTRODUCTION

1.1 BRIEF MANAGEMENT HISTORY AND PUBLIC INPUT

Highly Migratory Species Management

Atlantic highly migratory species[1] (HMS) are managed under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and the Atlantic Tunas Convention Act (ATCA). Under the Magnuson-Stevens Act, NOAA Fisheries must, consistent with 10 National Standards, manage fisheries to achieve optimum yield on a continuing basis while preventing overfishing. Under ATCA, the Secretary of Commerce promulgates regulations as may be necessary and appropriate to carry out recommendations by the International Commission for the Conservation of Atlantic Tunas (ICCAT). The authority to issue regulations under the Magnuson-Stevens Act and ATCA has been delegated from the Secretary of Commerce to the Assistant Administrator for NOAA Fisheries.

ICCAT is an international regional fisheries management organization comprised of over 50 Contracting Parties including the United States, Cooperating non-Contracting Parties, Entities, and/or Fishing Entities (CPCs), which manages tuna and tuna-like species in the Atlantic Ocean and its adjacent seas and also conducts research. ICCAT meets annually and adopts "recommendations" (binding on CPCs) and "resolutions" (non-binding measures) that are intended to achieve ICCAT Convention management goals and objectives. ICCAT publishes recommendations from its annual meetings online.

NOAA Fisheries develops regulations with input from the public and the HMS Advisory Panel (AP). NOAA Fisheries consults with, and considers the comments of, the HMS AP when preparing and implementing fishery management plans or amendments for Atlantic tunas, swordfish, billfish, and sharks. The members of the HMS AP represent commercial and recreational fishing interests, the scientific community, and the environmental community who are knowledgeable about Atlantic HMS and/or Atlantic HMS fisheries,. HMS AP members serve three-year terms, with approximately one-third of the total HMS AP members' terms expiring on December 31 of each year. Representatives from the International Commission for the Conservation of Atlantic Tunas (ICCAT) Advisory Committee, the regional Fishery Management Councils, State agencies, and fisheries commissions also participate on the AP; their terms do not expire and assignment and substitution of these AP representatives is at the discretion of the respective agencies.

The conservation and management measures proposed for the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan (2006 Consolidated HMS FMP) and

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[1] The Magnuson-Stevens Act, at 16 U.S.C. 1802(14), defines the term "highly migratory species" as tuna species, marlin (*Tetrapturus* spp. and *Makaira* spp.), oceanic sharks, sailfishes (*Istiophorus* spp.), and swordfish (*Xiphias gladius*)."

associated rulemaking are taken under the authority of the Magnuson-Stevens Act and ATCA. Management measures must also be consistent with other applicable laws including, but not limited to, the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), and the Coastal Zone Management Act (CZMA). This document is prepared, in part, to comply with NOAA Fisheries' responsibilities under NEPA, as implemented by the regulations published by the Council on Environmental Quality (CEQ), 50 Code of Federal Regulations (CFR) Parts 1501-1508, and NOAA Administrative Order 216-6A and Companion Manual.

NOAA Fisheries uses a variety of conservation and management measures to maintain appropriate levels of catch consistent with applicable science-based quotas or other management goals, to limit bycatch to the extent practicable, and to limit interactions with protected species as required. HMS management measures include permitting requirements, regional and seasonal quotas, reporting and monitoring requirements, gear restrictions, closed areas, minimum fish sizes, trip limits, and others. The permit categories include both limited access and open access permits. Other federally managed fisheries, or states, may have additional permit requirements, including special permits to sell fish. The annual Stock Assessment and Fisheries Evaluation (SAFE) Report includes more detailed information on HMS management measures.

Of particular relevance to this document are management measures commonly referred to as "closed areas" (including "time/area closures"), "gear restricted areas," "monitoring areas," or "spatial management areas," which refer to a range of different fisheries conservation and management measures that are based on geographic area. These types of management measures are referred to in this document as "spatial management measures."

Overview of Closed Areas

Closed areas are typically discrete geographic areas where certain types of fishing are restricted or prohibited (usually by restricting a particular type of gear) for limited time periods or the entire year. Closed areas can be particularly effective in reducing or eliminating fishing interactions between particular species and gears. Since 1999, NOAA Fisheries implemented a number of closed areas that curtail or prohibit fishing for certain HMS or that restrict the use of certain HMS gear types (e.g., effective in 1999, 2000, 2001, 2005, 2015, 2020). For example, NOAA Fisheries closed the DeSoto Canyon to pelagic longline gear in 2000, and the East Florida Coast and Charleston Bump areas effective in early 2001 (65 FR 47213; August 1, 2000). The Charleston Bump closed area is a seasonal closure from February through April every year, whereas the DeSoto Canyon and East Florida Coast closed areas are closed year-round to pelagic longline gear. The closures were implemented to reduce bycatch and incidental catch of overfished and protected species by pelagic longline fishermen who target HMS. The Mid-Atlantic shark closed area was closed to bottom longline fishing on January 1, 2005 to reduce all interactions between commercial fishing operations and pupping and nursery grounds and hence reduce both the catch and mortality of dusky and juvenile sandbar sharks. The current closed areas cover large geographic areas. A complete description of these closed areas, including management goals are in Chapter 4.

After implementation of any management measure, there is a need to determine whether the measure is achieving its objective and whether the balance of associated costs and benefits over time is appropriate. The need to assess the effectiveness of particular management measures may be heightened due to several types of changes: (1) changes in the affected fishery; (2) changes in stock status or ocean conditions; (3) changes in other management measures; and (4) changes in other relevant objectives.

The need to assess the effectiveness of spatial management measures in particular is also heightened due to the static nature of the existing spatial management measures, the highly dynamic nature of HMS fisheries, and the highly dynamic nature of the ocean environment. When each of the areas was implemented, NOAA Fisheries stated its intent to monitor and that NOAA Fisheries might reconfigure them in the future (e.g., responses to comments 3, 4, 6 in 65 FR 47214; August 1, 2000). NOAA Fisheries is following through with that intent with this document.

Although an effective management tool for achieving certain objectives, closed areas may also eliminate or limit the ability to gather fishery-dependent data within those areas. Therefore, the ability of managers to evaluate the effectiveness of spatial management measures can be constrained by limited, or non-existent, fishery-dependent data collected from closed areas or gear restricted areas after implementation. The difficulty of assessing spatial management areas can be further compounded the longer the measures remain in place. The limited research that exists from within HMS closed areas since they were closed is described in Chapter 3.

Fishery-dependent data are collected during normal fishing operations (e.g., catch composition, bycatch rates, and fishing effort), and constitute a vital and cost-effective source of information for fisheries management. Such data have been critical in determining stock status, assessing target species and incidental catch levels, and in meeting other fishery management and conservation needs. In some instances, fishery-dependent data may be the only data from a fishery that are cost-effective and feasible to collect when considering research and budgetary constraints. If normal fishing operations are curtailed or prohibited, as with closed areas, fishery-dependent data collection can be negatively affected and create data gaps that can have implications across multiple fisheries, such as a reduced understanding of species distribution and stock status. In addition to fishery-dependent data, fishery-independent data collection can also be reduced in these areas. Fishery-independent data are collected without involvement of commercial or recreational fisheries and are not directly influenced by harvesting activities; they are collected using fisheries surveys or experiments. As such, fishery-independent data collection programs often do not collect the same information as fishery-dependent data programs because fishery-independent programs do not operate the same as a fishing vessel. Additionally, because fishery-independent monitoring can be expensive, oftentimes the resources to fund such fishery-independent research may not be readily available. Fishery-independent data collection also relies on the ability of scientists to obtain permits needed to fish in closed areas. Of the four spatial management areas considered in Amendment 15, only the Mid-Atlantic shark closed area has had consistent data collection and monitoring because it is the only area that had research built into its design. From 2008 through 2010, there was one research project that collected data in the East Florida Coast closed area from three vessels over three years (73 FR 450; January 3, 2008). In 2017, NOAA Fisheries approved another research project for that area (82 FR 37566; August 11, 2017), but that research did not occur.

The need to assess the effectiveness of spatial management measures is not academic. There are environmental, social, and economic costs and benefits associated with closed or restricted areas. Ideally, closed areas overlap in space and time with the species habitat and/or life stages in need of protection, maximizing benefits and minimizing costs.

The lack of access to closed areas by directed fisheries may substantially reduce target catch and revenue for the affected fishery. Pelagic longline fishing effort and target species landings (e.g., swordfish, yellowfin tuna, and bigeye tuna) have been declining, and one of the reasons cited by fishery participants is the lack of access to perceived productive portions of the range of the target species due to the scope of the closed areas. Bottom longline gear is the primary commercial gear deployed for targeting large and small coastal sharks throughout the Atlantic Ocean. Bottom longline fishing effort targeting sharks has declined since 2016 (SAFE 2021). Catch of available shark quota and participation in the commercial shark fishery has dramatically declined from historical levels (NOAA Fisheries 2021a). If some existing closed areas affect the U.S. fleet's ability to harvest target species, NOAA Fisheries needs to evaluate the balance of these costs with the conservation benefits for other species to determine whether those closed areas warrant modification.

Furthermore, in addition to the direct benefits that accrue from protection of species for which a closed area is designed, and the direct costs associated with forgone revenue, there are indirect impacts that result from closed areas. Indirect impacts include ancillary protection of species within the closed area and incidental catch of species outside the closed area. Reductions in fishing effort in one area can displace fishing effort to other areas, with possible adverse impacts, depending on the magnitude of the effort and the geographic areas involved. For example, Chan and Pan (2016) examined the impact of displaced effort in the Hawaiian swordfish fishery. This analysis found that regulatory reductions in swordfish fishing effort to protect sea turtles displaced effort to other areas that were not as closely regulated. In these cases, sea turtle bycatch increased in the less regulated areas and fleets, negating the intended benefits to sea turtles. The transfer of negative ecological impacts like this is termed "spillover effects."

Lastly, there are impacts associated with allowing access to one resource user while prohibiting access to another resource user. Changes in access to an area may cause conflicts among different resource users, such as recreational and commercial fishermen, or eco-tourists. For example, the amount of recreational fishing often increases within the boundaries of areas closed to certain types of commercial fishing. As a result, any potential changes to closed areas may have direct and indirect impacts on anglers and related industries (e.g., marinas, hotels). These potential impacts also need to be evaluated.

The complexity of evaluating the direct and indirect cost and benefits of closed areas, as well as the different resource users and variety of affected stakeholders, compounds the challenge of effective spatial management. This situation results in the need to explore methods of collecting data from existing spatial and gear restricted areas; evaluate existing spatial and gear restricted areas; and consider design elements of spatial management measures that may increase their flexibility and utility in the context of relevant changes.

Changes in relevant stock status or ocean conditions that have altered the species' abundance, distribution, or migration patterns may result in a new situation with respect to a closed area. Closed areas may become less effective or obsolete in the context of new conditions. For example, the North Atlantic swordfish (*Xiphias gladius)* stock has been rebuilt since 2009. Oceanographic conditions have also changed as a result of climate change and have altered species distributions and ecosystem dynamics (IPCC 2019). For example, water temperature can directly impact current patterns, prey species distribution, and target species migration patterns. Because swordfish are now fully rebuilt, which is a positive change since the existing closed areas were first implemented, and because oceanographic conditions have changed, the geographically stationary closures may no longer achieve the original management goals. Rather, the closures may need to be modified by changing their spatial or temporal design.

Fishery regulations change over time, and because they are an important component of the context and environment in which closed areas exist, these regulatory changes may alter the effects or relevance of the closed area. Management measures that have been implemented in the pelagic longline fishery since 2001, include, but are not limited to, circle hooks, gear restrictions, careful release equipment and training, individual bluefin tuna quotas, catch quotas, and electronic video monitoring requirements. For example the pelagic longline fishery has been required since 2004 to use circle hooks instead of J-hooks to reduce sea turtle bycatch and bycatch mortality. Several other requirements described in Chapter 4 were also implemented in the decade after spatial management measures were implemented for the pelagic longline and the bottom longline fisheries. The Individual Bluefin Tuna Quota (IBQ) Program was implemented in 2015 (Amendment 7, NOAA Fisheries 2014), and made substantive changes applicable to the pelagic longline bluefin tuna fishery. The IBQ Program resulted in effective individual vessel accountability for bluefin tuna catch (NOAA Fisheries 2019b, Three-Year Review of the IBQ Program). The IBQ Program provides continuous incentives for vessels fishing with pelagic longline gear to utilize fishing strategies to reduce interactions with bluefin tuna (*Thunnus thynnus)*. Amendment 7 also required electronic monitoring (EM-recorded video and location data) for vessels fishing with pelagic longline gear. In consideration of the new data that resulted from the IBQ Program, and redundancy in bluefin tuna regulations, NOAA Fisheries implemented regulations in 2020 that modified two gear restricted areas and eliminated one. The Cape Hatteras Gear Restricted Area was eliminated and the Northeastern United States Closed Area and Spring Gulf of Mexico Gear Restricted area were modified by allowing conditional access to them (and renaming them as "monitoring areas").

Longline fisheries and the context in which they occur are changing over time. For example the number of pelagic longline permit holders that are fishing has declined over time, with an associated decline in total fishing effort. Changes in the HMS market have occurred over time, with imported swordfish affecting the demand and price for U.S.-caught swordfish. One of NOAA Fisheries' goals is to more fully utilize swordfish quota allocated to the United States by ICCAT.

NOAA Fisheries permit data indicate that participation in the HMS recreational fisheries have been steadily increasing in recent years after a decline in the 2000s. In 2020 there was a large increase in HMS recreational fishing effort associated with the COVID-19 pandemic, and people turning to safe outdoor activities. Recreational fishermen (private anglers, charter/headboat passengers, and tournament participants) target tunas (e.g., bluefin, yellowfin (*Thunnus albacares)*, bigeye tunas (*Thunnus obesus)*), swordfish, billfish (sailfish (*Istiophorus platypterus*), blue (*Makaira nigricans)* and white (*Kajikia albida*) marlin, roundscale spearfish (*Tetrapturus georgii*)), and sharks (e.g., blacktip (*Carcharhinus limbatus)*, bull (*Carcharhinus leucas)*, spinner (*Carcharhinus brevipinna)*, thresher (*Alopias vulpinus)*, bonnethead (*Sphyrna tiburo)*, Atlantic sharpnose (*Rhizoprionodon terraenovae)*, and smoothhound) using a variety of handgear (e.g., rod and reel and handline).

Analytical tools, which enable the modeling of relevant information used in the design and evaluation of special management areas, have changed since the implementation of many of the HMS closed areas. Spatial statistical tools like species distribution and habitat suitability modeling are available to help address these important management questions without on-the-water field sampling (Hobday and Hartmann 2006; Brodie et al. 2018; Welch et al. 2019). Spatial modeling approaches can be specifically designed to integrate existing species distribution data from outside of closed areas (e.g., observer data, survey data, tagging data) with available environmental covariates (e.g., sea surface temperature, depth, chlorophyll) to project species distributions and habitat suitability (Brodie et al. 2018; White et al. 2019) inside and outside closed areas relative to the fishery.

Fishery management tools have evolved to incorporate the new analytical or monitoring tools. For example, dynamic ocean management is a relatively new approach to fisheries management, which better addresses the variability in the marine environment, can be used to meet multiple objectives, and can improve efficiency in management (Lewison et al. 2015; Dunn et al. 2016). Similarly, electronic monitoring (EM)(i.e., the use of video technology) may be used as a means of providing information to managers and vessel owners on catch and vessel operations alone or in coordination with fishery observers. The use of EM systems has been required for HMS vessels fishing with pelagic longline gear since 2015, and has contributed to the success of the Individual Bluefin Tuna Quota Program. A full description of the use of EM is in Chapter 4.

Lastly, changes to relevant objectives, legal mandates, and policies change over time. Changing statutes, international agreements, Executive Orders (E.O.), and Presidential Proclamations will impact spatial management measures and their role in the management of HMS. For example, on September 15, 2016, a Presidential Proclamation implemented the Northeast Canyons and Seamounts Marine National Monuments, which prohibited commercial fishing in the area. More information is available at this website. During a subsequent administration, a June 5, 2020 Presidential Proclamation lifted the prohibition on commercial fishing in that area. More recently, on October 8, 2021, the current administration reinstated the prohibition on commercial fishing in the area, with the exception of American lobster (*Homarus americanus*) and Atlantic deep-sea red crab (*Chaceon quinquedens*) taken with fixed gear. As another example, in 2019, NOAA Fisheries finalized a policy directive titled "*Cost Allocation in Electronic Monitoring Programs for Federally Managed U.S. Fisheries*" (NMFS Procedure 04-115-02; May 7, 2019), which established a framework for allocating costs between the fishing industry and NOAA Fisheries, and a timeline for implementing the framework.

Public Scoping on Spatial Management - 2019

On May 16, 2019, NOAA Fisheries published a Notice of Intent to prepare a draft environmental impact analysis, hold scoping meetings, solicit public comment, and announce the availability of an issues and options paper (84 FR 22112). The Notice of Intent stated that NOAA Fisheries would explore options to perform research and collect data in closed areas to evaluate the effectiveness of spatial fisheries management. The issues and options paper titled "Issues and Options for Research and Data Collection in Closed and Gear Restricted Areas in Support of Spatial Fisheries Management" (NOAA Fisheries 2019a) was also published in 2019 to accompany the NOI. That paper noted examples of changes in: the affected fishery; stock status or ocean conditions; other management measures; and other relevant objectives that reinforced the need to obtain data from within the closed areas in order to evaluate them.

The Issues and Options paper included options to meet NOAA Fisheries' objectives with regard to spatial management (i.e., to summarize the management history and goals for existing HMS closed areas and to begin exploring different approaches to collecting data in the closed areas in support of HMS management). The options were:

- Option 1 – No action. Continue to authorize any closed area research through the current HMS exempted fishing permit (EFP) program.
- Option 2 – Authorize closed area research through a streamlined HMS EFP process; Streamline process of issuing HMS EFPs for closed area research.
- Option 3 – Collect data on closed area catch through an observed access program.
- Option 4 – Institute an HMS closed area research program, similar to the current shark research fishery.
- Option 5 – Conduct closed area research through public/private partnerships, partially funded by NOAA Fisheries, similar to the 2001 through 2003 Atlantic northeast distant waters (NED) research program.
- Option 6 – Conduct closed area research through a research program led by NOAA Fisheries, using NOAA or contract vessels.
- Option 7 – Performance-based closed area access.

NOAA Fisheries received written and verbal comments on the Issues and Options paper. Public scoping meetings were held in Gloucester, Massachusetts, Fort Pierce, Florida, Manteo, North Carolina, and Houma, Louisiana, on June 4, June 19, July 10, and July 25, 2019, respectively. In addition, scoping was conducted at the HMS Advisory Panel (AP) meeting in Silver Spring, Maryland, on May 22, 2019, and via webinar on June 19, 2019.

Among the comments received, there was widespread agreement that quality research and data collection is important for management, especially with changing ocean conditions and shifting HMS distribution. Many commenters said that research should be led by NOAA Fisheries and that the process to develop methods of obtaining data from closed areas should be inclusive and transparent. They stated that funding should be an important consideration when choosing a method to obtain data from within closed areas. Some commenters urged that NOAA Fisheries exercise caution when evaluating spatial management measures, and noted the importance of economic analyses.

There were many specific suggestions for research activities including: fishermen should conduct the research since they know how to target fish; NOAA Fisheries' Southeast Fisheries Science Center (SEFSC) should lead study design; 100-percent human observer coverage or 100-percent electronic monitoring should be required for research in closed areas; research should be funded by commercial sale of target catch on research trips; and there should be a bycatch interaction limit that, once reached, stops further data collection from within a closed area.

The Blue Water Fishermen's Association, a pelagic longline fishery organization, stressed the need for any research within closed areas to be as representative of a normal fishing operation as possible, so that the results could and would be interpreted to reflect the reality of an actual fishery if and when access to an area is restored. The Florida Fish and Wildlife Conservation Commission stressed the need for public input and transparency in the decision making process, and opposed collecting data with pelagic longline fishing in the East Florida Coast closed area. Organizations representing the recreational fishing community expressed the need for an objective process for making decisions about closed areas[2]. Further they suggested formal, scientifically rigorous research led by NOAA Fisheries, but only when there is a definitive need for such research. The HMS Advisory Panel members expressed support for evaluating the closed areas, given the environmental changes over time.

1.2 Scope and Organization of this Document

This draft amendment document includes a DEIS that assesses the potential direct, indirect, and cumulative ecological, social, and economic impacts associated with the proposed action and alternatives. Under NEPA, Federal agencies prepare an EIS if a proposed major

2 American Sportfishing Association, Center for Sportfishing Policy, Coastal Conservation Association, Congressional Sportsmen's Foundation, Guy Harvey Ocean Foundation, National Marine Manufacturers Association.

federal action is determined to significantly affect the quality of the human environment. An EIS is an analytical document that provides full and fair discussion of significant environmental impacts and informs decision makers and the public of reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment. NOAA Fisheries developed this DEIS, consistent with procedural requirements of NEPA and CEQ implementing regulations, 40 C.F.R. §§ 1500-1508; NOAA's procedures for implementing NEPA, including NOAA Administrative Order (NAO) 216-6A and Companion Manual; and "Revised and Updated NEPA Procedures for Magnuson-Stevens Fishery Management Actions" (See 79 FR 36726; June 30, 2014, and 81 FR 8920; February 23, 2016). This DEIS is being prepared using the 1978 CEQ NEPA Regulations. NEPA reviews initiated prior to the effective date of the 2020 CEQ regulations may be conducted using the 1978 version of the regulations. The effective date of the 2020 CEQ NEPA Regulations was September 14, 2020. This review began with a Notice of Intent published on May 21, 2019, and the Agency has decided to proceed under the 1978 regulations. After considering public comment, NOAA Fisheries will develop a Final EIS.

The following definitions were generally used to characterize the nature of the various impacts evaluated with this DEIS. Some or all of the terms may be used to describe impacts, as relevant.

- Short-term or long-term impacts. These characteristics are determined on a case-by-case basis and do not refer to any rigid time period. In general, short-term impacts are those that would occur only with respect to a particular activity or for a finite period. Long-term impacts are those that are more likely to be persistent and chronic. An example of a short-term impact might include a change in an allocation of bluefin tuna quota for a pelagic longline fisherman, if an alternative that modifies the method of allocating IBQ is selected. Long-term impacts might be more aligned with overall catch trends that might not be apparent following the implementation of a new management measure.
- Direct or indirect impacts. A direct impact is caused by a proposed action and occurs contemporaneously at or near the location of the action. A direct action may also not be geographically linked with respect to impact. For example, increases or decreases in fishing effort may have negative or positive ecological impacts on stocks due to increased or decreased mortality on target species. An indirect impact is caused by a proposed action and might occur later in time or be farther removed in distance but still be a reasonably foreseeable outcome of the action. An example of an indirect action that is not geographically linked may include increases or decreases in catch of non-target species, or food web impacts for prey species that may result from actions that might increase or decrease localized abundance of predators.
- Minor, moderate, or major impacts. These relative terms are used to characterize the magnitude of an impact. Minor impacts are generally those that might be perceptible but, in their context, are not amenable to measurement because of their relatively minor character. Moderate impacts are those that are more perceptible and, typically, more amenable to quantification or measurement.

Major impacts are those that, in their context and due to their intensity (severity), have the potential to meet the thresholds for significance set forth in CEQ regulations (40 CFR 1508.27) and, thus, warrant heightened attention and examination for potential means for mitigation to fulfill the requirements of NEPA.

- Adverse or beneficial impacts. An adverse impact is one having adverse, unfavorable, or undesirable outcomes on the man-made or natural environment. A beneficial impact is one having positive outcomes on the man-made or natural environment. A single act might result in adverse impacts on one environmental or social resource and beneficial impacts on another environmental or social resource.
- Cumulative impacts. CEQ regulations implementing NEPA define cumulative impacts as the "impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions." (40 CFR 1508.7) Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time within a geographic area.

This chapter, Chapter 1, provides introductory and background information for this amendment. Chapter 2 details analytical methodology related to the fishery interaction prediction spatial modeling tool, HMS Predictive Spatial Modeling (PRiSM). Chapter 3 summarizes the alternatives considered in this amendment and Chapter 4 fully describes the affected environment. Chapter 5 analyzes the ecological, social, and economic impacts of each alternative, consistent with NEPA requirements.

In addition to NEPA, NOAA Fisheries must comply with other federal statutes and requirements such as the Magnuson-Stevens Act, Executive Order 12866, and the Regulatory Flexibility Act. This document comprehensively analyzes the alternatives considered for all these requirements. Chapters 5, 6, 7, and 8 provide the ecological/environmental, economic, and social analyses; Chapter 7 meets the requirements under Executive Order 12866; Chapter 8 provides the Initial Regulatory Flexibility Analysis required under the Regulatory Flexibility Act. Chapter 9 describes how the preferred alternatives would comply with various statutes and executive orders.

In addition to the various chapters, additional information and analyses supporting the information provided in the Chapters is provided in various Appendices (Appendix 1: Observed Species Occurrence; Appendix 2: HMS PRiSM Model Results and Validations; Appendix 3: Species Interaction Probability Maps; Appendix 4: High-Bycatch-Risk Area Maps; Appendix 5: Options, Metrics, and Scoring; and Appendix 6. CIE Review and Responses).

While some of the chapters were written in a way to comply with the specific requirements under these various statutes and requirements, it is the document as a whole that meets these requirements and not any individual chapter.

1.3 Purpose and Need

Closed and gear restricted areas are important management tools in HMS fisheries. After implementation of any management measure, there is the need to determine whether the measure is achieving its objective and whether the balance of associated environmental, social, and economic costs and benefits remain appropriate. HMS closed areas should be periodically evaluated for their continued utility in meeting management goals and legal obligations, including those under the ESA, the MMPA, and the Magnuson-Stevens Act. Such reviews should include ensuring that closed areas remain appropriately designed to achieve ongoing conservation and management objectives. Many of the closed areas under the purview of the 2006 Consolidated HMS FMP have been in place for 15 or 20 years, with little or no evaluation.

The need to assess the effectiveness of spatial management measures is critical due to the static nature of the existing spatial management measures, the highly dynamic nature of HMS fisheries, and the highly dynamic nature of the ocean environment. Chapter 4 of this document provides detailed information on the affected environment, including closed areas under consideration. When each area was implemented, NOAA Fisheries stated its intent that they be monitored, and that NOAA Fisheries might reconfigure them in the future.

As discussed above, while closed areas can be an effective management tool for achieving certain objectives, closed areas may also limit or eliminate the ability to gather fishery-dependent data within the areas. Therefore, the ability of managers to evaluate the impacts and effectiveness of spatial management measures is constrained by limited, or non-existent, fishery-dependent data collected from closed or gear restricted areas after implementation. In other words, fishery managers need to know what is going on inside the closed area to properly manage the fishery and ensure the goals of the closed area (e.g., bycatch reduction) are being met, but no fishery-dependent data are available because the area is closed. NOAA Fisheries acknowledges that incidental catch is different than "bycatch," which has a specific definition under the Magnuson-Stevens Act, see 16 U.S.C. 1802(2). However, for ease of communication in this rule, unless otherwise noted, "bycatch species" generally refer to all non-target catch species, including incidentally-caught species that fishermen may or may not retain.

Instead, we (NOAA Fisheries) need to consider alternative or standardized methods of spatial management design. The design of the current closed areas did not include information on how to obtain data from within the closed or restricted areas or how to modify the areas if needed. Specifically, when the areas were implemented, there was the stated intent that the areas be reviewed in the future, but there was no guidance on when or how this review or evaluation of the areas should occur. Also, the closed area regulations and related FEISs provided little discussion on what would happen if the current closed areas were not meeting the original objectives. Although the closed areas could be modified by amending the regulations, their design was static, and did not reflect a changing environment. A more flexible design of spatial management areas is needed given the changing environment, developments in fisheries modeling, and the use of dynamic management tools in other fisheries.

As noted briefly above, EM has proven useful to date in the HMS pelagic longline fishery. In consideration of the 2019 policy regarding EM cost allocation, and the need to obtain data from within spatially management areas, we need to consider changes to the current EM Program.

This situation results in the need to analyze alternatives covering two aspects of spatial management and EM in the HMS pelagic longline fishery:

1) Methods of modifying, collecting data, and analyzing HMS spatial management areas.
2) Administration and funding of the HMS EM Program.

1.4 Objectives

Consistent with the 2006 Consolidated HMS FMP, its amendments, and all applicable law, the objectives of this amendment are as follows:

1) Using spatial management tools, minimize bycatch and bycatch mortality, to the extent practicable, while also optimizing fishing opportunities for U.S. fishing vessels.
2) Develop methods of collecting target and non-target species occurrence and catch rate data from HMS spatial management areas for the purpose of assessing spatial management area performance.
3) Broaden the considerations for the use of spatial management areas as a fishery management tool, including to provide flexibility to account for the highly variable nature of HMS and their fisheries, manage user conflicts, facilitate collection of information, address the need for regular evaluation and performance review, plan for climate resilience, and address environmental justice.
4) Evaluate the effectiveness of existing HMS spatial management areas, and if warranted, modify them to achieve an optimal balance of ecological, social, and economic benefits and costs.
5) Modify the HMS EM program as necessary to augment spatial management and address the requirements of relevant NOAA Fisheries policies regarding EM, including the 2019 Cost Allocation Policy.

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Chapter 2 METHODS AND DEVELOPMENT OF SPATIAL MANAGEMENT AREA ALTERNATIVES

This chapter describes the sequential methods by which the spatial management area alternatives ("A" Alternatives) in this DEIS were developed. The term "spatial management area" in this document is inclusive of the current "closed areas" under consideration, which are currently closed to pelagic and bottom longline fishing. When referring specifically to current areas, NOAA Fisheries may use the term "closed area," consistent with their current definitions. In general, however, this DEIS refers to all of the areas under consideration as "spatial management areas" rather than "closed areas" because this draft amendment includes alternatives that could allow access to spatially managed areas to meet the objectives of this action (see Section 1.4 for Objectives).

This chapter specifically focuses on the methodology used to develop the alternatives that represent modifications to the existing closed areas. This methodology includes the use of the modeling tool HMS PRiSM (**PR**ed**i**ctive **S**patial **M**odeling), as explained below. Additional data relevant to the development of the alternatives are in the Appendices. The various management alternatives and associated rationale are described in Chapter 3. The methods used to analyze the ecological and economic impacts of the alternatives are detailed in Chapter 5. NOAA Fisheries acknowledges that incidental catch is different than "bycatch," which has a specific definition under the Magnuson-Stevens Act, see 16 U.S.C. 1802(2). However, for ease of communication in this rule, unless otherwise noted, "bycatch species" generally refer to all non-target catch species, including incidentally-caught species that fishermen may or may not retain and also protected species.

HMS PRiSM is a complex spatial modeling tool. While NOAA Fisheries often relies on complex tools, such as stock assessments, to guide fisheries management, spatial modeling is less often used in this context of HMS management and so we approached its use two ways: 1) validation of the technical approach and 2) communication and outreach. First, as discussed in Section 2.1, we published the methodology in a peer-reviewed journal and submitted its application to the Center of Independent Experts (CIE) for review. Both these steps provide confidence that the methodology and application meets stringent scientific standards. Second, we provided communication and outreach about PRiSM for a wide range of audiences, i.e., those who may have spatial modeling or other technical expertise and those who may not. We created a website explaining HMS PRiSM when we announced publication of the journal article. We also explain the details and application of HMS PRiSM in a series of presentations provided at HMS AP Meetings and public hearings. Finally, we also included this chapter, the appendices, and a terminology list to fully explain the HMS PRiSM model.

The general steps we used to develop the spatial management alternatives are in Table 2.1. Figure 2.1 summarizes steps 4 through 6.

Table 2.1. Summary of the process of developing closed area alternatives

Step	Procedure
1	Select relevant bycatch species using the criteria (Section 2.3).
2	Develop HMS PRiSM models for each bycatch species (Section 2.4).
3	Develop and evaluate HMS PRiSM model outputs (interaction probability and high-bycatch-risk area) and metrics for each bycatch species and month (Section 2.5).
4	Based on the information derived from step 3 and additional considerations (e.g., known fishing ports or locations), develop a suite of 9 to 16 options (including current closed area) that provide a combination of potential temporal and spatial modifications to the closed area. Generate high-bycatch-risk area maps and 4 metrics for each option (Section 2.6).
5	Combine the 4 metrics into a single overall metric score to allow for rankings and comparisons of each option (to facilitate synthesis of large amounts of data –many species, with 4 metrics each– and enable standardized comparisons) (Section 2.7 and Table 2.4).
6	Based on scores from step 5 and additional considerations, pick 4 or 5 options to be alternatives, including the current closed area (Section 2.8).

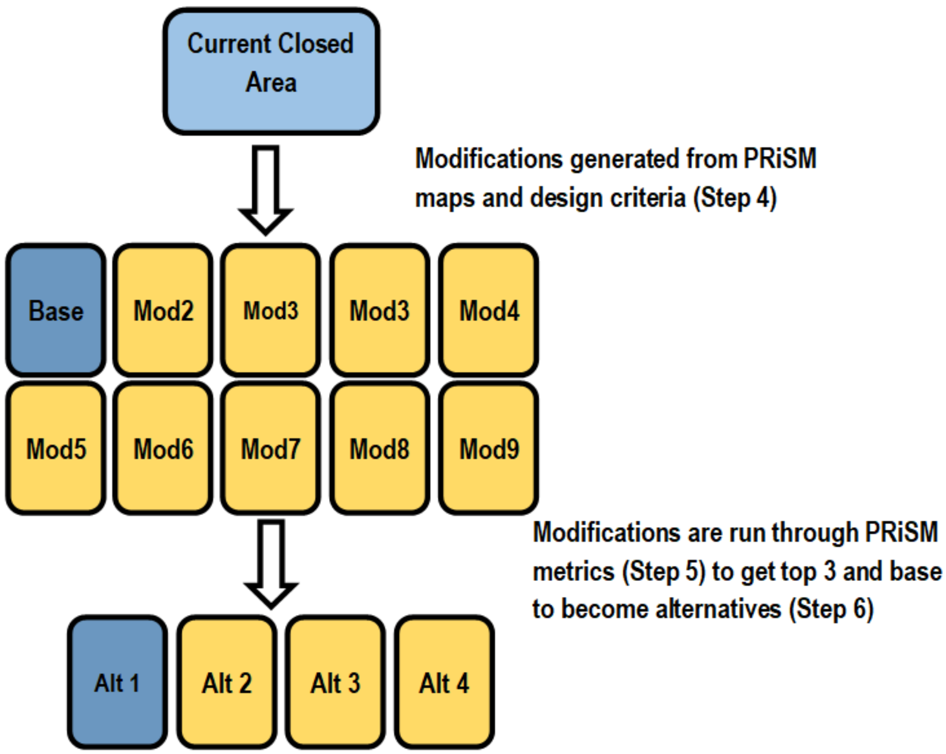

Figure 2.1. Flow chart of steps 4 through 6

The rest of this chapter provides the details on the use of HMS PRiSM in the development of options, the scoring system, and the use of non-PRiSM considerations in the development of alternatives.

2.1 HMS PRISM

HMS PRiSM is a modeling tool that uses fishery observer data and environmental data to predict where and when fishery interactions with particular species may occur. A detailed technical description of HMS PRiSM, and the validation methods are in a peer-reviewed paper (Crear et al. 2021) published in the scientific journal Marine Biology, and described by NOAA Fisheries on a PRiSM Website.

In summary, the HMS PRiSM model is based on data from commercial bottom longline (2005 through 2019) and pelagic longline (1997 through 2019) fishing trips collected by at-sea observers in conjunction with oceanographic data (HYCOM, Copernicus Marine Service). The fishery observer data include catch (species presence-absence), catch location (latitude/longitude), and gear information. The oceanographic data include water temperature, chlorophyll concentrations, salinity, currents and fronts, sea surface height (altimetry), and bottom depth, among others. HMS PRiSM uses the relationships between all of these environmental and observer data to predict the probability of fishery interactions. In other words, HMS PRiSM would predict a higher probability of species interaction with fishing gear in areas where water temperature, salinity, current, and other environmental features were shown previously to be associated with that species. Species fishery interaction distributions were projected over recent mean conditions each month to represent present conditions. Specifically, predictions using the model (of the probability of fishery interactions) were based on environmental data from 2017 through 2019 (mean monthly conditions). The monthly fishery interaction outputs generated by the model are referred to as occurrence probabilities ranging from 0 to 100 percent (represented on maps as 0 to 1).

The oceanographic characteristics differ between the Gulf of Mexico and Atlantic regions (separated at 80° 30’ W long.), therefore separate HMS PRiSM models were developed for a given bycatch species in each oceanographic region.

Validation of HMS PRiSM (Crear et al. 2021) was conducted separately for the Atlantic and the Gulf of Mexico regions. Model validation was done to ensure the results of the model are appropriate and essentially compared the model predictions (bycatch fishery interaction) with the actual observer bycatch data. Further description and results of the model validation is located in Section 2.4 and Appendix 2.

HMS PRiSM modeling used in the development of the alternatives included the use of four metrics, which are quantitative tools designed, in conjunction with non-quantitative methods, to evaluate closed areas (Crear et al. 2021). The use of the four metrics in the development of the alternatives is described further below.

The application of HMS PRISM in Amendment 15 is an innovative approach to address challenges in assessing the effectiveness of existing spatial management areas for commercial HMS bottom and pelagic longline fisheries. To ensure that the approach is sound, NOAA Fisheries formally consulted with outside experts at two points in the process, each providing valuable insight and assurances. First, the HMS PRiSM methodology was submitted for peer-review and publication in the scientific journal Marine Biology, as described above. Second, as detailed below, portions of the DEIS were submitted to the Center of Independent Experts (CIE) for review. To ensure that NOAA Fisheries is using the best available scientific information for management considerations, CIE was established in 1998 to routinely provide external, independent and expert reviews of the Agency's science used for policy and management decisions. The CIE process satisfies peer-review standards as specified in the Magnuson-Stevens Act provision National Standard 2 guidelines. These guidelines specify that peer review is an important factor in the determination of best scientific information available, and the selection of reviewers must adhere to peer-review standards such as high qualifications, independence, and strict conflict of interest standards. The CIE is a proven process that strengthens the quality and credibility of the Agency's science, and has improved stakeholder's trust that the Agency is basing policy decisions on the best scientific information available.

On July 8, 2022, NOAA Fisheries submitted portions of the Amendment 15 DEIS to CIE for review by three independent experts. NOAA Fisheries requested that the reviewers provide comments on the description and communication of the spatial management alternatives and the application of the analytical approach including HMS PRiSM's use in developing the alternatives and analyzing impacts. Portions of the DEIS selected for CIE review were those applicable to this request for reviewer comment. Because the HMS PRiSM methodology had already been peer-reviewed and published in the scientific journal Marine Biology, we requested that reviewers not focus on the specific HMS PRiSM methodology. However, NOAA Fisheries did provide background material and answer questions to ensure the reviewers had a complete understanding of the spatial modeling tool. EM cost allocation alternatives were not included in the CIE review. On August 24, 2022, NOAA Fisheries received review reports from the three CIE-selected independent experts. In general, all three reviewers were supportive of the analytical approach and indicated that it is appropriate for fisheries management. Each reviewer also found that the approach was well-described and communicated. In addition to the overall supportive findings, each reviewer also provided suggestions for near-term and long-term improvements in the approach and communication of the alternatives. Most of the suggestions were incorporated into the DEIS. Appendix 6 provides responses and/or action taken to address each of the comments, suggestions, or questions in the reviewer reports.

2.2 Selection of Existing Closed Areas for Evaluation and Scope of the Spatial Management Area Alternatives

The range and number of "A" Alternatives analyzed was determined by the objectives of this action (Chapter 1), the Notice of Intent, which announced to the public NOAA Fisheries' intent to prepare a draft environmental impact analysis (84 FR 22112; May 16, 2019), and an Issues and Options Paper, which explored different approaches to collecting data in closed areas in support of fishery management. Based on the objectives of this management action and in consideration of Magnuson-Stevens Act requirements and relevant executive orders, the "A" Alternatives do not include novel geographic areas. In other words, all of the areas we evaluate have a clear or meaningful spatial or temporal overlap with a currently existing closed area; we are not evaluating any completely new closed areas at this time. The spatial management areas we analyze in this DEIS are the current principal HMS closed areas that have been in effect for close to, or more than, two decades, and are the Mid-Atlantic shark closed area, the Charleston Bump closed area, the East Florida Coast closed Area, and the DeSoto Canyon closed Area (Figure 2.2).

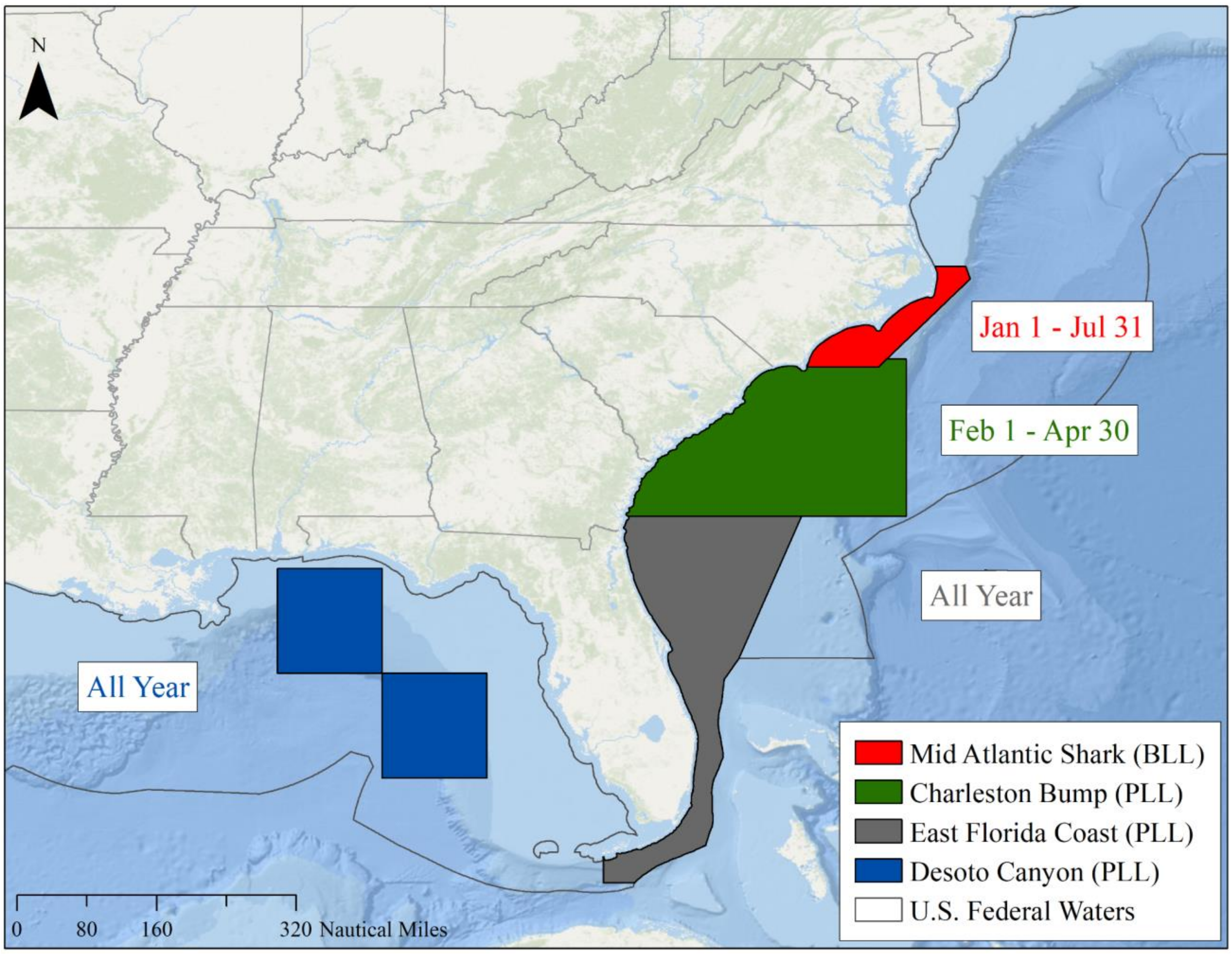

Figure 2.2. Bottom and pelagic longline closed areas and associated closed area time periods.

2.3 SELECTION OF SPECIES

In order to address the objectives of this DEIS, NOAA Fisheries first needed to determine which bycatch species should be included in the mathematical modeling (using HMS PRiSM) used in the process of evaluating existing HMS spatial management areas. *See* Terminology for explanation of how the term "bycatch" is being used in this document.

Although the objectives of this DEIS are intentionally not species-specific, to enable consideration of relevant bycatch, the process of developing alternatives to meet the objectives required creation of criteria for selection of species caught in the relevant HMS fisheries. As a practical matter, NOAA Fisheries did not attempt to develop and analyze alternatives considering all bycatch species due to the complexity associated with such a large scope, and the fact that optimization of the utility of the current closed areas is likely to be enhanced by the selection of certain bycatch species to be priorities. Further, the use of HMS PRiSM was constrained by data availability (as explained below).

The approach taken to select certain bycatch species focused on the present-day fishery for several reasons: 1) The current conditions of the U.S. fisheries and the oceanographic environment are different from those conditions at the time the closed areas were established; 2) Evaluation of the closed areas based on species for which the closed areas were created may be difficult because the original objectives of the closed areas may be interpreted differently by various constituent groups; and 3) There may have been ancillary benefits associated with the closed areas, which may be relevant regardless of the stated original objectives.

For this DEIS, we used four principal criteria to select species. We applied these criteria separately for bottom longline gear for the Atlantic, pelagic longline gear for the Atlantic, and pelagic longline gear for the Gulf of Mexico.

The four principal criteria were:

1. Occurrence rate in the relevant gear type. A high rate of occurrence (with occurrence defined as at least one individual caught in an observed set) may be an indication that bycatch has not been minimized adequately; a relatively high rate of occurrence is needed for robust model results; and bycatch species with relatively low occurrence rates are relatively non-responsive to the use of spatial management as a tool (especially HMS, which are highly mobile).
2. The overfished and overfishing status of the species.
3. The Endangered Species Act (ESA) status (e.g., threatened, endangered) of the species.
4. Community importance or unique characteristics, such as a species that may be highly sought after in the recreational fishery.

These criteria are also reflective of the original objectives for the Charleston Bump, East Florida Coast, and DeSoto Canyon pelagic longline closed areas, and Mid-Atlantic shark closed area, which were to reduce the bycatch and incidental catch of overfished and protected species by pelagic and bottom longline fishermen who target HMS. Table 2.2 shows the species for which HMS PRiSM was used, and the primary basis for the current evaluation of closed areas. These species are referred to in Amendment 15 as “modeled species.”

Table 2.2. Species List

Gear	Species included in HMS PRiSM*
Pelagic longline	Billfish (collectively: blue marlin (*Makaira nigricans)*, white marlin (*Kajikia albida*), roundscale spearfish (*Tetrapturus georgii*), longbill spearfish (*Tetrapturus pfluegeri*), sailfish (*Istiophorus platypterus*) Leatherback sea turtle (*Dermochelys coriacea*) Loggerhead sea turtle (*Caretta caretta*) Shortfin mako shark (*Isurus oxyrinchus)*
Bottom longline	Sandbar shark (*Carcharhinus plumbeus)* Dusky shark (*Carcharhinus obscurus)* Scalloped hammerhead shark (*Sphyrna lewini)*

For more information on the derivation of the above species, consult the tables in Appendix 1 that provide a list of all species in the observer data and information on the application of these criteria.

We selected billfish, shortfin mako shark, loggerhead sea turtle, and leatherback sea turtle for the Atlantic bycatch species for which the pelagic longline HMS PRiSM model was run. Billfish (combined billfish species including white marlin, overfished; roundscale spearfish, overfished; longbill spearfish, unknown; blue marlin, overfished; and sailfish, not overfished) occurred in 40 percent of pelagic longline sets in the Atlantic region. Retention is prohibited in the pelagic longline fishery and the species are important for the recreational fishing community. Billfish were aggregated to improve sample size. Shortfin mako shark (overfished, with overfishing occurring) occurred in 27 percent of pelagic longline sets in the Atlantic region. Note that currently no retention of shortfin mako sharks is allowed in any commercial or recreational fishery (87 FR 39373; July 1, 2022). Loggerhead sea turtle (listed as threatened under ESA) occurred in 7 percent of Atlantic pelagic longline sets, and leatherback turtle (listed as endangered under ESA) occurred in 6 percent Atlantic pelagic longline sets. As explained in Sections 4.11.1 through 4.11.3, the original objectives of the pelagic longline closed areas (East Florida Coast, Charleston Bump, and De Soto Canyon) were to reduce bycatch, bycatch mortality, and incidental catch of multiple species and/or life stages including undersized swordfish, billfish, and other overfished and protected species. At that time, Atlantic blue marlin, white marlin, sailfish, bluefin tuna, and swordfish were overfished. Swordfish is now fully rebuilt, and thus, was not included in HMS PRiSM.

We selected shortfin mako shark (overfished, with overfishing occurring, and landing/retention prohibition), billfish, and leatherback turtle for the Gulf of Mexico bycatch species for which the pelagic longline HMS PRiSM model was run. In addition to the aforementioned information above for each species, shortfin mako shark occurred in 9 percent of pelagic longline sets in the Gulf of Mexico, billfish occurred in 44 percent of sets, and leatherback sea turtle occurred in 5 percent of sets. Loggerhead sea turtle was not included for the Gulf of Mexico region because of its low occurrence rate in the pelagic longline fishery (< 1 percent of sets).

Other species of interest, which were not fully integrated into the full HMS PRiSM modeling/metric/modification score process, were considered in the evaluation of closed areas, as described in the description of alternatives in Chapter 3. For example, bluefin tuna was modeled and fishery interaction probability maps were produced separately for the Atlantic and Gulf of Mexico pelagic longline fisheries, but metrics and modification scores (described below) were not calculated. Instead, bluefin tuna fishery interaction probability maps were taken into consideration separately due to the unique nature of bluefin tuna as an incidental species in the pelagic longline fishery, which is successfully managed through the IBQ Program. Target species in the HMS pelagic longline fishery (e.g., swordfish, bigeye tuna, and yellowfin tuna) were not modeled using HMS PRiSM since the tool is focused on reducing bycatch. Similarly, target Council species such as dolphin and wahoo were not included in HMS PRiSM either.

We selected sandbar shark, scalloped hammerhead shark, and dusky shark as the bycatch species for which the bottom longline HMS PRiSM model was run. As explained in Section 4.11.6, the intent of the original Mid-Atlantic Shark bottom longline closure was to reduce all interactions between commercial fishing operations and pupping and nursery grounds and hence reduce both the catch and mortality of dusky and juvenile sandbar sharks. Sandbar shark is overfished with a percent occurrence of 78 percent in the Atlantic (i.e., 78 percent of the observed bottom longline sets had a catch of at least one sandbar shark). Dusky shark is overfished, with overfishing occurring, and with a percent occurrence of 23 percent in the Atlantic. Scalloped hammerhead shark is overfished, with overfishing occurring, and with a percent occurrence of 29 percent in the Atlantic. Loggerhead sea turtle, which is a bycatch species that is threatened under the ESA, was not included because it has a low occurrence rate. The only other bycatch species with a high occurrence rate and that is overfished with overfishing occurring is blacknose shark. We did not analyze blacknose shark because the species distribution is generally south of the Mid-Atlantic shark closed area and the species is only occasionally encountered in that area.

2.4 Develop HMS PRiSM Models

Separate HMS PRiSM models and subsequent validations were developed for each bycatch species for the appropriate fishery and region as described in Section 2.3. Please see a detailed technical description of the development of HMS PRiSM models and validation methods in the peer-reviewed paper (Crear et al. 2021). Descriptions of the best model for each bycatch species, model validations, and relationships between each species and the model variables are located in Appendix 2. Briefly, HMS PRiSM models for bycatch species in the pelagic longline fishery Atlantic region and the Atlantic bottom longline fishery received good validation scores. Validation of the HMS PRiSM models for bycatch species in the Gulf of Mexico region indicated that for some species, the models did not perform as well as the HMS PRiSM models for the Atlantic region did. Therefore, there is a greater level of uncertainty around the occurrence probabilities for certain species in the Gulf of Mexico.

The level of uncertainty for the HMS PRiSM results in the Gulf of Mexico region was taken into consideration in the selection of the preferred alternatives (Chapter 5).

In addition, it is important to provide justification for the use of fishery-dependent data (e.g., observer program data) rather than fishery-independent data (e.g., tagging data). Fishery-dependent data (observer program data) were used for HMS PRiSM modeling because from a management perspective we are concerned with where a species may interact with the fishing gear, not necessarily where a species is distributed. For example, a species may be at a specific depth where fishing gear would not interact with that species, the size of the hook used by the fishermen may reduce the chances of a species interacting with the gear, or a species may not be feeding for various biological reasons. In addition, the current closed areas are only closed for a specific gear type. Therefore, NOAA Fisheries determined that it is most appropriate to use fishery-dependent data from that specific gear type, rather than using tagging or other fishery-independent data, which would simply produce the species distribution. Despite these differences, interaction probability developed from fishery-dependent data and species distributions developed from tagging data will produce relatively similar outputs. For example, shortfin mako shark distribution of interaction probability with the pelagic longline from HMS PRiSM shifted latitudinally with season, a pattern also observed in the satellite tagged shortfin mako sharks (Vaudo et al. 2016). HMS PRiSM found that dusky sharks may prefer areas within the Mid-Atlantic shark closed area one to two months prior to the closure, a similar observation found in acoustically tracked juvenile dusky sharks (Bangley et al. 2020). Lastly, maps of billfish fishery interaction probability developed from HMS PRiSM showed similar seasonal distributions to that of blue marlin satellite tagged in Goodyear et al. (2016). These similarities found between models developed from observer and satellite data, validates HMS PRiSM further. Monthly interaction probability maps for each bycatch species can be found in Appendix 3.

HMS PRiSM utilizes the fishery-dependent observer data collected in bottom and pelagic longline fisheries rather than data reported directly by vessel operators such as logbook data. Although logbook data could provide a census of all catch and would include the greatest number of records, observer data has several advantages that make it specifically more useful for HMS PRiSM. First, observers receive formal training in species identification, providing more confidence in this information. Fishermen are likely very good at species identification, particularly target species and commonly caught bycatch species, but regional differences or the presence of newer crew decrease confidence in the information. Second, vessel operators may not have the same incentive to correctly report some information, particularly bycatch, as observers do. Observers are onboard with a goal to provide, among other things, complete catch data including bycatch. Vessel operators may not prioritize complete and accurate catch reporting, especially for some bycatch or catch that is not retained. Furthermore, some vessel operators may be disincentivized to report bycatch of protected species if such reports are perceived to lead to additional fishing restrictions in the future. Third, observers collect more accurate catch location information, allowing for a closer link between spatiotemporal catch data and environmental variables used in the model. Logbooks contain general location information and fishing effort can be located using VMS, however, observer data provides more accurate location information. Fourth, observers collect additional information that can be useful in some modeling efforts including size of fish and disposition. Although HMS PRiSM does not currently include predictions for catch of certain size classes, observer data provides the flexibility to create those models.

As in all modeling exercises, there are limitations and uncertainties in the approach. These are explained in detail in Crear et al. 2021. Briefly, we recognize the level of uncertainty in models contributed to many factors, including species occurrence rate and quality of environmental variables. To understand these uncertainties, we used model selection, conducted model validation, and visually inspected the upper and lower bounds of the monthly interaction probability maps (using standard errors) for each bycatch species.

2.5 High-Bycatch-Risk Areas and Metrics

HMS PRiSM High-Bycatch-Risk Area Maps

Using oceanographic data averaged monthly from 2017 through 2019 and the environmental relationships for each species, we used HMS PRiSM to predict the occurrence probabilities on a monthly basis by the bycatch species listed in Sections 2.3 and 2.4 (Appendix 3). The predictions were limited to the fishery domain, which is the area where 95 percent of the fishery occurs. Using these occurrence probabilities, we developed high-bycatch-risk area maps for each species and month. "High-bycatch-risk areas" are the areas where high probabilities of fisheries interactions are predicted to occur for a given species. The following description of the method of determining high-bycatch-risk areas is based on the HMS PRiSM peer-reviewed published paper (Crear et. al. 2021).

To determine the high-bycatch-risk areas, we needed to define a *high-bycatch-risk area value* for each bycatch species. Defining the high-bycatch-risk area value provides a method to weigh each species based on the level of management importance. A greater range of occurrence probabilities for a given species would be considered "high risk" when a greater high-bycatch-risk area value is defined. In other words, if NOAA Fisheries determines it is important to consider protecting the area where the top 25 percent of occurrence probabilities occurred, then the high-bycatch-risk area value would be 25 percent. The higher the high-bycatch-risk area value, the more area NOAA Fisheries would consider protecting for a given species. In Amendment 15, for species listed as endangered or threatened under the ESA, we used a high-bycatch-risk area value of 50 percent. We feel that because a species is listed under the ESA, the species has a greater management importance, and, therefore, requires a more risk-averse approach. As such, for leatherback and loggerhead sea turtles, the high-bycatch-risk area value was defined as the area where the occurrence probability represents the top 50 percent of areas where those species were most likely to interact with the fishery (Table 2.3). For species that are managed under the Magnuson-Stevens Act and where overfishing is occurring, that are overfished, and/or have high community importance, we used a value of 25 percent. Thus, for shortfin mako shark, billfish, dusky shark, sandbar shark, and scalloped hammerhead shark, a high-bycatch-risk area value was defined as the area where the occurrence probability represents the top 25 percent of areas where those species were most likely to interact with the fishery (Table 2.3).

Once we define a high-bycatch-risk area value, that value can be applied to the range of interaction probabilities produced through HMS PRiSM, to calculate a corresponding *occurrence probability threshold* from all occurrence probabilities across all grid cells across all months. In short, for each bycatch species, there is an occurrence probability for each grid cell of the map (each grid cell is a square location with sides equal to 1/12°) for each month. We calculate the occurrence probability threshold using these thousands of occurrence probabilities. The resulting occurrence probability thresholds are shown in Table 2.3.

Table 2.3. The seven species statuses used to determine the high-bycatch-risk area value and corresponding occurrence probability threshold needed to calculate each species' high-bycatch-risk area for each particular region.

Species	Species Status (per 2021 HMS SAFE Report)	Region	High-Bycatch-Risk Area Value	Occurrence Probability Threshold
Leatherback Sea Turtle	ESA/endangered	Atlantic	50%	2.4%
		Gulf of Mexico	50%	2.8%
Shortfin Mako Shark	MSA*/overfished /overfishing	Atlantic	25%	25%
		Gulf of Mexico	25%	49%
Billfish Species Group	MSA/community importance	Atlantic	25%	75%
		Gulf of Mexico	25%	73%
Loggerhead Sea Turtle	ESA/endangered	Atlantic only	50%	3.4%
Dusky Shark	MSA/overfished/ overfishing	Atlantic only	25%	25%
Sandbar Shark	MSA/overfished/ overfishing	Atlantic only	25%	99.5%
Scalloped Hammerhead	MSA/overfished/ overfishing	Atlantic only	25%	58%

*"MSA" is the Magnuson-Stevens Act

Differences in occurrence probability thresholds for each species listed in Table 2.3 are due to variations in each species' probability of interacting with longline gear. Figure 2.3 is provided for demonstration purposes to help the reader understand the concepts described in this document. Specifically, Figure 2.3 provides examples of different curves describing the frequency of occurrence (i.e., interaction) probabilities of a species. The bottom of each graph shows the occurrence probabilities where values on the left indicate the occurrence probability is low or rare and values on the right indicate the occurrence probability is high or likely. Each point along the curve represents the number of grid cells (i.e., frequency) at each occurrence probability. In other words, taller areas of the curve represent more common occurrence probabilities and shorter areas of the curve represent less common occurrence probabilities. The first curve on the left hand side of Figure 2.3 demonstrates a "normal distribution of occurrence probabilities." The arrow marked "50%" shows the "50-percent delineation" or where half of the interaction probabilities are to the left of the arrow and half are to the right. For the purposes of this explanation, if the high-bycatch-risk area value was defined as 50-percent, then by following the arrow straight down to the x-axis we would determine the occurrence probability threshold would also roughly equal 50. In our analyses, none of the modeled species' had a normal distribution of occurrence probabilities, and instead all were more similar to the other two curves in Figure 2.3. The curve in the middle of Figure 2.3 shows an example of what the distribution of occurrence probabilities could look like if interaction rates are less likely (i.e., lower occurrence probabilities). For example, if a species is not commonly caught and reported in observer data, such as the case for leatherback sea turtles, the curve is taller on the left (i.e., skews left) and the 50-percent delineation occurs at a lower occurrence probability threshold as shown with the 50-percent arrow. As shown in Table 2.3 above, the occurrence probability threshold for leatherback sea turtles for a 50-percent high bycatch area value is 2.4 percent. This means the actual curve for leatherback sea turtles would skew left even more than what is shown in this example. The last curve on the right of Figure 2.3 shows an example of what the distribution could look like if interaction rates are more likely (i.e., higher occurrence probabilities). For example, if a species is commonly caught and reported in the observer data , such as the case for sandbar sharks, the curve is taller on the right (i.e., skews right) and the 50-percent delineation occurs at a higher occurrence probability threshold as shown with the 50-percent arrow. In addition to the 50-percent arrows, Figure 2.3 also includes arrows labeled "top 25% break." These arrows indicate the point where 75 percent of the occurrence probability values are found to the left of the arrow and the 25 percent of occurrence probabilities are to the right. For species with a high-bycatch-risk area value of 25 percent (e.g., shortfin mako shark and the billfish species group), we used the top 25 percent of occurrence probabilities, or the values to the right of the arrow, to designate high-bycatch-risk areas.

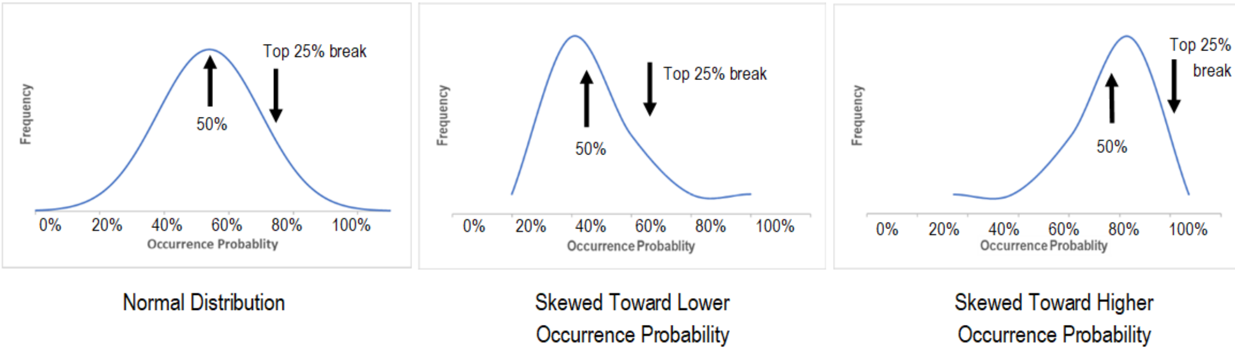

Figure 2.3. Demonstration of relationship between high-bycatch-risk area value and occurrence probability threshold. The 50-percent arrow demonstrates where along the curve the 50-percent high-bycatch-risk area value is and the top 25-percent break arrow demonstrates where along the curve the 25-percent high-bycatch-risk area value. By following the arrow down to the x-axis the corresponding occurrence probability threshold for each high-bycatch-risk area value can be determined.

Once the occurrence probability threshold was calculated, we compared the occurrence probability in each grid cell for each month to the occurrence probability threshold. We defined the high-bycatch-risk area for each month as the area (grid cells) where the occurrence probabilities were equal to or greater than the occurrence probability threshold. The result can be shown on a map. An example of a high-risk map is shown below in Figure 2.4. High-risk maps for all species selected and months are in Appendix 4. NOAA Fisheries used the high-bycatch-risk area maps to provide information on potential shifts in the spatial configuration of the current closed areas that would optimize the protection of bycatch species.

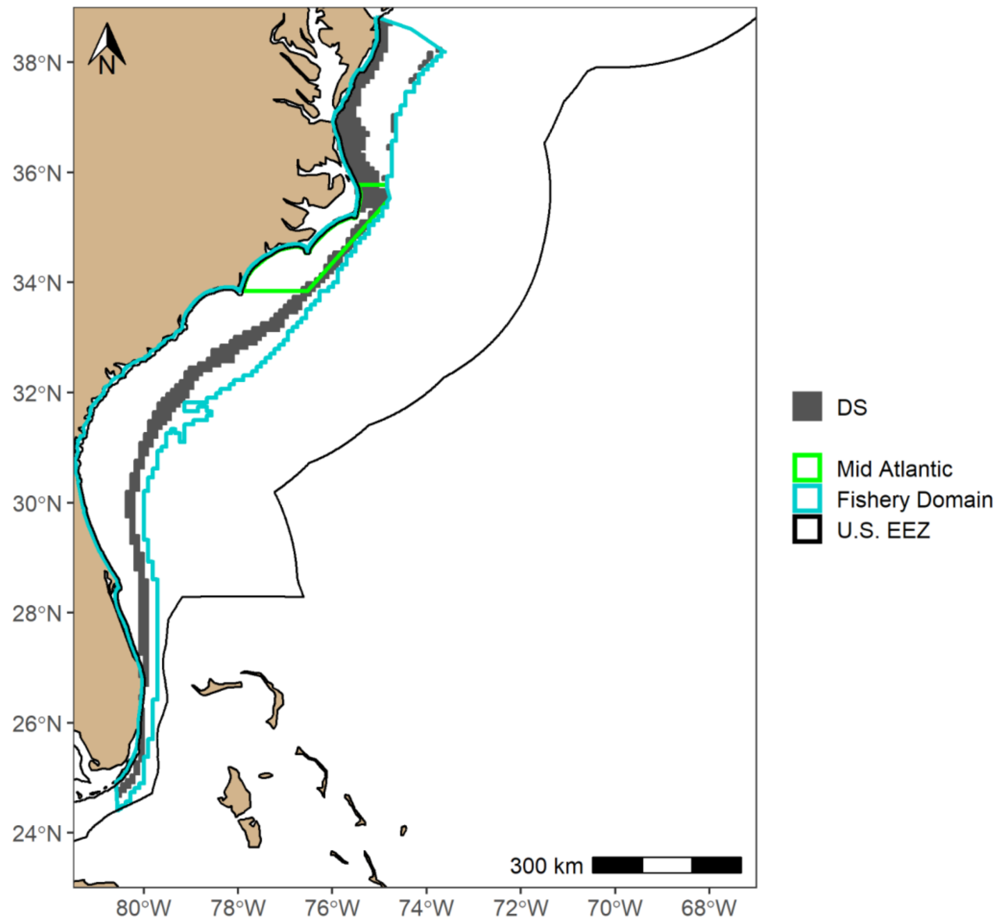

Figure 2.4. High-Bycatch-Risk Area for Dusky Shark (DS) in May, based on Year 2017 through 2019 data. The area inside the green represents the Mid-Atlantic shark closed area, while the area inside the light blue represents the bottom longline fishery domain.

HMS PRiSM Metrics

For the current closed areas, we calculated four metrics for each of the species. These metrics provided information on potential geographic and/or temporal shifts in the closed areas that could optimize the protection of bycatch species. The high-bycatch-risk area values and corresponding occurrence probability thresholds described above and shown in Table 2.3 are used with Metrics 2, 3, and 4. We applied these four metrics to all of the selected species in Section 2.3 (see Option 0 for each closed area in Appendix 5). Based on the high-bycatch-risk area maps and metrics, NOAA Fisheries developed options (see Section 2.6) that modified the geographic and temporal extent of the current closed areas to improve the conservation of bycatch species.

<u>Metric 1 (average occurrence probability inside/outside closed area by month)</u>

For a given species and month of the closed area, metric 1 compares the average occurrence probability (predicted by each model based on average conditions from 2017 through 2019) inside the closed area to the actual occurrence rate (the number of sets the species occurred in divided by the number of total sets) from fisheries data collected by observers outside the closed area (from 1997 through 2019). Because we do not have occurrence rates inside the closed areas during the closure months, predicted occurrence (i.e., interaction) probability is the best available information to estimate occurrence rate inside the closed area. The rationale behind this metric is to understand how species occurrence inside the closed area compares to the species occurrence in the areas fished outside the closed area. Figure 2.5 provides a hypothetical example where the average occurrence probability inside the closed area (generated from average conditions; map on the left side) is 45 percent while the actual occurrence rate outside the closed area (generated from observer data; map on the right side) is 30 percent.

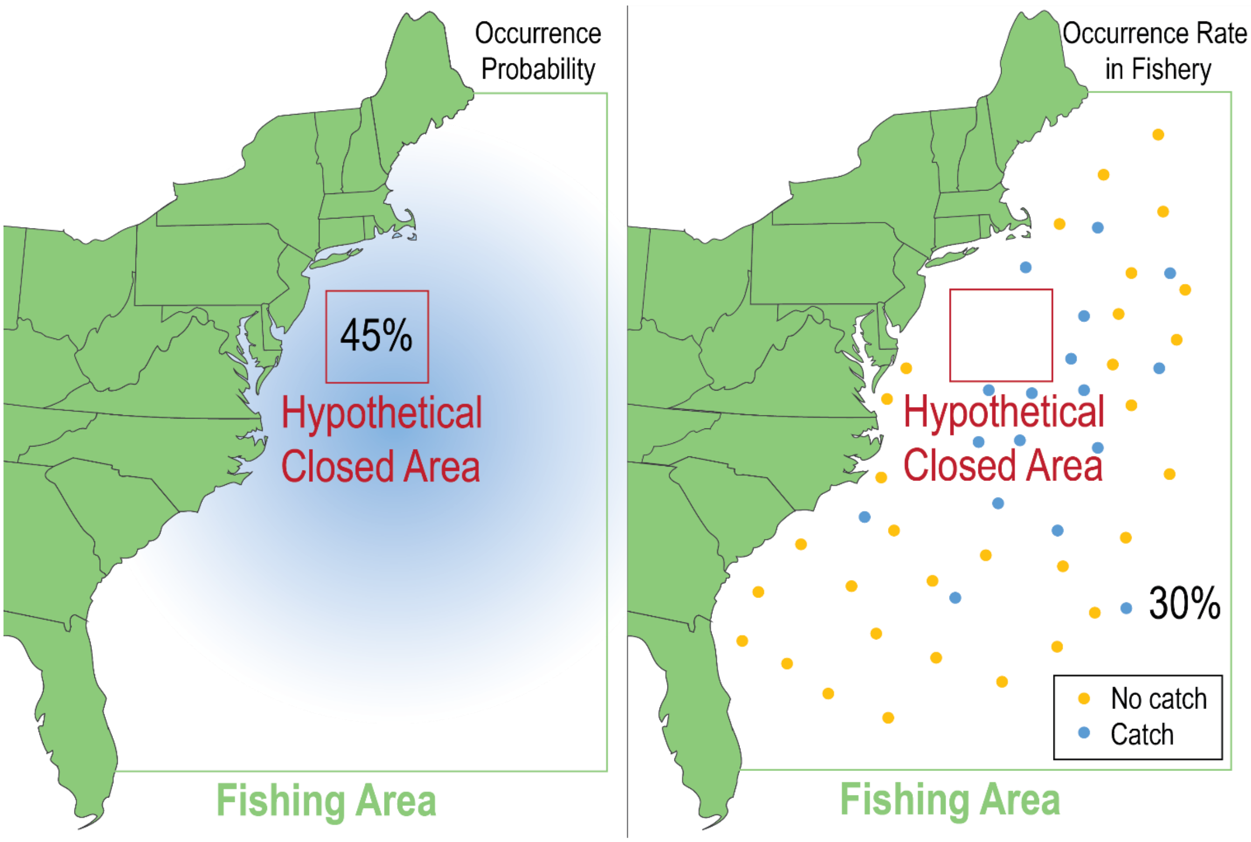

Figure 2.5. Example of Metric 1. Average occurrence probability inside closed area (45%; predicted from model based on average environmental conditions) is greater than the actual occurrence rate outside closed area (30%; generated from observer data). On the left map, the darker the blue the higher the occurrence probability.

Metric 2 (high-bycatch-risk areas inside/outside closed area by month)

Metric 2 is a ratio that compares the median occurrence probability of high-bycatch-risk areas inside the closed area to the median occurrence probability of high-bycatch-risk areas outside the closed area for each month of the year. The rationale for this metric was to identify, for high-bycatch-risk areas, how the probability of fishery interaction compares inside the closed area to outside, and whether the closed area is protecting the areas with the highest probability of interactions. Figure 2.6 provides a hypothetical example of this metric. In Figure 2.6, the median occurrence probability that was considered high-bycatch-risk area that occurred inside the closed area was 65 percent, while the median occurrence probability that was considered high-bycatch-risk area that occurred outside the closed area was 80 percent. Based on this, the ratio would be less than 1, indicating the closed area was not protecting the areas with the highest probability of interactions. If the ratio was greater than 1, the closed area would be doing better at protecting the areas with the highest probability of interactions.

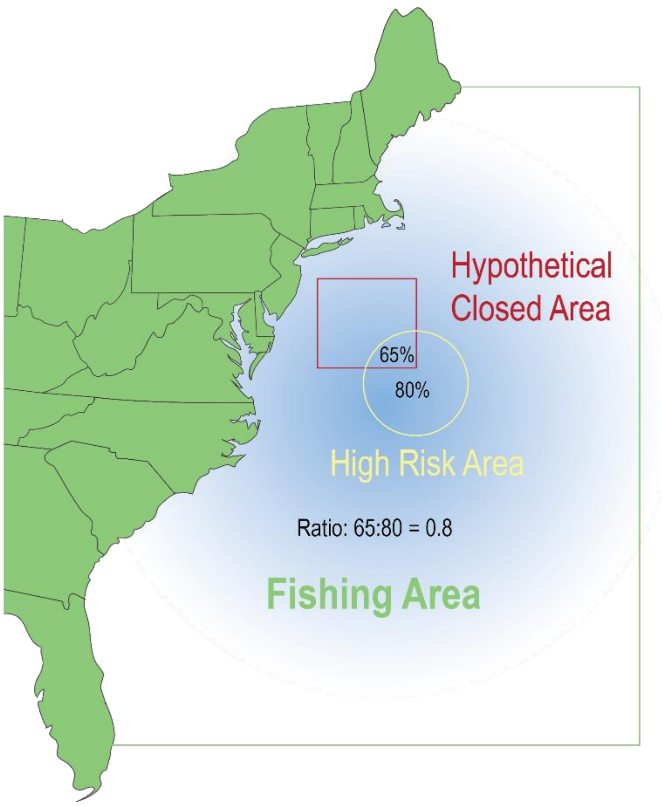

Figure 2.6. Example of Metric 2. The median occurrence probability that was considered high-bycatch-risk area that occurred inside the closed area was 65 percent, while the median occurrence probability that was considered high-bycatch-risk area that occurred outside the closed area was 80 percent. Based on this the ratio would be less than 1 indicating the closed area was not protecting the areas with the highest probability of interactions.

Metric 3 (percent of total high-bycatch-risk area inside closed area by month)

Metric 3 calculates the percent of high-bycatch-risk areas that occurred inside the closed area for each month of the year for a given species. The rationale of this metric is to determine the percent of high-bycatch-risk areas across the whole fishery domain that is protected by the closed area. In the hypothetical example provided in Figure 2.7, only 15 percent of the high-bycatch-risk area occurs inside the closed area, indicating that the majority of the high-bycatch-risk area is not protected by the closed area.

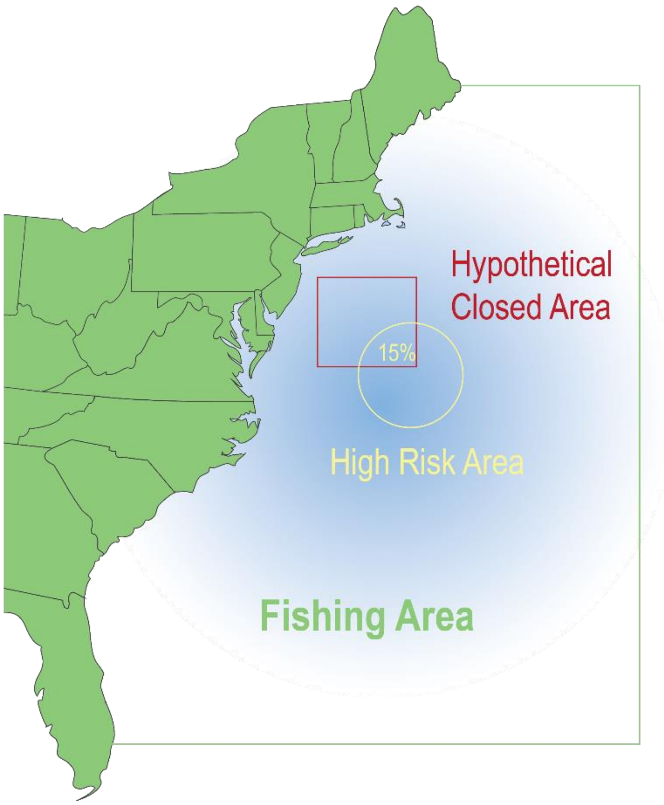

Figure 2.7. Example of Metric 3. Fifteen percent of the high-bycatch-risk area occurs inside the closed area, indicating that the majority of the high-bycatch-risk area is not protected by the closed area.

Metric 4 (percent of closed area protecting high-bycatch-risk areas by month)

Metric 4 calculates the percent of the closed area that would protect high-bycatch-risk areas for each month of the year for a given species. The rationale of this metric is to understand the percentage of the closed area that protects high-bycatch-risk areas. A low percent means only a small amount of the closed area is protecting high-bycatch-risk areas. A high percent means a large amount of the closed area is protecting high bycatch-risk areas. In the hypothetical example provided in Figure 2.8, only 20 percent of the closed area is protecting high-bycatch-risk area, indicating that the closed area could be more efficiently designed.

Figure 2.8. Example of Metric 4. Twenty percent of the closed area protects high-bycatch-risk area, indicating that the closed area could be more efficiently designed.

2.6 DEVELOPMENT OF OPTIONS

We used the HMS PRiSM high-bycatch-risk area maps and metrics as the primary basis for the development of options. For the purpose of this DEIS, an *option* is considered a defined spatial-temporal area. For each of the closed areas under consideration (Mid-Atlantic shark closed area, the Charleston Bump closed area, the East Florida Coast closed area, and the DeSoto Canyon closed area), we evaluated between 9 and 16 different options, including one option which is the current existing closed area definition (spatial and temporal). Overall, the strategy for the development and evaluation of closed area options was to base the options on the effectiveness of the protection of the bycatch species selected (Section 2.3) using HMS PRiSM, while also considering other information such as fishing ports and bathymetric features.

Additional considerations for the development of options (step 4 in Table 2.4) include: spatial/temporal *scope* (square nautical miles of area x the number of closure months) compared to the No Action alternative; large scale target fishery patterns (e.g., swordfish found along depth contours and Gulf Stream); bluefin tuna interaction patterns based on HMS PRiSM occurrence probabilities; the range of alternatives (e.g., inclusion of both spatial and temporal shifts); location of the southern Florida recreational fishery; location of Bahamian Exclusive Economic Zone (EEZ); and how Charleston Bump and East Florida Coast areas relate to each other.

For each option, a map visually displaying the spatial and temporal extent was generated and the four metrics were calculated (see Appendix 5).

2.7 Scoring of Options

Using the HMS PRiSM metrics 1 through 4 (as described in section 2.5), we developed a scoring system for the metrics in order to synthesize the large amount of information and enable a standardized comparison of options. Based on this scoring system, we calculated scores for each species and metric as described in Table 2.4 below. For each option, and species, the scores for each metric were summed. For example, if for a particular option and species, the Metric 1 score was 1, the Metric 2 score was 1, and the scores for Metrics 3 and 4 were each 0 (respectively), the total metric score for that option and species was 2 (1+1+0+0=2). We then added the total scores across species for that particular option to represent the overall metric score for that option. The higher the overall metric score, the greater the conservation value and conservation efficiency is. The scores for each option and species are provided in Appendix 5.

Table 2.4. Scoring of Options based on Metrics

Metric	**Description of System to Score Options based on Metrics**
1: Average occurrence probability inside vs actual fishery occurrence rate outside.	Number of closure months (0-12) where the average probability of fishery interaction inside closure > the average fishery occurrence rate outside closure.
	Underlying question: How does the probability of interaction inside the closed area compare to occurrence rate in the areas fished outside the closed area?
2: Ratio that compares the median occurrence probability of high-bycatch-risk area inside the closed area to the median occurrence probability of high-bycatch-risk area outside the closed area.	Number of closure months (0-12) where the ratio > 1.
	Underlying question: Does the closed area protect the most at risk areas? How does the probability of fishery interaction inside the closed area compare to outside the closed area?
3: Percent of high-bycatch-risk area that occurred inside the closed area for each month of the year.	Set a threshold percentage for each closed area, then the score is: Number of closure months (0-12) where percent of high-bycatch-risk area that occurred inside the closed area > percentage threshold.

	List of threshold percentages (average % of high-bycatch-risk area across bycatch species in the current closed area during the current closure months): Mid-Atlantic shark closed area: 18% Charleston Bump closed area: 2% East Florida Coast closed area: 1% DeSoto Canyon closed area: 8%
	Underlying question: What percent of total high-bycatch-risk area across whole fishery domain does the closed area protect?
4: Percent of the closed area that could protect high-bycatch-risk area for each month of the year.	Set a threshold percentage for each closed area, then the score is: Number of closure months (0-12) where percent of closed area that protects high-bycatch-risk area > percentage threshold. List of threshold percentages (average % of high-bycatch-risk area across bycatch species in current closed area during the current closure months): Mid-Atlantic shark closed area: 48% Charleston Bump closed area: 31% East Florida Coast closed area: 15% DeSoto Canyon closed area: 28%
	Underlying question: What percentage of the closed area protects high-bycatch-risk area?

2.8 ALTERNATIVE SELECTION

Based on the metric scoring and evaluation of the options, we then selected several options across the full range of scores to be *alternatives* for full analysis. The alternatives selected from the options (on the basis of their scores and other considerations such as fishing ports and bathymetric features) and our rationale to why we chose those options as alternatives rather than other options are described in Section 3.1. As described in the rest of the document, in selecting our preferred alternatives for the spatial management portion of Amendment 15, we considered similar criteria mentioned above in addition to other factors. We also visually compared the spatial and temporal extents of the preferred alternatives with monthly interaction probability maps of each bycatch species to further demonstrate how the closed areas may improve their conservation value and conservation efficiency. A flow chart of the process is depicted in Figure 2.9 using mock metric scores for demonstration.

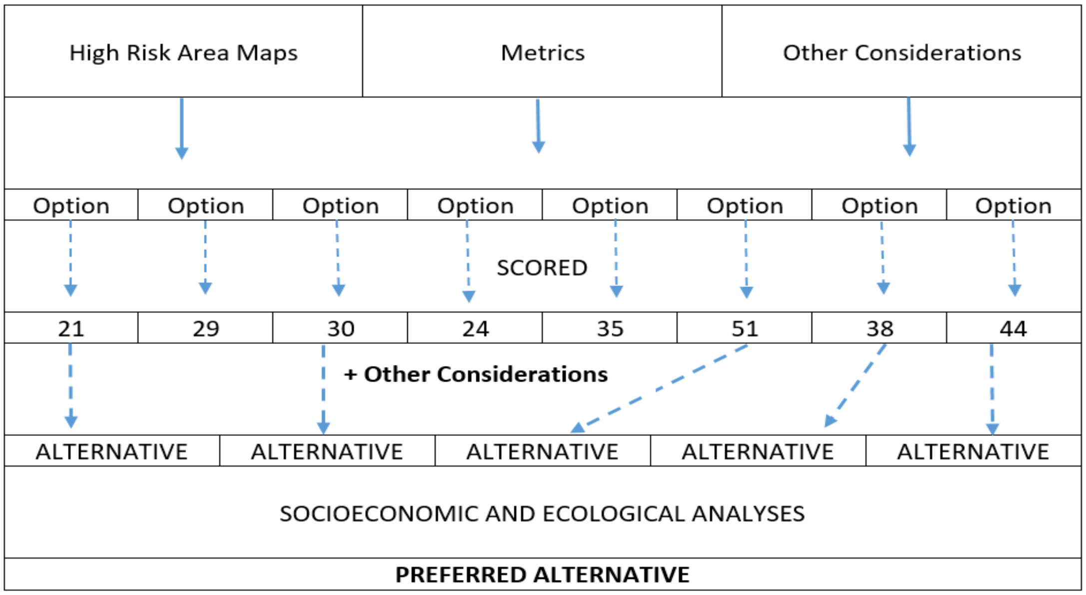

Figure 2.9. Process of developing closed area options and alternatives using example scoring.

2.9 References

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Chapter 3 SUMMARY OF THE ALTERNATIVES

Legal Requirements

The National Environmental Policy Act (NEPA) and its implementing regulations require that any federal agency proposing a major federal action consider a reasonable range of alternatives, in addition to the proposed action. The evaluation of alternatives in an Environmental Impact Statement (EIS) assists NOAA Fisheries in ensuring that any unnecessary impacts are avoided through an assessment of alternative ways to achieve the underlying purpose of the project that may result in less environmental harm.

To warrant detailed evaluation, an alternative must be reasonable and meet the purpose and need of the action (see Chapter 1). Screening criteria are used to determine whether an alternative is reasonable. The following discussion identifies the screening criteria used in this Draft Environmental Impact Statement (DEIS) to evaluate whether an alternative is reasonable; evaluates various alternatives against the screening criteria (including the proposed measures) and identifies those alternatives found to be reasonable; identifies those alternatives found not to be reasonable; and for the latter, the basis for this finding.

Screening Criteria—To be considered "reasonable" for purposes of this DEIS, an alternative must be designed to meet the purpose and need for action described in Chapter 1 and meet the following criteria:

- An alternative must be consistent with the 10 National Standards set forth in the Magnuson-Stevens Act and other requirements of the Act;
- An alternative must be administratively feasible and enforceable. The costs associated with implementing an alternative cannot be prohibitively exorbitant or require unattainable infrastructure;
- An alternative cannot violate other laws (e.g., Atlantic Tunas Convention Act (ATCA), Endangered Species Act (ESA), Marine Mammal Protection Act (MMPA);
- An alternative must be consistent with the 2006 Consolidated Atlantic Highly Migratory Species (HMS) Fishery Management Plan (FMP) and its amendments;
- An alternative must be consistent with International Commission for the Conservation of Atlantic Tunas (ICCAT) recommendations, which the United States is legally obligated to implement as necessary and appropriate under ATCA;
- An alternative must be consistent with the Terms and Conditions and Reasonable and Prudent Alternatives of applicable biological opinions (BiOps);
- An alternative should be consistent with the objectives of this action;
- An alternative should, where applicable, mitigate factors contributing to the continued decline in pelagic longline effort and target species landings; and
- An alternative should not result in additional regulations that may be considered unnecessarily duplicative to existing regulations.

This DEIS includes analysis of a reasonable range of alternatives, and prefers a set of alternatives that would achieve the objectives of this FMP amendment (as described in Chapter 1). NOAA Fisheries developed a range of alternatives considering changes to the management of HMS using spatial management tools and electronic monitoring, which would be responsive to current information, changes in the fishery, and public suggestions. The environmental, economic, and social impacts of these alternatives are discussed in later chapters. NOAA Fisheries may make changes to the alternative structure in the Final Environmental Impact Statement (FEIS) to meet the same purpose and need in response to public comment on this DEIS and the proposed rule. Such changes may include modifying the preferred measures, selecting different alternatives, or adding new measures. When referring specifically to current areas, NOAA Fisheries may use the term "closed area," consistent with their current definitions. In general, however, this DEIS refers to all of the areas under consideration loosely as "spatial management areas" rather than "closed areas" because this draft amendment includes alternatives that could allow access to spatially managed areas to meet the objectives of this action. Additionally, NOAA Fisheries acknowledges that incidental catch is different than "bycatch," which has a specific definition under the Magnuson-Stevens Act, see 16 U.S.C. 1802(2). However, for ease of communication in this rule, unless otherwise noted, "bycatch species" generally refer to all non-target catch species, including incidentally-caught species that fishermen may or may not retain.

For each set of alternatives, the DEIS includes a "No Action" alternative with impact analyses. The No Action alternative analyzes expected impacts if none of the other alternatives in the group are implemented and provides a baseline from which to compare impacts resulting from the other alternatives. An overarching "No Action" option is also possible (i.e., no alternatives in Amendment 15 are implemented). Impacts from an overarching No Action option are not separately analyzed, however, if no alternatives in Amendment 15 are implemented, expected impacts would be the sum of the impacts from all No Action alternatives analyzed in the DEIS.

Overview of the Alternatives

The scope and organization of the alternatives reflect the multiple objectives of this action (Chapter 1), and therefore include alternatives that focus on improving and standardizing the use of spatial management as a tool in fisheries management; collecting information from existing closed areas; and evaluating and modifying existing closed areas. Alternatives were also developed to consider changes to the administration of the pelagic longline EM program. The titles of the various sections are as follows: *Evaluation and Modification of Closed Areas* (Section 3.1); *Commercial Data Collection* (Section 3.2); *Evaluation Timing of Spatial Management Areas* (Section 3.3); *Preferred Alternative Packages* (Section 3.4), and *Electronic Monitoring Program* (Section 3.5).

The spatial management alternatives are intended to be considered as potential components of a spatial management program that may be combined together to achieve the objectives. For example, a particular spatial management area ("A" Alternatives) (Section 3.1) would be coupled with a data collection and monitoring alternative ("B"

Alternatives) (Section 3.2) and timeline for evaluation ("C" Alternatives) (Section 3.3). In Section 3.4, *Preferred Alternative Packages (D1, D2, D3, and D4)*, we provide the details of our preferred A, B, and C Alternatives for each of the four spatial management areas (Figure 3.1). Chapter 5 provides impact analyses of each unique alternative and summarizes those impacts for the Preferred Alternative Packages. While this DEIS provides NOAA Fisheries' preferred combination for each of the four spatial management areas, based on public comment and additional analyses, the preferred alternative packages may change in the FEIS.

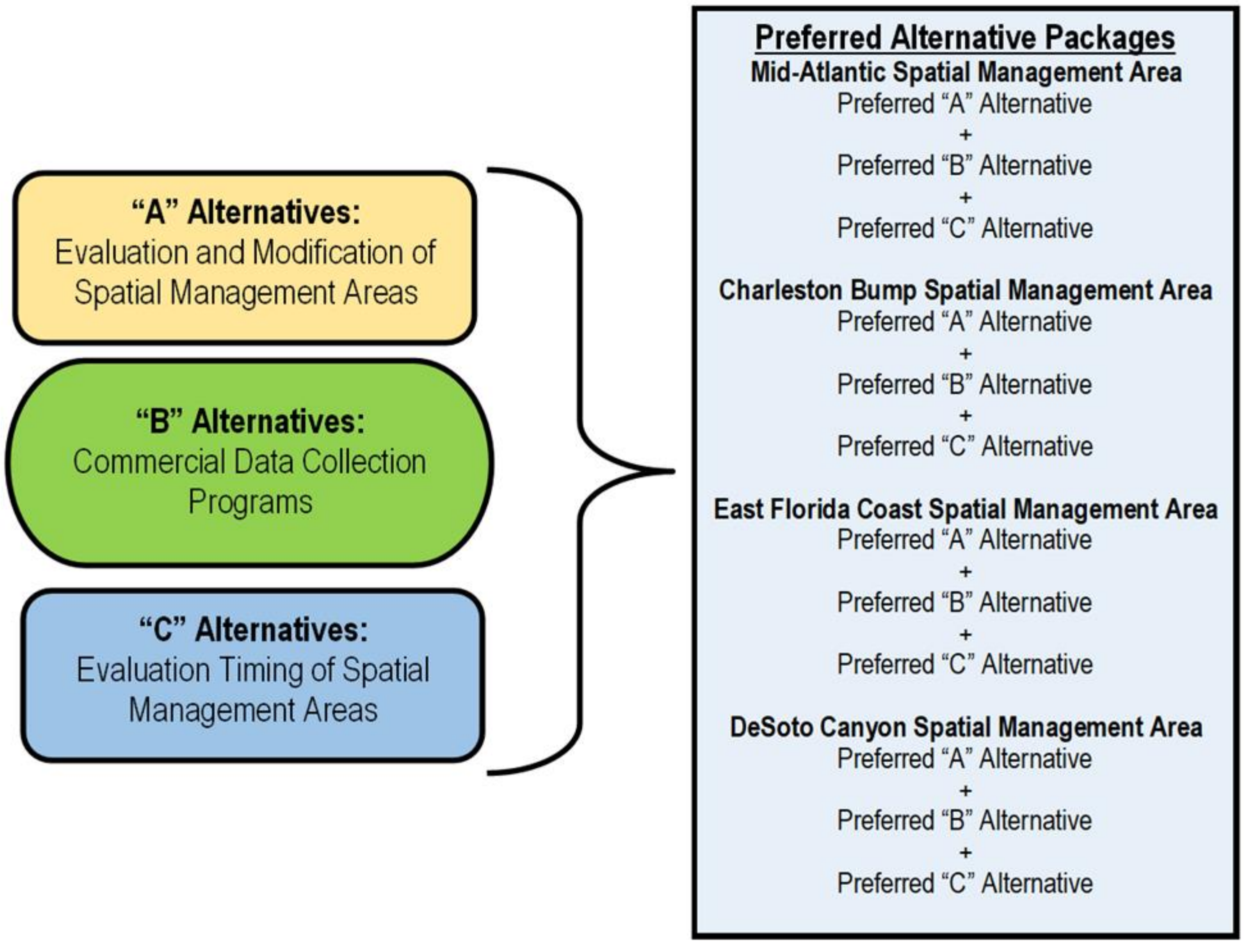

Figure 3.1. Combination of alternatives into preferred alternative packages

3.1 "A" ALTERNATIVES: EVALUATION AND MODIFICATION OF SPATIAL MANAGEMENT AREAS

The "A" alternatives consist of four suites of alternatives (and associated sub-alternatives) as summarized below:

- Alternative Suite A1: Mid-Atlantic shark closed area (four sub-alternatives).

- Alternative Suite A2: Charleston Bump closed area (five sub-alternatives).
- Alternative Suite A3: East Florida Coast closed area (five sub-alternatives).
- Alternative Suite A4: DeSoto Canyon closed area (four sub-alternatives).

As described in Chapter 2, NOAA Fisheries intends to combine a sub-alternative from each of the A1 through A4 Alternative Suites, with one or more of the "B" and "C" Alternatives to form a Preferred Alternative "package."

The "A" Alternatives are those designed to evaluate several current closed areas, and consider modifications to those areas. The No Action alternatives for each suite described below, and analyzed in Chapter 5, are the current HMS closed areas that have been in effect for approximately two decades. Specifically, these are the Mid-Atlantic shark closed area, the Charleston Bump closed area, the East Florida Coast closed area, and the DeSoto Canyon closed area. Additional information on these closed areas is in the Affected Environment section of this document (Chapter 4).

The method of development of the "A" Sub-Alternatives other than No Action sub-alternatives is described in detail in Chapter 2. As noted in Chapter 2, based on the objectives of this management action and in consideration of Magnuson-Stevens Act requirements and relevant executive orders, the sub-alternatives do not include novel closed areas (i.e., those without a clear or meaningful spatial or temporal overlap with a currently existing closed area). The sub-alternatives in this section were chosen from among more numerous "options" that were ranked (found in the Appendix 5). These sub-alternatives represent a reasonable range, selected in order to achieve the objectives as well as include different temporal and spatial extents for consideration. As explained in Chapter 2, the development of the sub-alternatives relied on multiple considerations, including quantitative and qualitative factors.

When describing these sub-alternatives below (and analyzing anticipated impacts in Chapter 5), NOAA Fisheries expressed the spatiotemporal scope of the spatial management areas in size or spatial extent (expressed in square nautical miles (nm^2), duration or temporal extent (number of months closed), as well as by using a single derived value that reflects both size and duration. The use of a single value that incorporates both spatial and temporal extents enables comparison of alternatives using a standardized value. A single value is helpful for comparing the spatial management areas, because the different alternatives vary with respect to both spatial and temporal extent. To derive the single value, the size of the area (expressed as nm^2) was simply multiplied by the number of months the area-based measures are in effect. For the purpose of this DEIS, NOAA Fisheries refers to this value as the "scope" of the area. The spatial and temporal extent of an area is only one of many relevant attributes of the areas considered.

3.1.1 Alternative Suite A1: Mid-Atlantic Shark Spatial Management Areas

For the Mid-Atlantic shark closed area, we developed 14 options (including the No Action option) using HMS PRiSM. Thirteen of these options consisted of shifts in the temporal extent, spatial extent, or both the temporal and spatial extents. The overall metric scores were ranked from 1 to 14 where 1 indicates the option that performed the best at conserving bycatch (i.e., conservation value and conservation efficiency, *See* Section 2.7) and 14 performed the worst. These options and their corresponding metric scores are described in Appendix 5. We selected four options as sub-alternatives to cover the reasonable range of alternatives that meet the purpose and need of this action (Table 3.1). Each sub-alternative could be combined with one or more of the data collection ("B") or evaluation ("C") alternatives in this DEIS, which would have the effect of modifying other relevant aspects of the closed area, such as specifying commercial data collection methods (Alternative Suite B) or specifying the timing of an evaluation (Alternative Suite C).

Table 3.1. Mid-Atlantic Shark Spatial Management Area Sub-Alternatives

Sub-Alternative	Spatial Change	Temporal Change	Scope (Change in Scope from No Action)
Sub-Alternative A1a – No Action	N/A	N/A - January 1 through July 31	37,849 (N/A)
Sub-Alternative A1b	No Change	November 1 through May 31	37,849 (0%)
Sub-Alternative A1c	Extend eastern boundary to the 350-m shelf break; shift northern boundary south to Cape Hatteras (35° 13' 12" N. lat.).	November 1 through May 31	36,793 (-2.8%)
Sub-Alternative A1d – Preferred Sub-Alternative	Extend the eastern boundary to the 350-m shelf break.	November 1 through May 31	43,179 (+14.1%)

3.1.1.1 Sub-Alternative A1a: No Action

This sub-alternative would maintain the current Mid-Atlantic shark closed area in effect with respect to its spatial and temporal extent. The spatial and temporal extent (January 1 through July 31 each calendar year) specified in the regulations would remain the same. This closed area has been in effect since January 1, 2005 (68 FR 74746; December 24, 2003). The purpose of the closed area was to reduce the catch and mortality of dusky sharks and juvenile sandbar sharks by bottom longline fishermen.

Rationale: Of the 14 options considered, the overall metric score ranking of this option was 12th (Appendix 5). Continuation of the Mid-Atlantic shark closed area would continue to reduce bottom longline interactions with bycatch species of sharks in this area during January through July each year, and reduce uncertainty regarding potential impacts of modifying the closed area. Also, the CEQ regulations for NEPA require that a "No Action Alternative" be considered for each proposed action.

A depiction of the spatial extent of the Mid-Atlantic shark closed area is shown in Figure 3.2. The approximate size of the area is 5,407 nm^2. The scope of the area is 37,849 (i.e., 5,407 nm^2 x 7 months = 37,849).

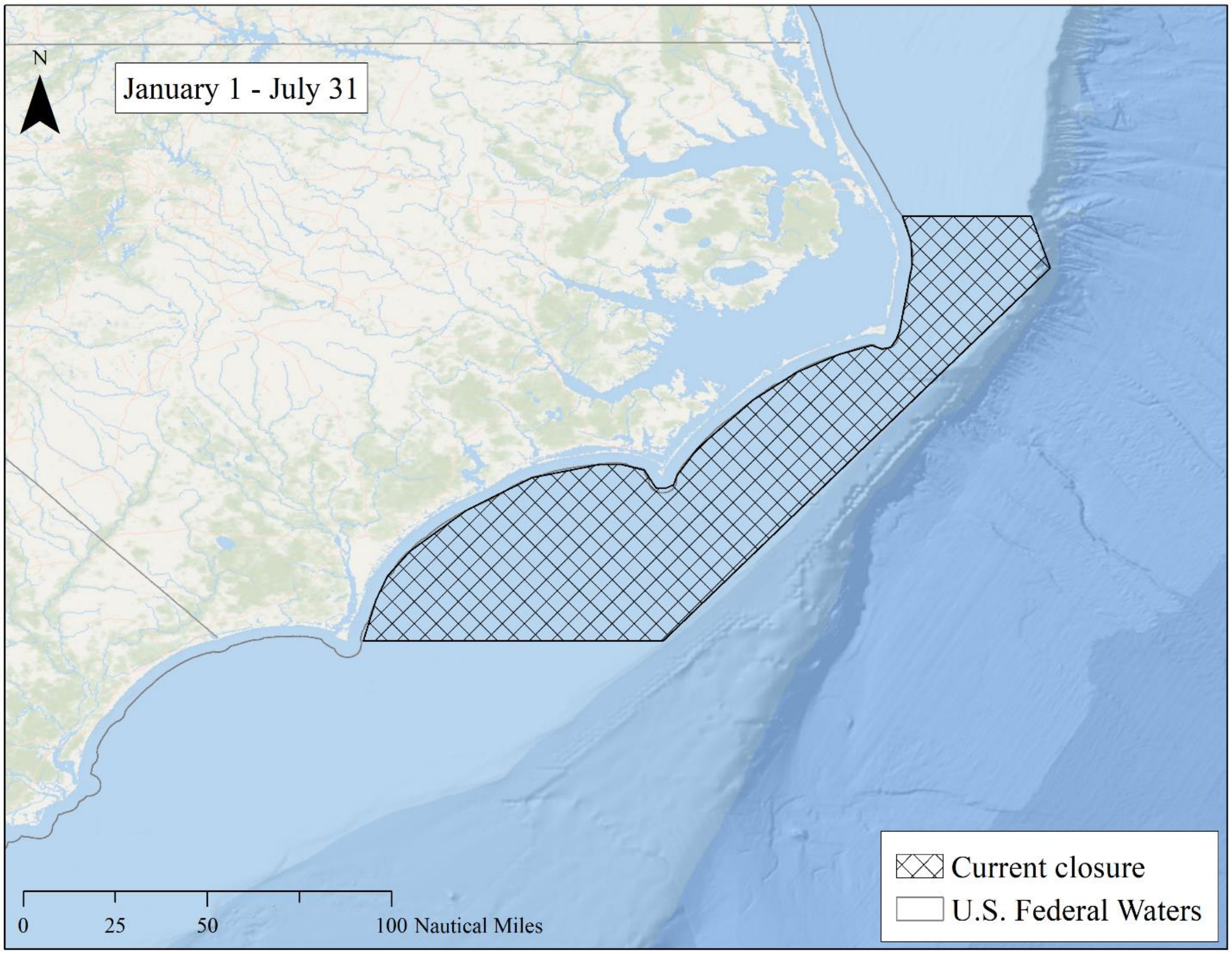

Figure 3.2. Sub-Alternative A1a - No Action – Current Mid-Atlantic shark closed area

3.1.1.2 Sub-Alternative A1b

This sub-alternative would maintain the current Mid-Atlantic shark closed area spatial extent for the high-bycatch-risk area and shift the temporal extent to November 1 through May 31 from January 1 through July 31 (i.e., same seven-month duration, but shifted two months earlier).

Rationale: Of the 14 options considered, the overall metric score ranking of this option was tied for 5th (Appendix 5). A simple temporal shift of two months would result in higher HMS

PRiSM metrics for dusky and sandbar shark compared to the No Action alternative (Sub-Alternative A1a).

The spatial extent would not change for this sub-alternative relative to the No Action alternative (Figure 3.3), therefore the approximate size of the area is 5,407 nm^2. The scope of the area is 37,849 (i.e., 5,407 nm^2 x 7 months = 37,849), the same as the No Action alternative.

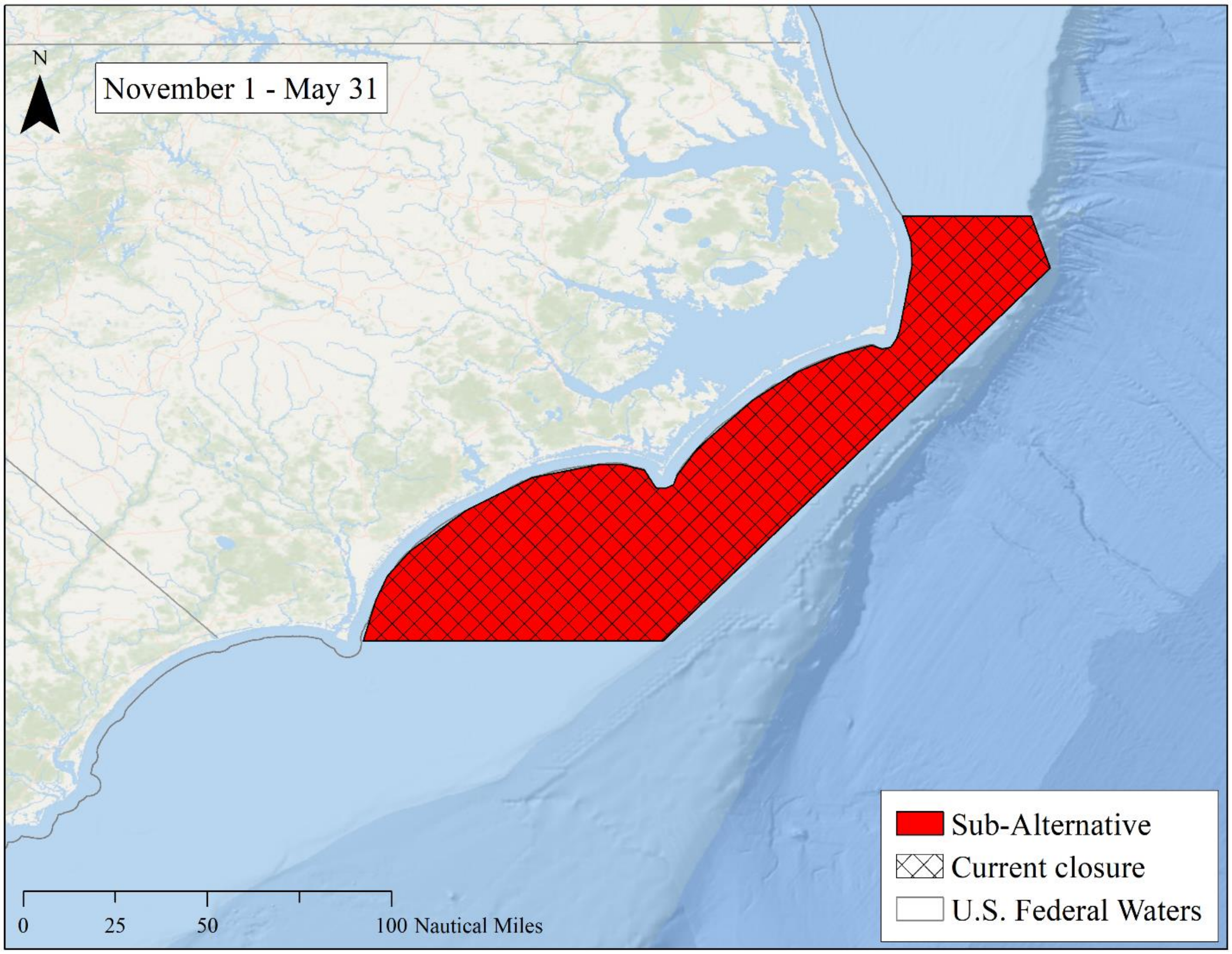

Figure 3.3. Sub-Alternative A1b – Mid-Atlantic Management Area

3.1.1.3 Sub-Alternative A1c

This sub-alternative would modify both the spatial and temporal extent of the high-bycatch-risk area relative to the current closed area. Specifically, this sub-alternative would extend the eastern boundary of the high-bycatch-risk area relative to the current Mid-Atlantic shark closed area eastward to the 350-m shelf break and shift the north boundary south to Cape Hatteras (35° 13' 12" N. lat.). The temporal extent would shift to November 1 through May 31 from January 1 through July 31.

Rationale: Of the 14 options considered, the overall metric score ranking of this option was tied for 5th (Appendix 5). The high-bycatch-risk area extends out to approximately the 350-m shelf break for multiple bycatch species. A contraction of the northern boundary southward would potentially provide more access for bottom longline fishing to the area currently closed, but would be balanced by an eastward extension in the closed area to the 350-m shelf break. These spatial shifts coupled with a temporal shift of two months improve the metric scores for all three bycatch species (dusky, sandbar, and scalloped hammerhead shark).

A depiction of the spatial extent of this sub-alternative is shown in Figure 3.4. The approximate size of the area is 5,256.1 nm^2. The scope of the area is 36,793 (i.e., 5,256.1 nm^2 x 7 months = 36,793), which is comparable, but slightly smaller (2.8 percent) than the No Action alternative (Sub-Alternative A1a; "current closure" in Figure 3.4).

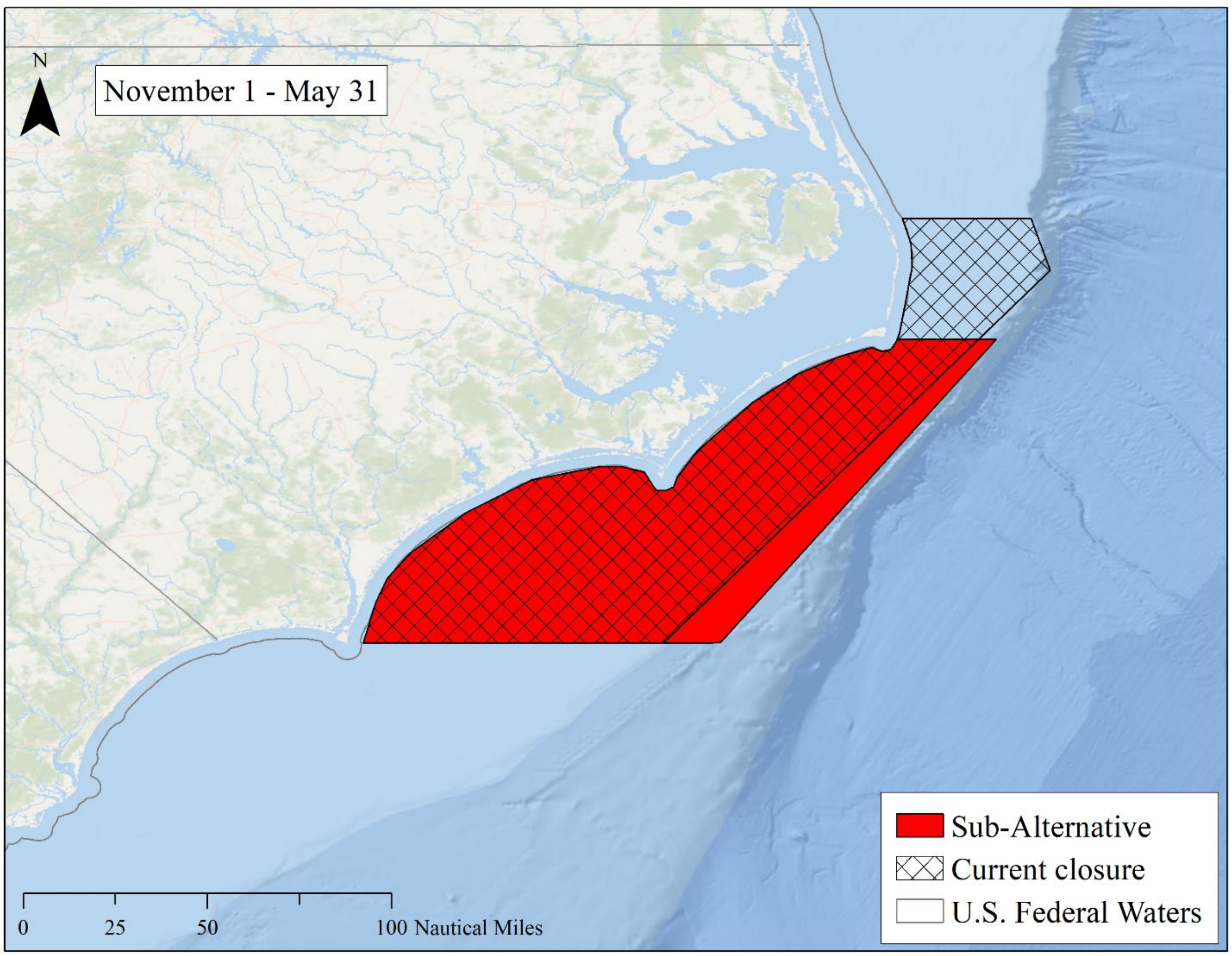

Figure 3.4. Sub-Alternative A1c – Mid-Atlantic Shark Management Area

3.1.1.4 Sub-Alternative A1d

This sub-alternative would modify both the spatial and temporal extent of the high-bycatch-risk area relative to the current closed area. Specifically, this sub-alternative would extend the eastern boundary of the current Mid-Atlantic shark closed area eastward to the 350-m shelf break. The temporal extent would shift to November 1 through May 31 from January 1 through July 31.

Rationale: Of the 14 options considered, the overall metric score ranking of this option was 2nd (Appendix 5). The high-bycatch-risk area extended out to approximately the 350-m shelf break for multiple bycatch species. The spatial shift coupled with a temporal shift of two months resulted in high metric scores for all three bycatch species (dusky, sandbar, and scalloped hammerhead shark).

A depiction of the spatial extent of this sub-alternative is shown in Figure 3.5. The approximate size of the area is 6,168.4 nm^2. The scope of the area is 43,179 (i.e., 6,168.4 nm^2 x 7 months = 43,179), which is 14 percent larger than the No Action alternative (Sub-Alternative A1a).

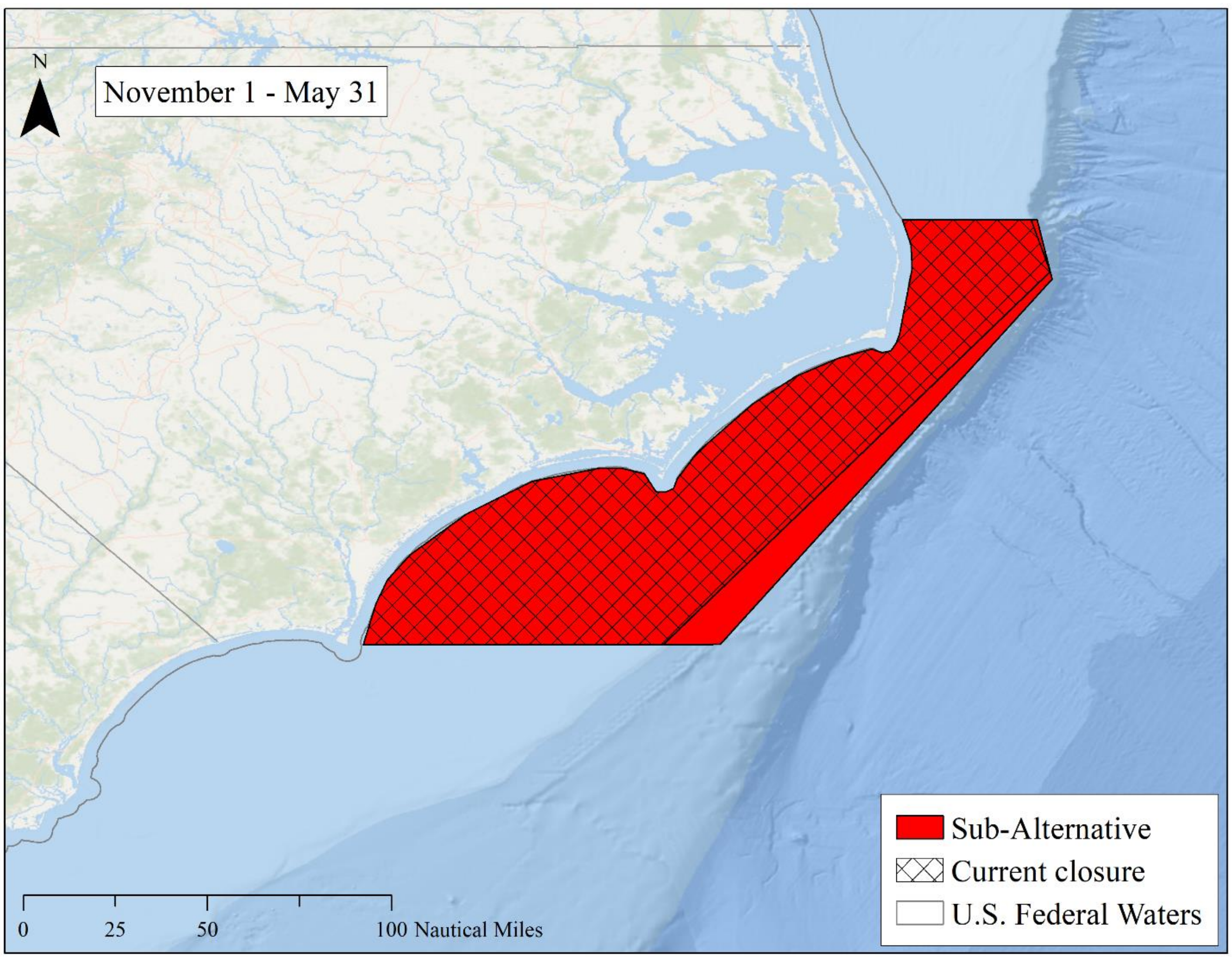

Figure 3.5. Sub-Alternative A1d – Mid-Atlantic Shark Management Area

3.1.2 Alternative Suite A2: Charleston Bump Spatial Management Areas

For the Charleston Bump closed area, we developed 16 options (including the No Action option) using HMS PRiSM. Fifteen of these options consisted of shifts in the temporal extent, spatial extent, or both the temporal and spatial extents. The overall metric scores were ranked from 1 to 16 where 1 indicates the option that performed the best at conserving bycatch and 16 performed the worst. These options and their corresponding metric scores are described in Appendix 5. We selected five options as sub-alternatives to cover the reasonable range of alternatives that meet the purpose and need of this action (Table 3.2). Each sub-alternative could be combined with one or more of the data collection ("B") or evaluation ("C") Alternatives in this DEIS, which would have the effect of modifying other relevant aspects of the closed area, such as specifying commercial data collection methods (Alternative Suite B) or specifying the timing of an evaluation (Alternative Suite C).

Table 3.2. Charleston Bump Spatial Management Area Sub-Alternatives

Sub-Alternative	Spatial Change	Temporal Change	Scope (Change in Scope from No Action)
Sub-Alternative A2a – No Action	N/A	N/A - February 1 through April 30	108,796 (N/A)
Sub-Alternative A2b	No Change	December 1 through March 31	145,061 (+33.3%)
Sub-Alternative A2c – Preferred Sub-Alternative	Shift eastern boundary to diagonal bisect	January 1 through December 31 (year-round)	240,372 (+121%)
Sub-Alternative A2d	Move the eastern boundary westward to 40 nm from the coastline.	October 1 through May 31	82,712 (-24%)
Sub-Alternative A2e	Shift northern boundary southward to 33° 12' 39" N. lat. and the eastern boundary westward to 78° 00' W. long.	October 1 through May 31	132,730 (+22%)

3.1.2.1 Sub-Alternative A2a: No Action

This sub-alternative would maintain the current Charleston Bump closed area in effect with respect to its spatial and temporal extent. The spatial and temporal extent (February 1 through April 30 each calendar year) specified in the regulations would remain the same. This closed area has been in effect since September 1, 2000 (65 FR 47214; August 1, 2000). The purpose of the closed area when it took effect was to reduce bycatch and incidental catch of overfished and protected species by pelagic longline fishermen who target highly migratory species.

Rationale: Of the 16 options considered, the overall metric score ranking of this option was tied for 15th (Appendix 5). Continuation of the Charleston Bump closed area would continue to reduce pelagic longline interactions with bycatch species in this area during February through April each year, and reduce uncertainty regarding potential impacts of modifying the closed area. Also, the CEQ regulations for NEPA require that a "No Action Alternative" be considered for each proposed action.

A depiction of the spatial extent of the Charleston Bump closed area is shown in Figure 3.6. The approximate size of the area is 36,265.2 nm^2. The scope of the area is 108,796 (i.e., 36,265.2 nm^2 x 3 months = 108,796).

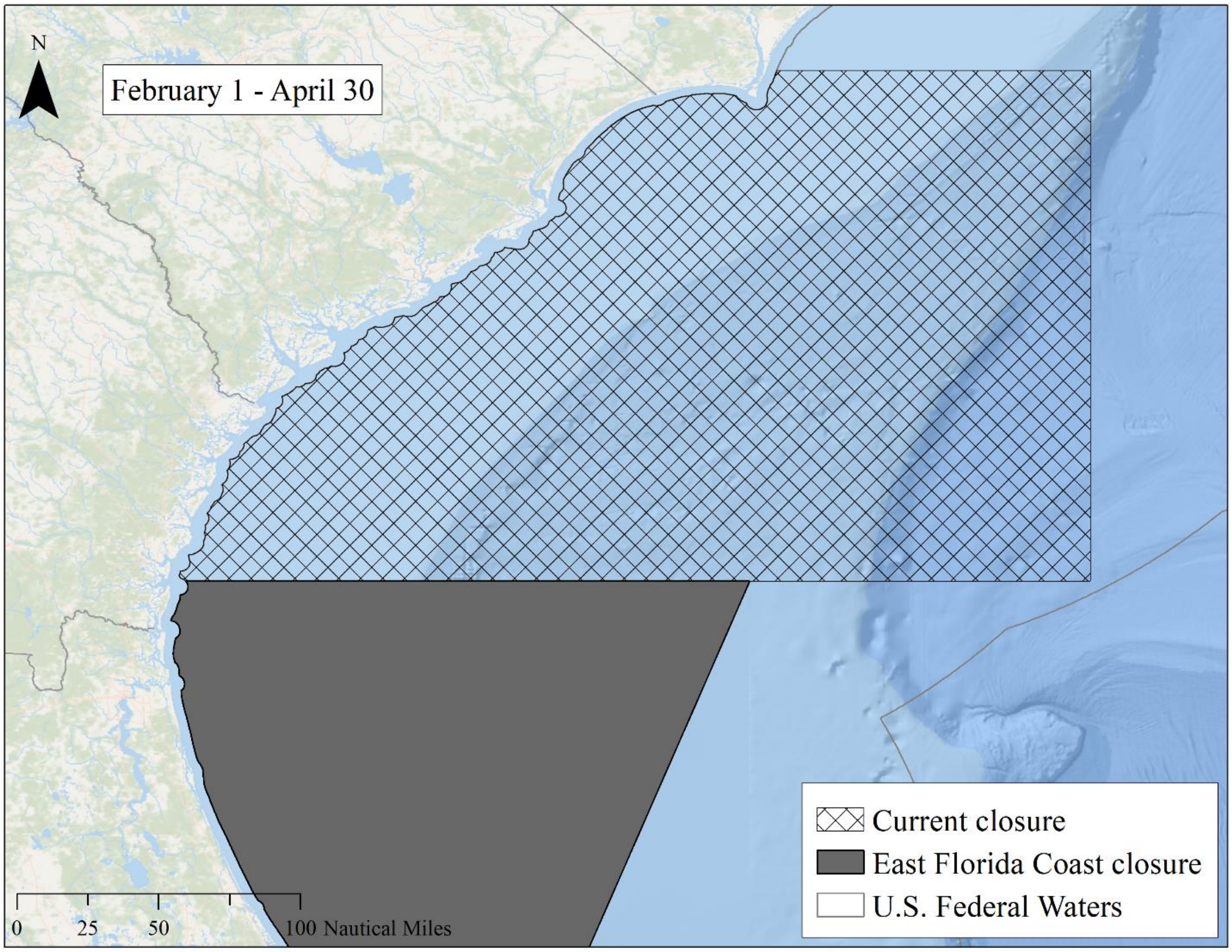

Figure 3.6. Sub-Alternative A2a – No Action – Charleston Bump Closed Area

3.1.2.2 Sub-Alternative A2b

This sub-alternative would maintain the current Charleston Bump closed area spatial extent for the high-bycatch-risk area and would shift the temporal scope from December 1 through March 31 from February 1 through April 30 (i.e., starting two months earlier and ending one months earlier; change from a three-month closure to a four-month closure).

Rationale: Of the 16 options considered, the overall metric score ranking of this option was 9th (Appendix 5). Shifting the temporal extent to begin two months earlier and finish one month earlier resulted in higher HMS PRiSM metrics for leatherback sea turtle and shortfin mako shark. Specifically, all four metrics were higher than the No Action option for the leatherback sea turtle and two metrics improved for the shortfin mako shark. In addition to the metrics, another consideration in the temporal extent of this sub-alternative is potential increased access to target species for the pelagic longline fishery.

The spatial extent would not change for this sub-alternative relative to the No Action (see Figure 3.7). Therefore, the approximate size of the area is 36,265.2 nm^2. The scope of the area is 145,061 (i.e., 36,265.2 nm^2 x 4 months = 145,061), which is 33 percent larger than the No Action alternative (Sub-Alternative A2a).

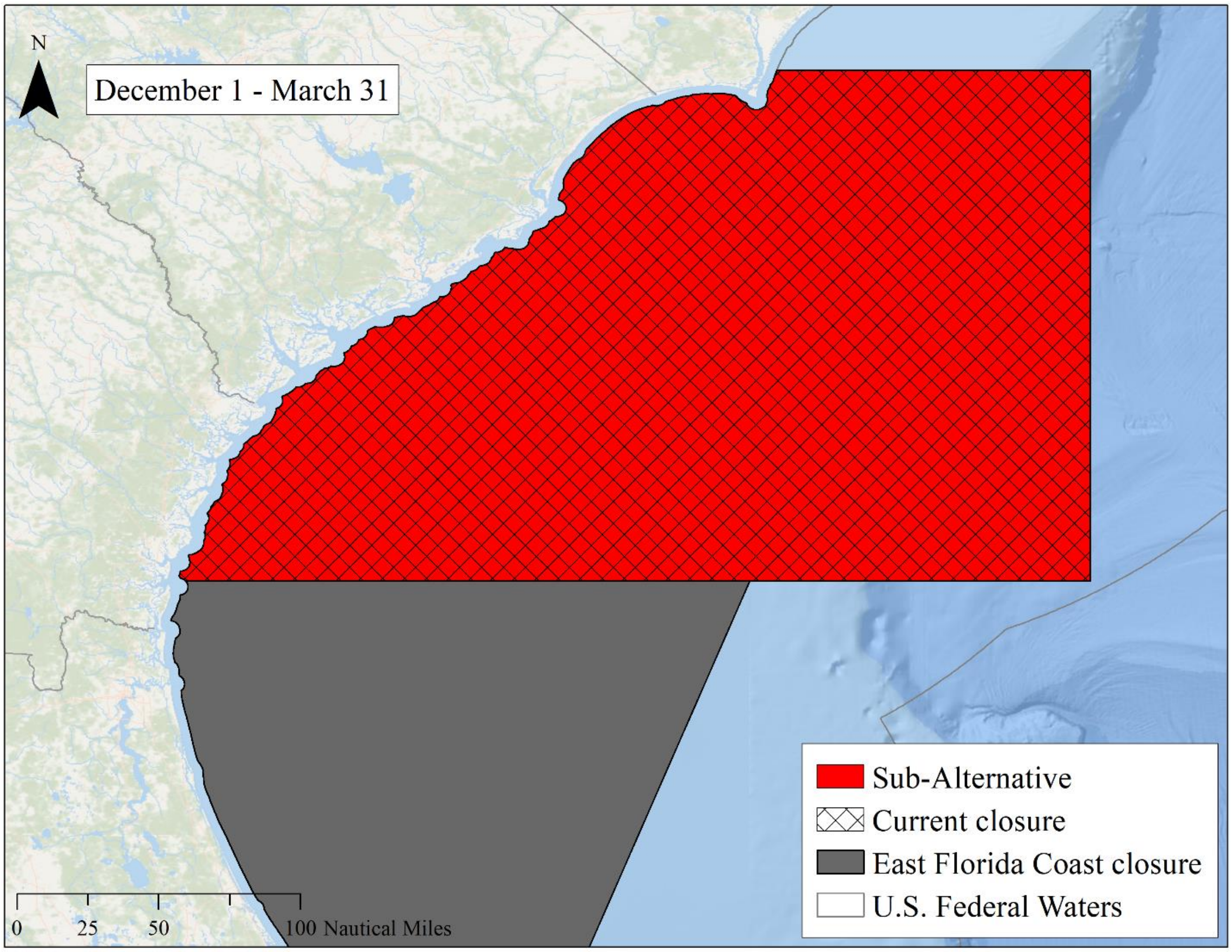

Figure 3.7. Sub-Alternative A2b – Charleston Bump Management Area

3.1.2.3 Sub-Alternative A2c

This sub-alternative would modify both the spatial and temporal extent of the current closed area for the high-bycatch-risk area. This sub-alternative would move the eastern boundary of the high-bycatch-risk area relative to the current Charleston Bump closed area westward. Specifically, the eastern boundary of this sub-alternative would be formed by the line connecting the northeast corner of the current Charleston Bump closed area (34° 00' N. lat., 76° 00' W. long.) to a point on the current southern border of Charleston Bump closed area (31° 00' N. lat., 79° 32' 46" W. long.)(Figure 3.8). The western boundary of this management area would remain the same as the current western boundary of Charleston Bump closed area. The temporal extent of the high-bycatch-risk area (red in map below) would increase from February 1 to April 30 to include the entire year. The remainder of the current closed area footprint would only be designated low-bycatch-risk area from

February 1 through April 30. Outside those months, that area would be open to normal pelagic longline fishing.

Rationale: Of the 16 options considered, the overall metric score ranking of this option was 2nd (Appendix 5). High-bycatch-risk area occurs for multiple species closer to the coastline. Increasing the temporal extent to encompass the entire year may balance the effects of the reduced spatial extent of the management area. Total metric scores substantially increased for leatherback sea turtle and shortfin mako shark and increased for the billfish species group. In addition to the metrics, another consideration in the spatial and temporal extent of this sub-alternative is potential increased access to target species (i.e., swordfish) for the pelagic longline fishery.

A depiction of this sub-alternative is shown in Figure 3.8. The approximate size of the area is 20,031 nm^2. The scope of the area is 240,372 (i.e., 20,031 nm^2 x 12 months = 240,372), which is 121 percent larger than the No Action alternative (Sub-Alternative A2a).

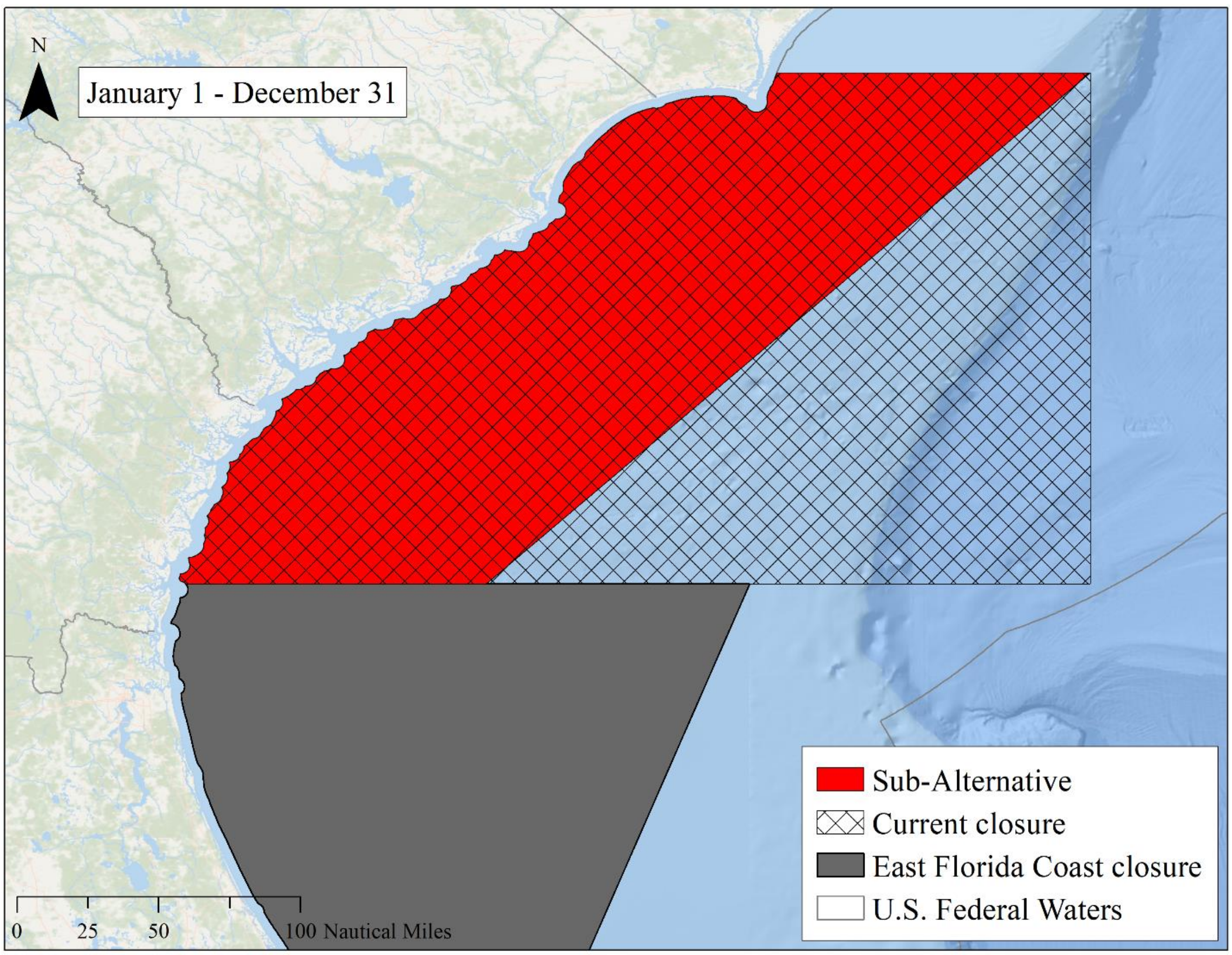

Figure 3.8. Sub-Alternative A2c – Charleston Bump Management Area

3.1.2.4 Sub-Alternative A2d

This sub-alternative would modify both the spatial and temporal extent of the high-bycatch-risk area relative to the current closed area. Specifically, this sub-alternative would shift the eastern boundary westward 40 nm from the coastline; retain the current northern and southern boundaries of the current Charleston Bump closed area; and retain the current western boundary of Charleston Bump closed area. The temporal extent of the high-bycatch-risk area (red in map below) would be extended from February 1 through April 30 to October 1 through May 31. The remainder of the current closed area footprint would only be designated low-bycatch-risk area from February 1 through April 30. Outside those months, that area would be open to normal pelagic longline fishing.

Rationale: Of the 16 options considered, the overall metric score ranking of this option was 4th (Appendix 5). High-bycatch-risk area occurs for multiple species closer to the coastline. Increasing the temporal extent from October through May when high-bycatch-risk area is most present within 40 nm of the coastline may balance the decrease in the spatial extent of the management area. Total metric scores substantially increased for leatherback sea turtle and shortfin mako shark and slightly increased for the billfish species group. In addition to the metrics, another consideration in the spatial and temporal extent of this sub-alternative is potential increased access to target species for the pelagic longline fishery. The spatial extent may increase potential access to fishing areas above the underwater bottom feature known as the Charleston Bump throughout the entire year, or facilitate fishing near oceanographic fronts.

A depiction of this sub-alternative is shown in Figure 3.9. The approximate size of the area is 10,339 nm^2. The scope of the area is 82,712 (i.e., 10,339 nm^2 x 8 months = 82,712), which is 24 percent smaller than the No Action alternative (Sub-Alternative A2a).

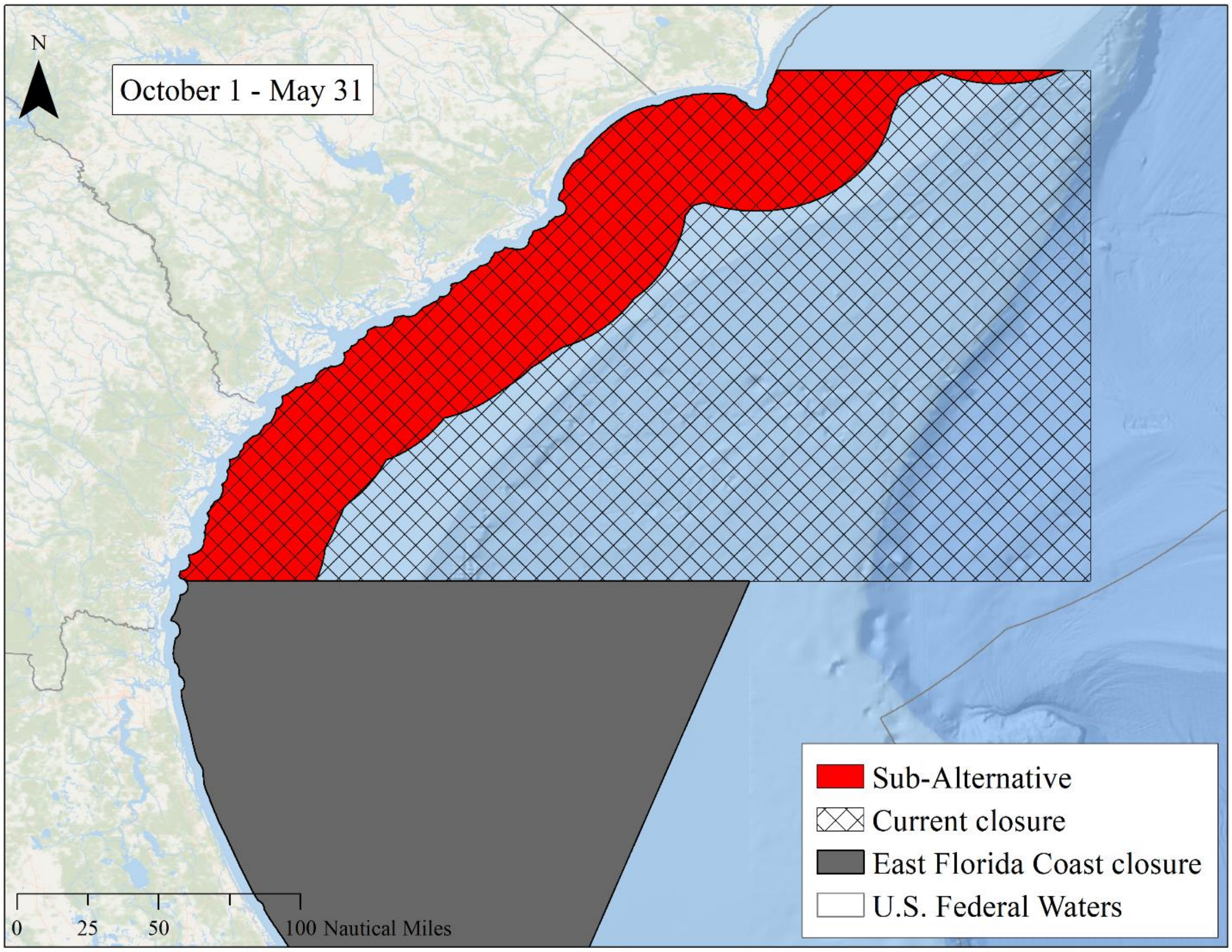

Figure 3.9. Sub-Alternative A2d – Charleston Bump Management Area

3.1.2.5 Sub-Alternative A2e

This sub-alternative would modify both the spatial and temporal extent of the high-bycatch-risk area relative to the current closed area. Specifically, this sub-alternative would reduce the spatial extent by moving the northern boundary of the current Charleston Bump closed area southward to 33° 12’ 39” N. lat. and shifting the eastern boundary westward to 78° 00’ W. long. The western boundary would be consistent with the current western boundary of Charleston Bump closed area. The temporal extent of the high-bycatch-risk area (red in map below) would be eight months (from October 1 through May 31) instead of three months (February 1 through April 30). The remainder of the current closed area footprint would only be designated low-bycatch-risk area from February 1 through April 30. Outside those months, that area would be open to normal pelagic longline fishing.

Rationale: Of the 16 options considered, the overall metric score ranking of this option was 6th (Appendix 5). Although the spatial extent of the management area would be reduced, the area would be close to the coastline where high-bycatch-risk area occurs for multiple species. Extending the temporal extent from October through May would include the time period when high-bycatch-risk area is most present closer to the coastline. Total metric scores substantially increased for leatherback sea turtle and shortfin mako shark and slightly increased for the billfish species group. In addition to the metrics, another consideration in the spatial and temporal extent of this sub-alternative is potential increased access to target species of the pelagic longline fishery, and relevant oceanographic conditions.

A depiction of this sub-alternative is shown in Figure 3.10. The approximate size of the area is 16,591.2 nm^2. The scope of the area is 132,730 (i.e., 16,591.2 nm^2 x 8 months = 132,730), which is 22 percent larger than the No Action alternative (Sub-Alternative A2a).

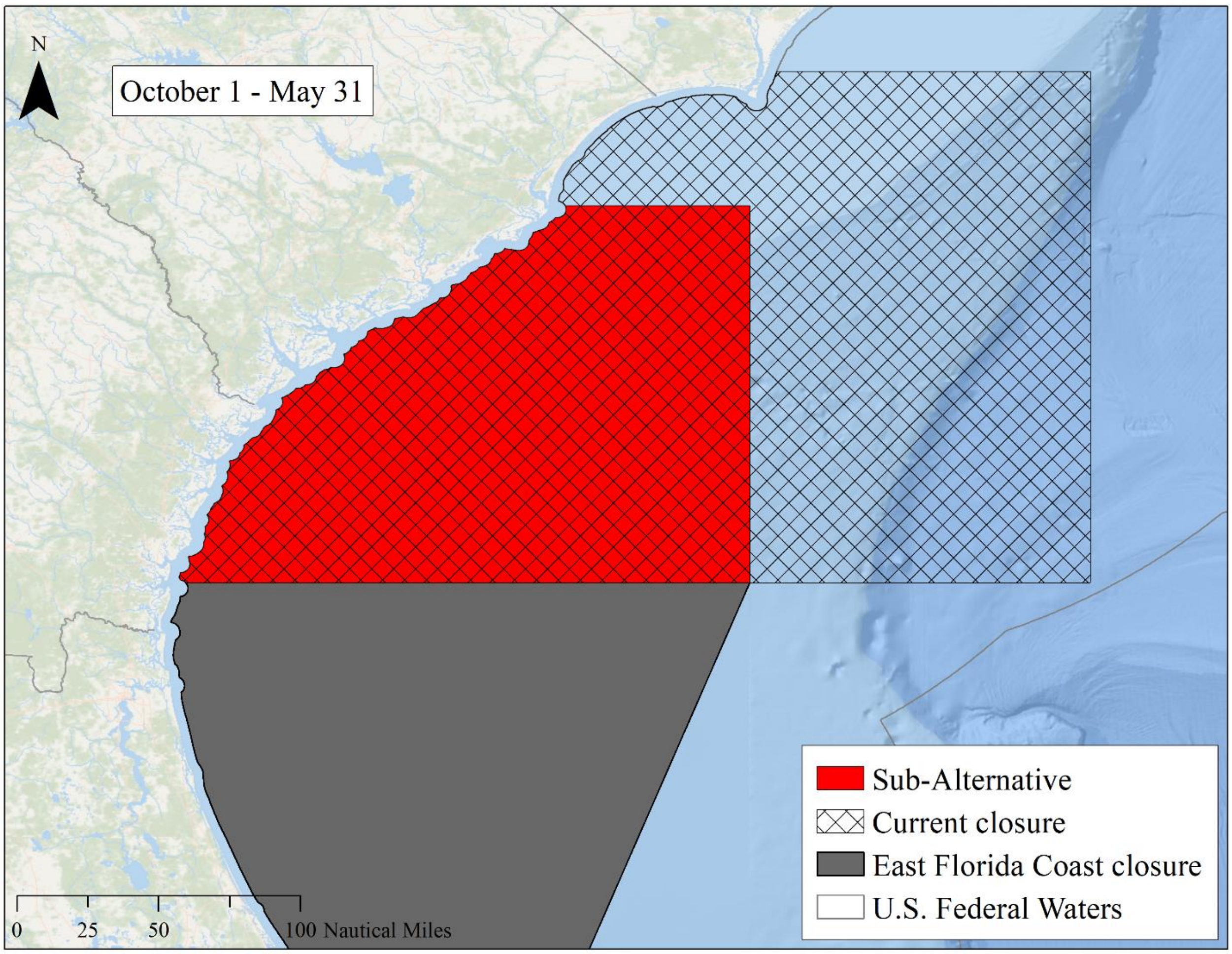

Figure 3.10. Sub-Alternative A2e – Charleston Bump Management Area

3.1.3 Alternative Suite A3: East Florida Coast Spatial Management Areas

For the East Florida Coast closed area we developed nine options (including the No Action option, Sub-Alternative A2a) using HMS PRiSM. Eight of these options consisted of shifts in the temporal extent, spatial extent, or both the temporal and spatial extents. The overall metric scores were ranked from 1 to 9 where 1 indicates the option that performed the best at conserving bycatch and 9 performed the worst. These options and their corresponding metric scores are described in Appendix 5. We selected five options as sub-alternatives to cover the reasonable range of alternatives that meet the purpose and need of this action (Table 3.3). Each sub-alternative could be combined with one or more of the data collection ("B") or evaluation ("C") Alternatives in this DEIS, which would have the effect of modifying other relevant aspects of the closed area, such as specifying commercial data collection methods (Alternative Suite B) or specifying the timing of an evaluation (Alternative Suite C).

Table 3.3. East Florida Coast Spatial Management Area Sub-Alternatives

Sub-Alternative	**Spatial Change**	**Temporal Change**	**Scope (Change in Scope from No Action)**
Sub-Alternative A3a – No Action	N/A	N/A - January 1 through December 31 (year-round)	362,653 (N/A)
Sub-Alternative A3b	• May 1 through November 30: No Change • December 1 through April 30: move the eastern boundary westward to 40 nm from the coastline	*See spatial changes*	288,106 (-21%)
Sub-Alternative A3c	Shift eastern boundary to 40 nm from the coastline in areas north of the U.S. – Bahamas EEZ boundary at approximately 28° 17' 24" N. lat. All areas south would not change	No Change	191,053 (-47%)
Sub-Alternative A3d - Preferred Alternative	Shift eastern boundary toward the shore to approximately 79° 28' 34" W. long.	No Change	266,700 (-26%)
Sub-Alternative A3e	• June 1 through September 30 the spatial extent would consist of the area within 40 nm of the coastline within the northern and southern boundaries of the current East Florida Coast closed area. From October 1 through May 31 and the spatial extent would include the	*See spatial changes*	239,047 (-34%)

	area east of the Florida coast to a line connecting two points at 31° 00’ N. lat., 79° 32’ 46” W. long. and 27° 52’ 55” N. lat., 79° 28’ 34” W. long. at the northern and southern boundaries, respectively, of the current closed area.		

3.1.3.1 Sub-Alternative A3a: No Action

This sub-alternative would maintain the current East Florida Coast closed area in effect with respect to its spatial and temporal extent. The spatial and temporal extent (year-round) specified in the regulations would remain the same. The purpose of the closed area when it took effect was to reduce bycatch and incidental catch of overfished and protected species by pelagic longline fishermen who target highly migratory species.

Rationale: Of the nine options considered, the overall metric score ranking of this option was 8th (Appendix 5). Continuation of the East Florida Coast closed area spatial and temporal extent would continue to eliminate pelagic longline interactions with bycatch species in this area, and reduce uncertainty regarding potential impacts of modifying the closed area. Also, the CEQ regulations for NEPA require that a “No Action Alternative” be considered for each proposed action.

A depiction of the spatial extent of the East Florida Coast closed area is shown in Figure 3.11. The approximate size of the area is 30,221.1 nm^2. The scope of the area is 362,653 (i.e., 30,221.1 nm^2 x 12 months = 362,653).

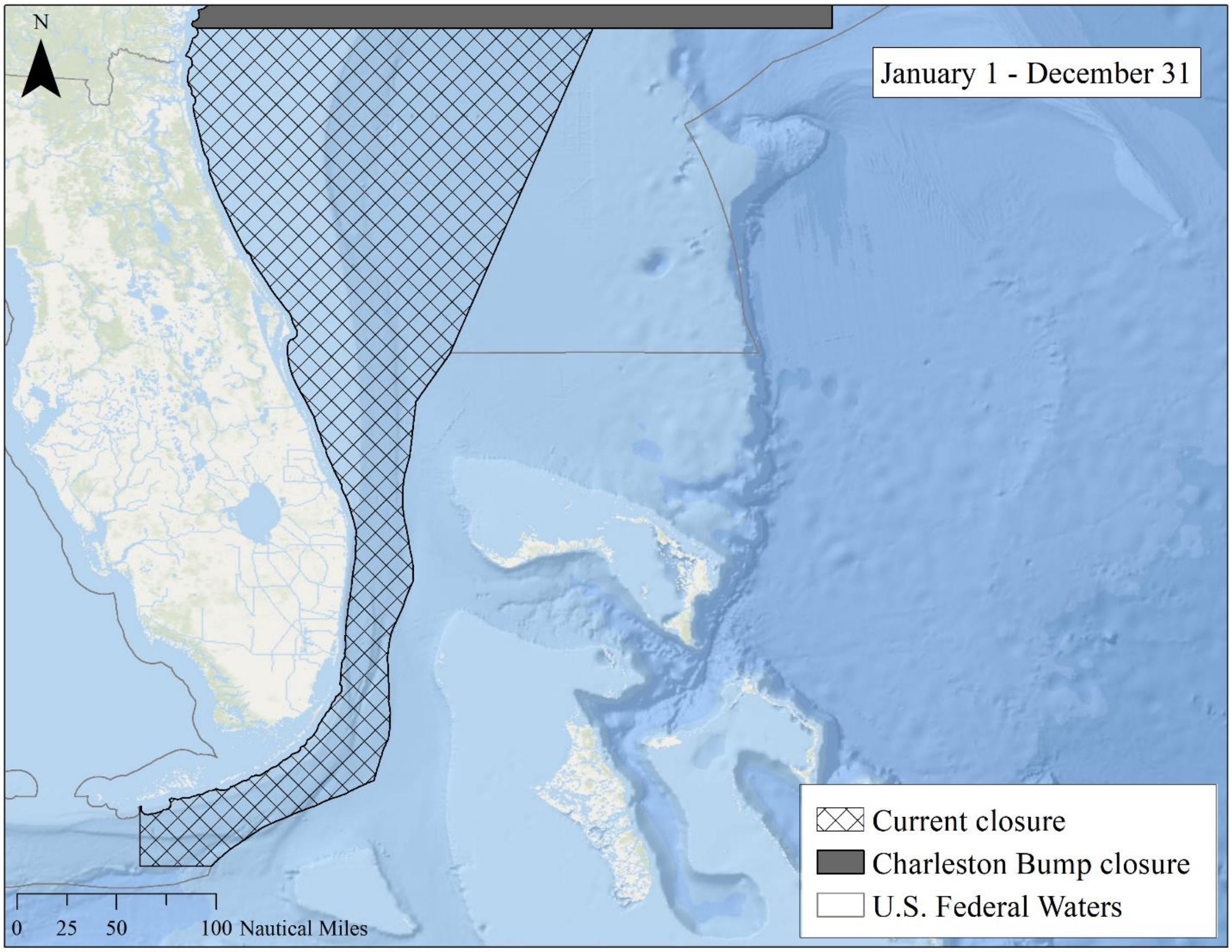

Figure 3.11. Sub-Alternative A3a – No Action – East Florida Coast closed area

3.1.3.2 Sub-Alternative A3b

This sub-alternative would modify both the spatial and temporal extent of the high-bycatch-risk area relative to the current closed area. Specifically, this sub-alternative consists of two different spatial configurations associated with two temporal periods. From May 1 through November 30 the spatial extent of the high-bycatch-risk area would be the same as the No Action alternative (Sub-Alternative A3a). From December 1 through April 30 the spatial extent of the high-bycatch-risk area would shift the eastern boundary to 40 nm from the coastline within the northern and southern boundaries of the current East Florida Coast closed area. The remainder of the current closed area footprint would be designated a low-bycatch-risk area from December 1 through April 30.

Rationale: Of the nine options considered, the overall metric score ranking of this option was tied for first (Appendix 5). Similar to the No Action alternative, the metric scores were highest for the billfish species groups compared to other options due to higher fishery interaction rates within the current closed area from May 1 through November 30. Total metric scores were high for both leatherback sea turtle and shortfin mako sharks as well even when the spatial extent was reduced to 40 nm from the coastline from December 1 through April 30. The area within 40 nm from the coastline encompasses high-bycatch-risk area of species that use areas closer to the coastline. In addition to the metrics, another consideration in the spatial and temporal extent of this sub-alternative is to continue to reduce potential longline fishery interactions with the recreational billfish fishery and potentially increase access to target species of the pelagic longline fishery.

A depiction of the spatial extent of this sub-alternative is shown in Figure 3.12. The approximate size of the area during the first temporal period is 30,221.1 nm^2. The approximate size of the area during the second temporal period is 15,311.7 nm^2. The scope of the area is 288,106 (i.e., 30,221.1 nm^2 x 7 months + 15,311.7 nm^2 x 5 months = 288,106), which is a 21 percent smaller than the No Action alternative (Sub-Alternative A3a).

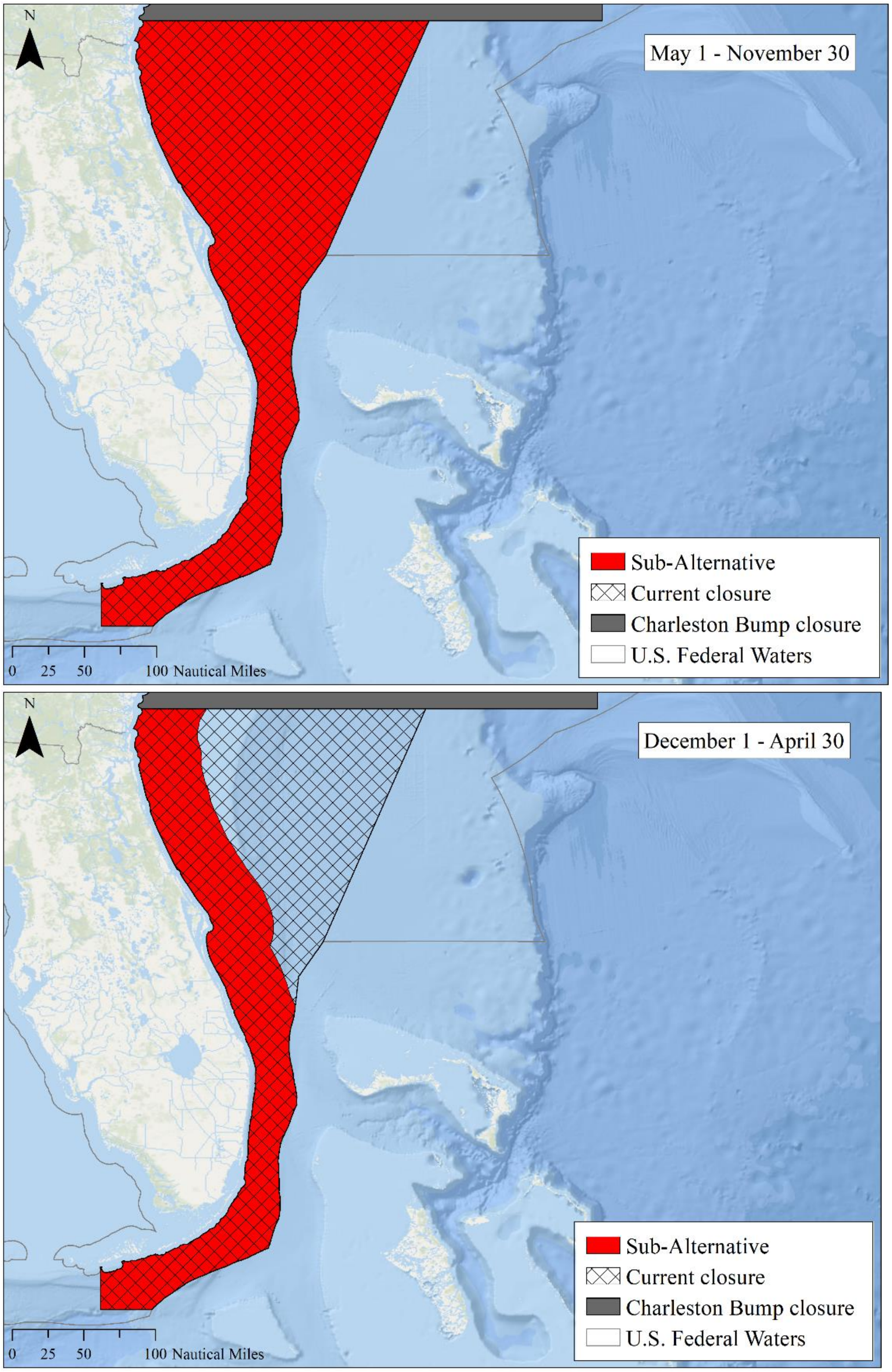

Figure 3.12. Sub-Alternative A3b – East Florida Coast Management Area (2 maps)

3.1.3.3 Sub-Alternative A3c

This sub-alternative would modify only the spatial extent of the high-bycatch-risk area relative to the current closed area. Specifically, this sub-alternative would reduce the spatial extent by shifting the eastern boundary of the current closed area to 40 nm from the coastline in areas north of the U.S. – Bahamas EEZ boundary at approximately 28° 17' 24" N. lat. All areas south of that boundary within the current closed area would remain the same relative to the No Action alternative (Sub-Alternative A3a). The temporal extent would remain unchanged relative to the No Action alternative. The remainder of the current closed area footprint would be designated a low-bycatch-risk area for the entire year.

Rationale: Of the nine options considered, the overall metric score ranking of this option was tied for 5th (Appendix 5). The total metric score would increase for shortfin mako shark and remain the same for leatherback sea turtle relative to the No Action alternative (Sub-Alternative A3a). Reducing the spatial extent to 40 nm north of 28° 17' 24" N would potentially increase access for the pelagic longline, while still encompassing high-bycatch-risk area of species that use areas closer to the coastline and avoiding important recreational fishing areas south of Cape Canaveral, Florida. In addition to the metrics, another consideration in the spatial extent of this sub-alternative is to continue to reduce potential longline fishery interactions with the recreational billfish fishery and potentially increase access to target species of the pelagic longline fishery. Past analyses/research has limited pelagic longline access to areas north of 28° N. lat. to reduce the potential for interactions with the recreational fishery (NOAA Fisheries 2007).

A depiction of the spatial extent of this sub-alternative is shown in Figure 3.13. The approximate size of the area is 15,921.1 nm2. The scope of the area is 191,053 (i.e., 15,921.1 nm^2 x 12 months = 191,053), which is 47 percent smaller than the No Action alternative (Sub-Alternative A3a).

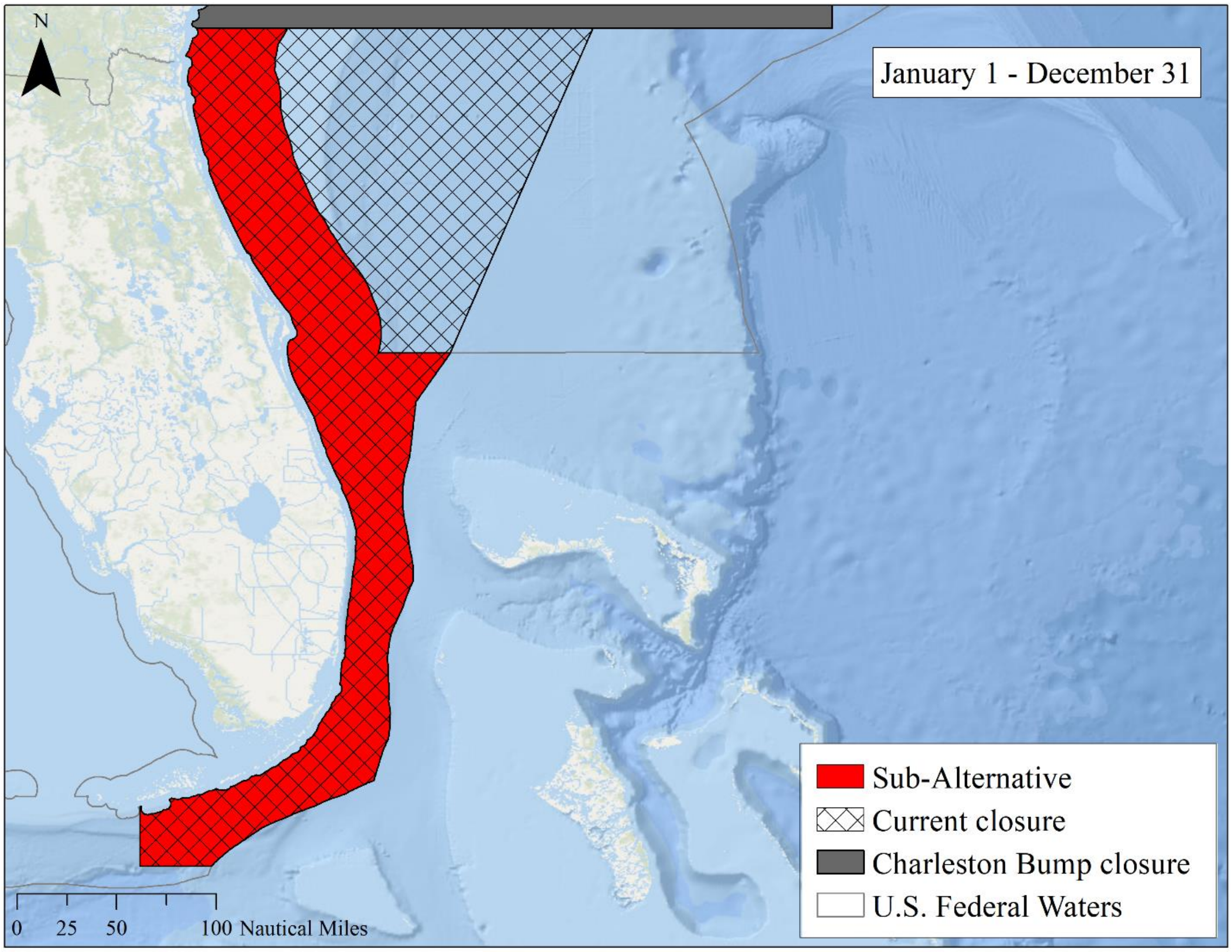

Figure 3.13. Sub-Alternative A3c – East Florida Coast Management Area

3.1.3.4 Sub-Alternative A3d

This sub-alternative would modify only the spatial extent of the high-bycatch-risk area relative to the current closed area. Specifically, this sub-alternative would reduce the spatial extent by including areas east of the line connecting two points at 31° 00' N. lat., 79° 32' 46" W. long. and 27° 52' 55" N. lat., 79° 28' 34" W. long. at the northern and southern boundaries, respectively, of the current closed area. All areas south of 27° 52' 55" N. lat. within the current closed area would remain the same relative to the No Action alternative (Sub-Alternative A3a). The temporal extent would remain unchanged relative to the No Action alternative. The remainder of the current closed area footprint would be designated a low-bycatch-risk area for the entire year.

Rationale: Of the nine options considered, the overall metric score ranking of this option was tied for 1st (Appendix 5). The total metric score would increase for shortfin mako shark and leatherback sea turtle relative to the No Action alternative (Sub-Alternative A3a). Shifting the eastern boundary westward would potentially increase access, while still encompassing high-bycatch-risk area of species that use areas closer to the coastline and avoiding recreational fishing areas. In addition to the metrics, another consideration in the spatial extent of this sub-alternative is to reduce potential longline fishery interactions with the recreational billfish fishery and potentially increase access to target species of the pelagic longline fishery.

A depiction of the spatial extent of this sub-alternative is shown in Figure 3.14. The approximate size of the area is 22,225 nm2. The scope of the area is 266,700 (i.e., 22,225 nm^2 x 12 months = 266,700), which is 26 percent smaller than the No Action alternative (Sub-Alternative A3a).

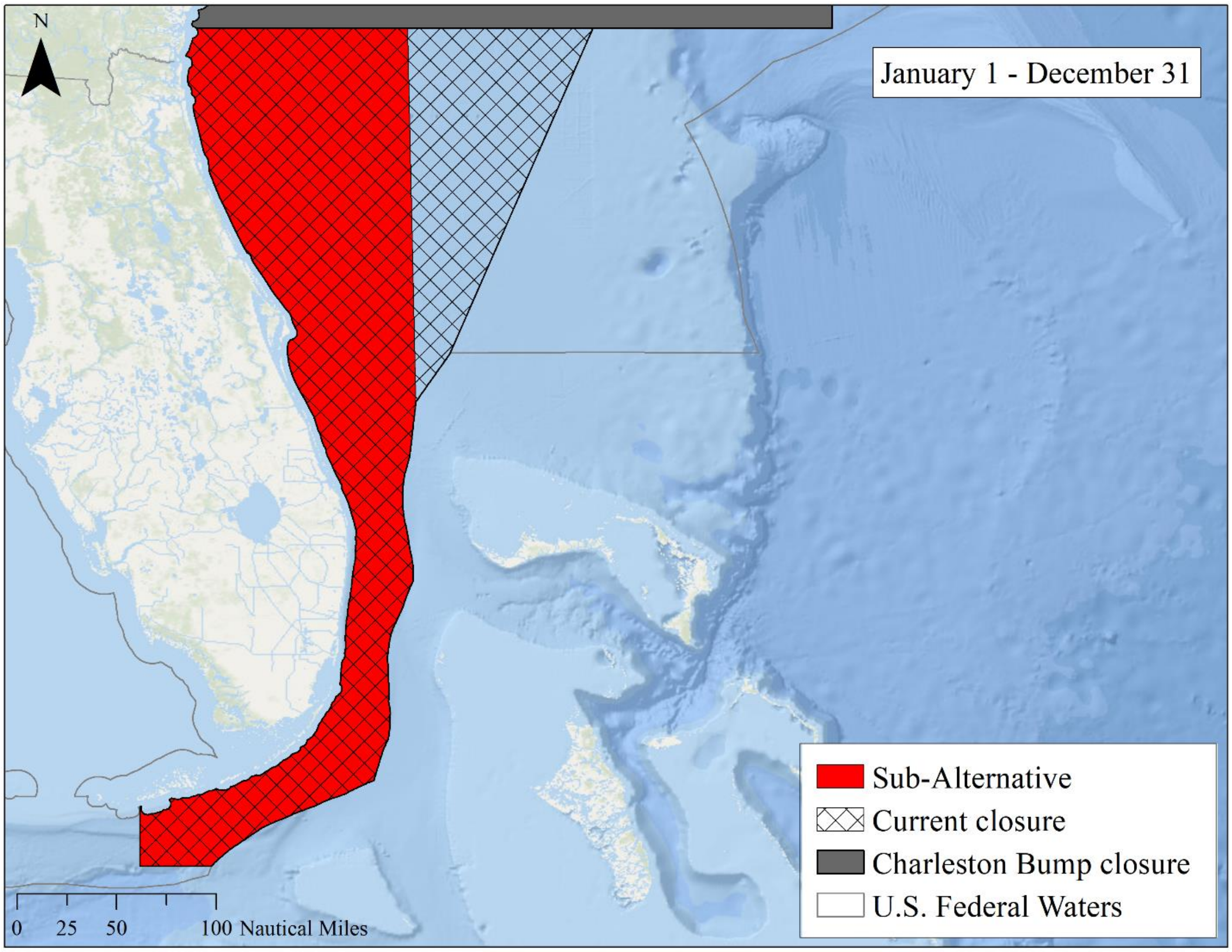

Figure 3.14. Sub-Alternative A3d – East Florida Coast Management Area

3.1.3.5 Sub-Alternative A3e

This sub-alternative would modify both the spatial and temporal extent of the high-bycatch-risk area relative to the current closed area. Specifically, this sub-alternative consists of two different spatial configurations associated with two temporal periods. From June 1 through September 30 the spatial extent would consist of the area within 40 nm of the coastline within the northern and southern boundaries of the current East Florida

Coast closed area. During this time period, the remainder of the current closed area footprint would be designated a low-bycatch-risk area. From October 1 through May 31, the spatial extent would include the area east of the Florida coast to a line connecting two points at 31° 00’ N. lat., 79° 32’ 46” W. long. and 27° 52’ 55” N. lat., 79° 28’ 34” W. long. at the northern and southern boundaries, respectively, of the current closed area. As with the June to September area, from October to May, the remainder of the current closed area footprint would be designated a low-bycatch-risk area.

Rationale: Of the nine options considered, the overall metric score ranking of this option was 3rd (Appendix 5). Total metric scores slightly increased for leatherback sea turtle and significantly increased for shortfin mako shark even when the spatial extent was reduced all year-round (although the reduction differed between the two temporal periods). Reducing the spatial extent to 40 nm from the coastline from June 1 through September 30 (4 months) would potentially increase access, while still encompassing high-bycatch-risk area of species that use areas closer to the coastline as south of Fort Pierce, Florida. Shifting the eastern boundary westward October 1 through May 31 (8 months) would potentially increase access as well, while still encompassing high-bycatch-risk area of species that use areas closer to the coastline and avoiding recreational fishing areas. In addition to the metrics, another consideration in the spatial and temporal extent of this sub-alternative is to continue to reduce potential longline fishery interactions with the recreational billfish fishery and potentially increase access to target species of the pelagic longline fishery.

A depiction of the spatial extent of this sub-alternative is shown in the two maps in Figure 3.15. The approximate size of the area during the first temporal period is 15,311.7 nm2. The approximate size of the area during the second temporal period is 22,225 nm^2. The scope of the area is 239,047 (i.e., 15,311.7 nm^2 x 4 months + 22,225 nm^2 x 8 months = 239,047), which is 34 percent smaller than the No Action alternative (Sub-Alternative A3a).

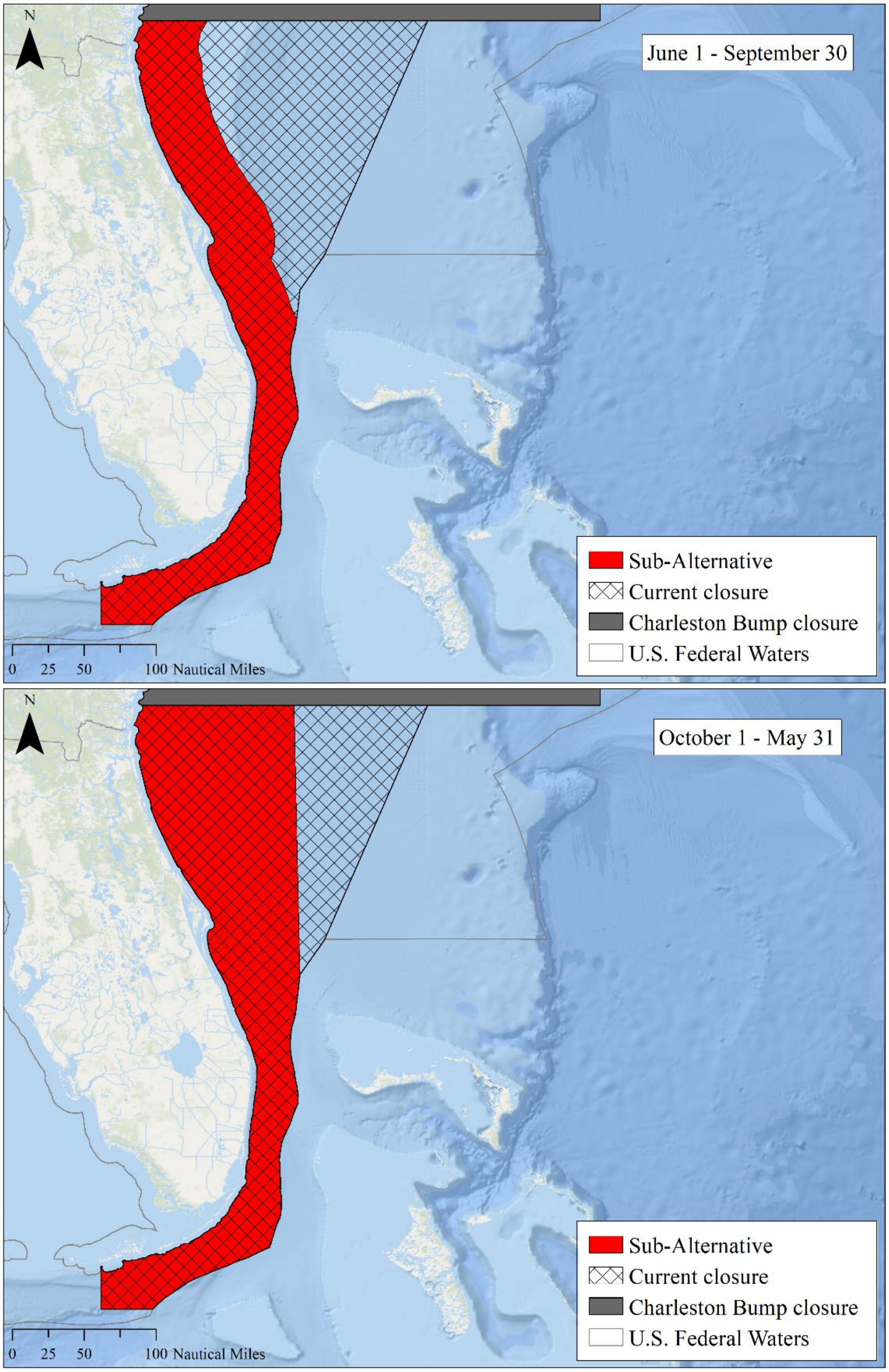

Figure 3.15. Sub-Alternative A3e – East Florida Coast Management Area (2 maps)

3.1.4 Alternative Suite A4: DeSoto Canyon Spatial Management Areas

For the DeSoto Canyon closed area we developed 13 options (including the No Action option) using HMS PRiSM. Twelve of these options consisted of shifts in the temporal extent, spatial extent, or both the temporal and spatial extents. The overall metric scores were ranked from 1 to 13 where 1 indicates the option that performed the best at conserving bycatch and 13 performed the worst. These options and their corresponding metric scores are described in Appendix 5. We selected four options as sub-alternatives to cover the reasonable range of alternatives that meet the purpose and need of this action (Table 3.4). Each sub-alternative could be combined with one or more of the data collection ("B") or evaluation ("C") Alternatives in this DEIS, which would have the effect of modifying other relevant aspects of the closed area, such as specifying commercial data collection methods (Alternative Suite B) or specifying the timing of an evaluation (Alternative Suite C).

Table 3.4. DeSoto Canyon Spatial Management Area Sub-Alternatives

Sub-Alternative	**Spatial Change**	**Temporal Change**	**Scope (Change in Scope from No Action)**
Sub-Alternative A4a – No Action	N/A	N/A - January 1 through December 31 (year-round)	305,042 (N/A)
Sub-Alternative A4b	• April 1 through October 31: No change. • November 1 through March 31: only include the northwest box.	*See spatial changes*	240,914 (-21%)
Sub-Alternative A4c	Shift southern boundary of southern box north to 27° 00' N. lat.	No Change	227,754 (-25%)
Sub-Alternative A4d – Preferred Alternative	Parallelogram through current area.	No Change	319,249 (+5%)

3.1.4.1 Sub-Alternative A4a: No Action

This sub-alternative would maintain the current DeSoto Canyon closed area in effect with respect to its spatial and temporal extent. The boundary of the area and temporal extent (year-round) specified in the regulations would remain the same. The purpose of the closed area when it took effect was to reduce bycatch and incidental catch of overfished and protected species by pelagic longline fishermen who target highly migratory species.

Rationale: Of the 13 options considered, the overall metric score ranking of this option was 2nd (Appendix 5). Continuation of the DeSoto Canyon closed area would continue to eliminate pelagic longline interactions with bycatch species in this area, and reduce uncertainty regarding potential impacts of modifying the closed area. Also, the CEQ regulations for NEPA require that a "No Action Alternative" be considered for each proposed action.

A depiction of the spatial extent of the DeSoto Canyon closed area is shown in Figure 3.16. The approximate size of the area is 25,420.14 nm^2. The scope of the area is 305,042 (i.e., 25,420.14 nm^2 x 12 months = 305,042).

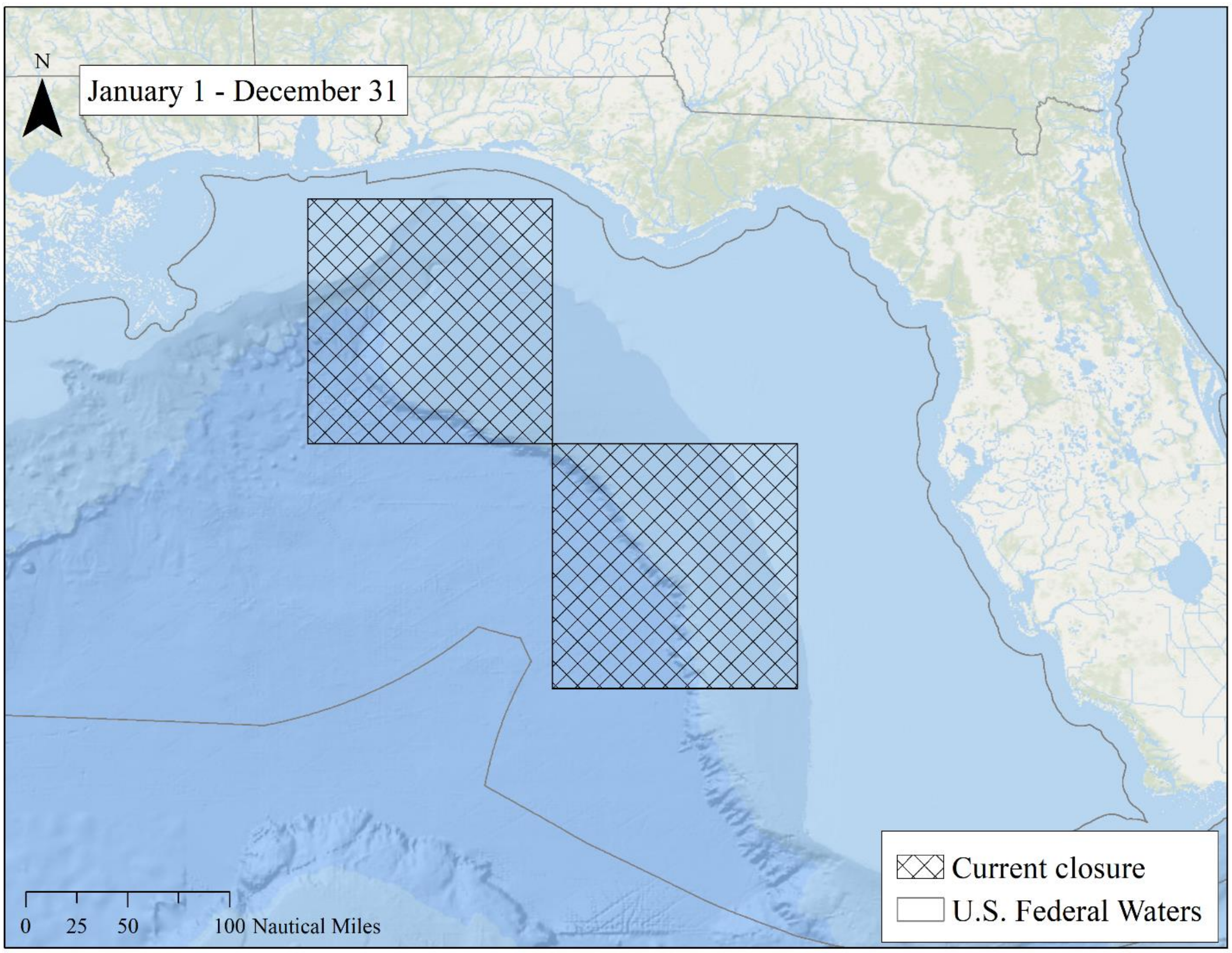

Figure 3.16. Sub-Alternative A4a – DeSoto Canyon Closed Area

3.1.4.2 Sub-Alternative A4b

This sub-alternative would modify both the spatial and temporal extent of the high-bycatch-risk area relative to the current closed area. Specifically, would maintain the current spatial extent of the DeSoto Canyon while changing the timing of the closed areas, as shown in Figure 3.16. Specifically, both boxes would be considered high-bycatch-risk areas from April 1 to October 31 instead of all year. Additionally, from November to March, the top northwest box would be considered high-bycatch-risk area while the bottom southeast box would be designated a low-bycatch-risk area.

Rationale: Of the 13 options considered, the overall metric score ranking of this option was tied for 3rd (Appendix 5). High-bycatch-risk area for leatherback sea turtle and shortfin mako shark occurred along the northern areas of the Gulf of Mexico throughout most of the year, therefore the northwest box was maintained for the whole year. However, high-bycatch-risk area for leatherback sea turtle and shortfin mako shark occurred rarely in the southeast box from November through March. The total metric scores for leatherback sea turtle and shortfin mako shark would not change relative to the No Action alternative (Sub-Alternative A4a), despite reducing the spatial extent of the second temporal period to only the northwest box. Please see the table of metric scores for each species in Appendix 5 to see the metric score breakdown by option by species. In addition to the metrics, another consideration in the spatial and temporal extent of this sub-alternative is the potential increased access to target species of the pelagic longline fishery.

A depiction of the spatial extent of this sub-alternative is shown in the two maps in Figure 3.17. The approximate size of the area during the first temporal period is 25,420.14 nm^2. The approximate size of the area during the second temporal period is 12,594.5 nm^2. The scope of the area is 240,914 (i.e., 25,420.14 nm^2 x 7 months + 12,594.5 nm^2 x 5 months = 240,914), which is 21 percent smaller than the No Action alternative (Sub-Alternative A4a).

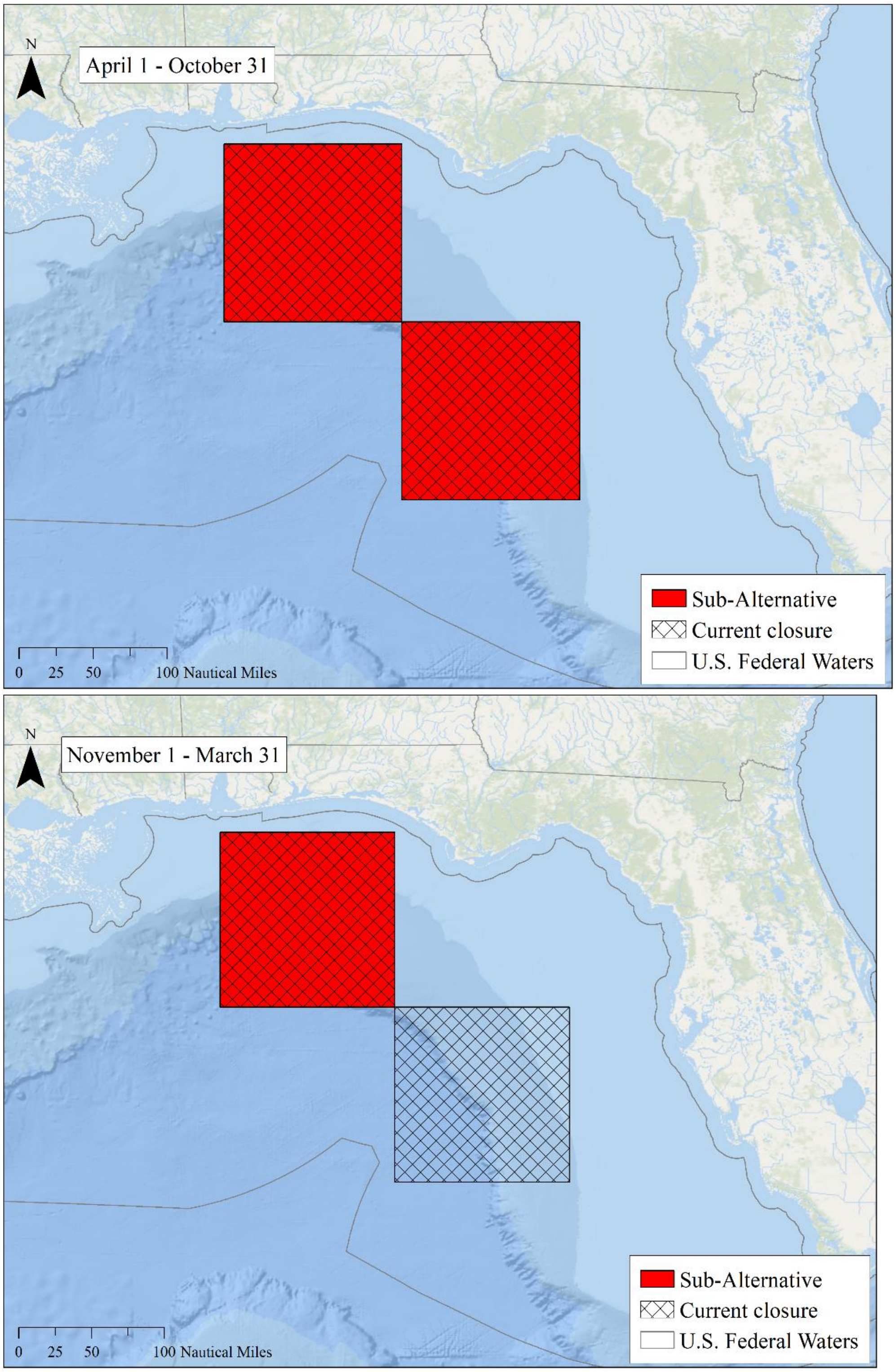

Figure 3.17. Sub-Alternative A4b – DeSoto Canyon Management Area

3.1.4.3 Sub-Alternative A4c

This sub-alternative would only modify the spatial extent of the high-bycatch-risk area relative to the current closed area. Specifically, this sub-alternative would reduce the spatial extent by including areas within the current spatial extent that occurs north of 27° 00' N. lat. The temporal extent would remain unchanged relative to the No Action alternative (Sub-Alternative A4a). The remainder of the current closed area footprint would be designated a low-bycatch-risk area throughout the year.

Rationale: Of the 13 options considered, the overall metric score ranking of this option was 6^{th} (Appendix 5). High-bycatch-risk areas for leatherback sea turtle and shortfin mako shark occurred along the northern areas of the Gulf of Mexico throughout most of the year, therefore the northwest box and the northern half of the southeast box were maintained for the whole year. The total metric scores for leatherback sea turtle and shortfin mako shark would slightly increase relative to the No Action alternative (Sub-Alternative A4a), despite reducing the spatial extent. High-bycatch-risk area for leatherback sea turtle and shortfin mako shark occurred rarely in the southeast box from November through March. In addition to the metrics, another consideration in the spatial and temporal extent of this sub-alternative is the potential increased access to target species of the pelagic longline fishery.

A depiction of the spatial extent of this sub-alternative is shown in Figure 3.18. The approximate size of the area is 18,979.5 nm^2. The scope of the area is 227,754 (i.e., 18,979.5 nm^2 x 12 months = 227,754), which is 25 percent smaller than the No Action alternative.

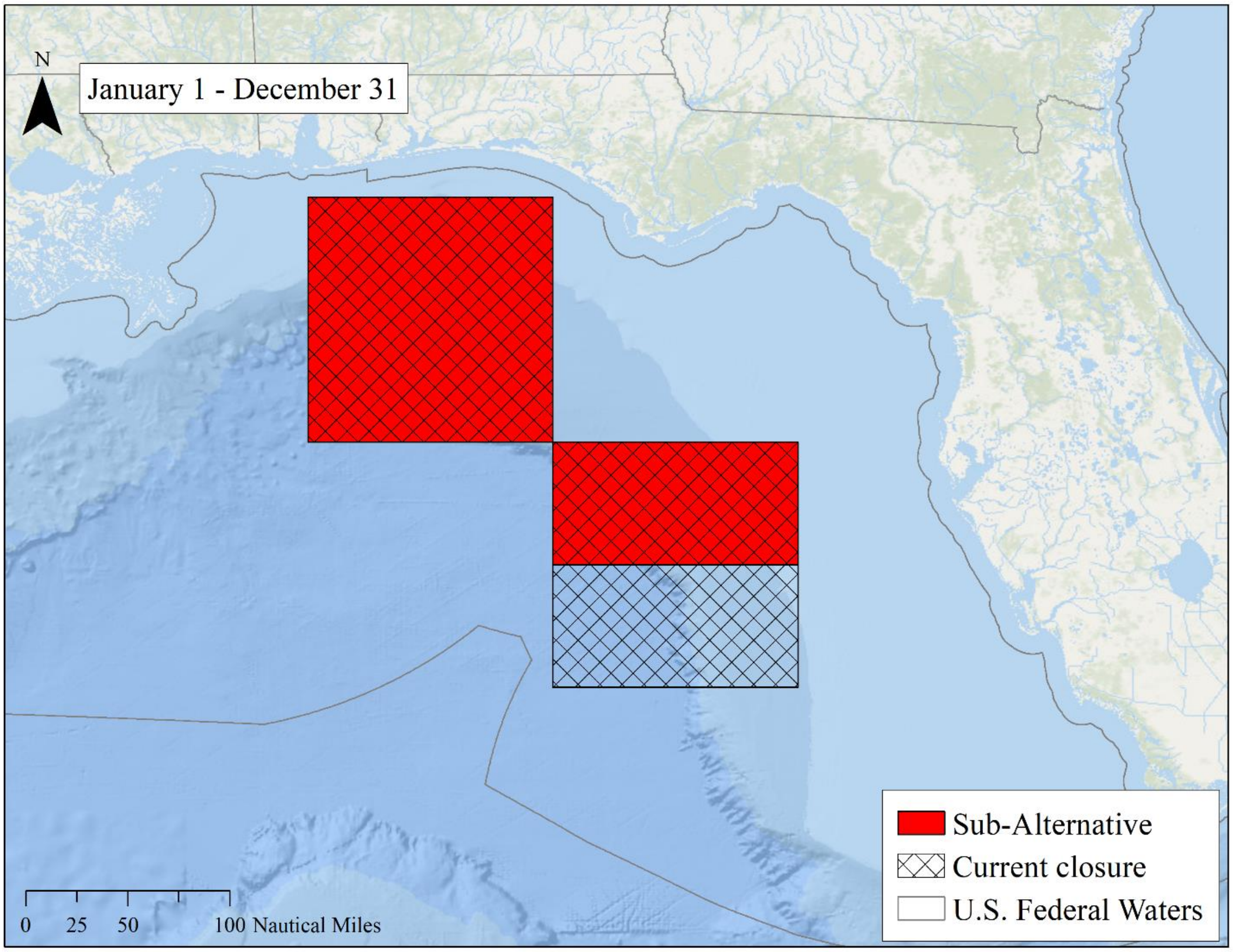

Figure 3.18. Sub-Alternative A4c – DeSoto Canyon Management Area

3.1.4.4 Sub-Alternative A4d

This sub-alternative would modify the spatial extent of the high-bycatch-risk area relative to the current closed area; the temporal extent would remain unchanged (i.e., area would remain closed year-round). Specifically, this sub-alternative would shift the spatial extent, putting a parallelogram through the current area. The parallelogram connects southern points; 27° 00' N. lat., 86° 30' W. long. and 27° 00' N. lat., 83° 48' W. long., while the northern boundary would be defined by the state water boundary between 88° 24' 58" W. long. and 85° 22' 34" W. long. The areas outside this parallelogram that are currently closed would reopen to normal fishing.

Rationale: Of the 13 options considered, the overall metric score ranking of this option was 1st (Appendix 5). high-bycatch-risk areas for leatherback sea turtle and shortfin mako shark occurred along the northern areas of the Gulf of Mexico throughout most of the year, therefore the northern boundary would extend up to the state water boundary to encompass these high-bycatch-risk areas. The total metric scores for leatherback sea turtle and shortfin mako shark would increase relative to the No Action alternative (Sub-

Alternative A4a). In addition to the metrics, another consideration in the spatial and temporal extent of this sub-alternative is the potential increased access to target species of the pelagic longline fishery.

A depiction of the spatial extent of this sub-alternative is shown in Figure 3.19. The approximate size of the area is 26,604.1 nm^2. The scope of the area is 319,249 (i.e., 26,604.1 nm^2 x 12 months = 319,249), which is 5 percent larger than the No Action alternative (Sub-Alternative A4a).

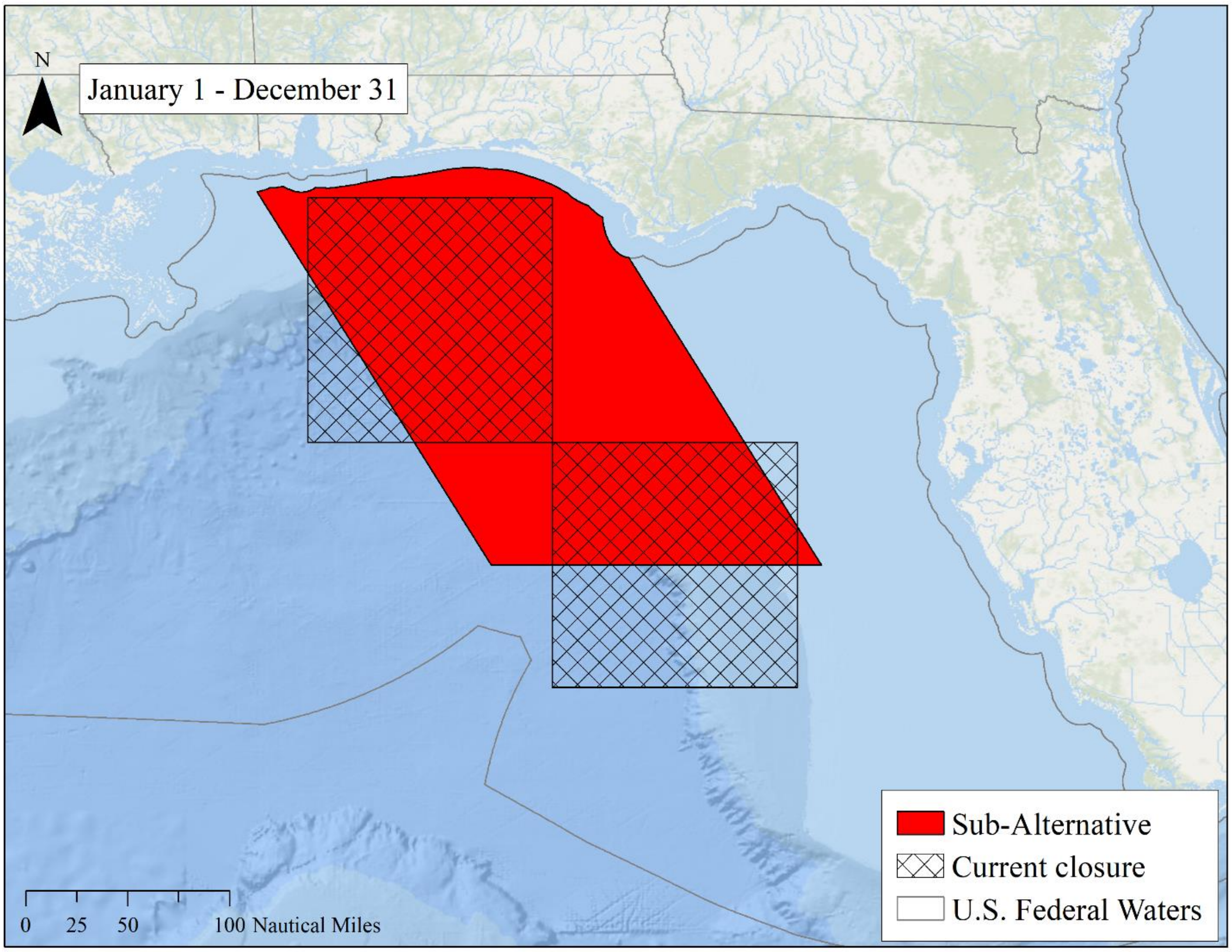

Figure 3.19. Sub-Alternative A4d – DeSoto Canyon Management Area

3.2 "B" Alternatives: Commercial Data Collection

Introduction to the "B" Alternatives

The "B" Alternatives are methods to obtain data from within the spatial management areas. These data collection programs could be employed in the areas inside the geographic footprint of the existing closures, or in the footprint of a newly defined area of one of the "A" Sub-Alternatives. There are two types of areas, "high-bycatch-risk areas" and "low-bycatch-risk areas," that are delineated based on HMS PRiSM results as detailed in Chapter 2. High-bycatch-risk areas (shown in red on the maps in Chapter 3) are areas where predicted fishery interaction rates in that time and area are sufficiently high as to warrant precautionary data collection activities to protect bycatch. Low-bycatch-risk areas (shown in cross-hatch on the maps in Chapter 3) are areas where predicted fishery interaction rates in that time and area are lower, indicating reduced need for bycatch protections. In the preferred alternatives package for each spatial management area, a data collection program would be preferred separately for each high- and low-bycatch-risk area. These are the preferred "B" Alternatives for high- and low-bycatch risk areas under the preferred alternative packages for each spatial management area:

- No Action (Alternative B1) for high-bycatch-risk area in the Mid-Atlantic spatial management area and for low-bycatch-risk area in the DeSoto Canyon spatial management area.
- Monitoring Areas (Alternative B3) and sub-alternatives for Effort Caps (Sub-Alternative B3a) and Electronic Monitoring (Sub-Alternative B3e) for low-bycatch-risk areas in the Charleston Bump and East Florida Coast spatial management areas.
- Cooperative Research via Exempted Fishing Permit (Alternative B4) for high- and low-bycatch-risk areas in the Charleston Bump and East Florida Coast spatial management areas and high-bycatch-risk area in the DeSoto Canyon spatial management area.

Each of the data collection "B" Alternatives has unique strengths and weaknesses associated with it as explained below and are intended to be combined with the "A" and "C" Alternatives in order to meet the multiple objectives of this management action. These data collection alternatives are characterized as commercial, given the current closed area restrictions apply only to commercial vessels, however, recreational data may be relevant to collect in order to assess ancillary impacts of closed areas. Each B Alternative carries with it a financial cost that may be born by NOAA Fisheries, the industry or both. Any such costs are separate from and in addition to costs for the F Alternatives (EM program used for bluefin tuna interactions and disposition and to verify shortfin mako sharks are released with a minimum of harm).

3.2.1 Alternative B1: No Action – Preferred Alternative for high-bycatch-risk area in the Mid-Atlantic spatial management area and for low-bycatch-risk area in the DeSoto Canyon spatial management area

This alternative is the status quo, under which no new closed area data collection approaches would be implemented to support HMS spatial management. Only existing mechanisms, such as individual EFPs with associated analyses or ongoing fishery-independent surveys, would be available for closed area data collection.

Rationale: This alternative matches the current mechanisms for collected data in closed areas. Also, the CEQ regulations for NEPA require that a "No Action Alternative" be considered for each proposed action.

3.2.2 Alternative B2: Spatial Management Area Research Fishery

This alternative would create a new research fishery, similar to the existing bottom longline shark research fishery, where permitted commercial longline fishing vessels may apply, and a small number would be selected for participation in the spatial management area research fishery. The selected vessels would conduct fishing operations guided by a research plan developed by NOAA Fisheries, and be subject to conditions. Spatial management area research trips would only be permitted when an observer is on board the vessel or if vessels are equipped with electronic monitoring and when submitting video data, request the review of video and data for 100 percent of the sets that occur within the spatial management area. This monitoring requirement would ensure accurate and complete characterization of catch and effort. Note that while most pelagic longline vessels are already equipped with electronic monitoring, bottom longline vessels would require electronic monitoring system installation. Other elements may include (but would not be limited to): a bycatch or target species quota, reporting requirements, gear restrictions (e.g., limited number of hooks), electronic monitoring, or a limited number of participants. The research fishery would be conducted under the auspices of the EFP program.

For example, shark research fishery permits allow fishermen to land sandbar, other large coastal sharks, small coastal sharks, smoothhound, and pelagic sharks from federal waters in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea. The permit is subject to 100-percent observer coverage, although participants can fish without an observer when not on a shark research fishery trip. The scientific data collected by fishery observers in the shark research fishery has been instrumental in numerous shark stock assessments. Fishermen who wish to participate must fill out an application for a shark research permit under the exempted fishing program. Fishermen are only qualified if they have been compliant with all other regulations including observer requirements. Other terms and conditions may apply such as hook and soak time limitations and a requirement to land all dead sharks, unless the shark is a prohibited species. More details are available in Amendment 2 to the 2006 Consolidated HMS FMP and the 2021 SAFE Report (NOAA Fisheries 2022).

The research fishery of this alternative would be designed to address the unique nature of each spatial management area. Each permit and its terms and conditions could structure the allowable fishing activity to take into consideration spatial and temporal aspects of the bycatch species and/or the commercial fishery. This alternative would have less fishing effort and more conditions associated with fishing activity than monitoring areas (see Alternative B3). A research fishery is distinguished from a typical EFP project because it is not structured as a one-time research project, with a hypothesis and specific experimental design in support of the hypothesis, but is continuous over time, with an annual process of renewal to accept participants and consideration of any necessary modifications to the conditions of the research.

Standardized Criteria

Standardized criteria would apply to all of the spatial management area research fisheries. Additional criteria or conditions may apply to each specific spatial management area research fishery, and may vary annually. As is done with the shark research fishery, NOAA Fisheries would publish a request for applications in the Federal Register and would invite longline permit holders to submit an application to participate in the research fishery on an annual basis. Applications would be evaluated based on several criteria such as willingness to: take an observer and have demonstrated past compliance with observer program requirements; collect and report data on all trips under the purview of the permit; schedule the timing of fishing trips to ensure that data are collected throughout the year; or fish in specific regions to ensure that samples are collected throughout the spatial management area. NOAA Fisheries would consider past HMS fisheries violations for which they received a Notice of Violation Assessment or other significant violations in the past. Criteria would be further described in the annual Federal Register notice published to solicit applications for the research fishery. NOAA Fisheries would determine when the research vessels would fish to ensure adequate spatial and temporal sampling throughout the year. The Agency would determine the number of vessels that may participate in the research fishery annually based on the objectives of the spatial management area and the best available information. If catches are higher than those estimated in analyses in a particular region or by a particular vessel, NOAA Fisheries could stop a trip or all trips. After review of data from the research area from a previous year(s) NOAA Fisheries can adjust the research protocols and modify effort or restrictions as warranted.

Rationale: The objective of this alternative is to establish catch series data from the commercial longline fisheries in spatial management areas, or collect data in support of an ongoing research plan developed by the NOAA Fisheries, consistent with the objectives of the relevant spatial management area. A research fishery may be more likely to provide data on a continuing basis, and reduce uncertainty from both the perspective of data collection and the commercial fishery.

3.2.3 Alternative B3: Monitoring Area – Preferred Alternative for low-bycatch-risk areas in the Charleston Bump and East Florida Coast spatial management areas

This alternative describes various approaches to data collection from a spatial management area. NOAA Fisheries is using the term "monitoring area" to describe spatial management areas that allow commercial fishing, and have associated restrictions that result in a relatively high level of information and precautionary management. Under this alternative a specific geographic area would be designated a "monitoring area" and commercial longline vessels would be permitted to fish inside the monitoring area subject to certain conditions and other applicable regulations. The purpose of a monitoring area is to collect data from within the spatial management area and provide fishing opportunities consistent with the objectives of the spatial management area. More specifically, access to the area is intended to provide data on the costs and benefits of the spatial management area, and the status of achievement of relevant objectives. To the extent practicable, the monitoring area would allow commercial fishing gear and practices similar to that employed outside the area, in order to be comparable to fishing using routine practices. The specific geographic areas to be defined as monitoring areas could be one of several potential areas defined in the "A" Alternatives. For example, the area defined by one of the current closed areas (No Action sub-alternatives), one of the new areas defined by one of the sub-alternatives, or a combination of the two. In the example below and in the impacts analysis, the monitoring areas would be within areas that are currently closed to pelagic longline fishing, but are outside the boundaries of the spatial management areas alternatives (i.e., the “A” Alternatives). These areas are of lower risk for bycatch than the area defined under the spatial management alternatives, based on HMS PRiSM. For example, regarding the Charleston Bump Management Area in Sub-Alternative A2c (Figure 3.8), the monitoring area would be the cross-hatched area that is not red. Notwithstanding the results of the HMS PRiSM data, because fishing has not occurred in the monitoring area during the closure months, there is uncertainty regarding the type and level of bycatch that may occur if commercial fishing were to occur there. Therefore, fishing in the monitoring area would be subject to conditions and restrictions to ensure that any bycatch or incidental catch is minimized to the extent practicable. Various tools to ensure that the monitoring area meets its objectives, including conditions and restrictions, are described in the sub-alternatives below (i.e., Sub-Alternatives B3a through B3f). The alternatives include effort caps, bycatch caps, trip-level effort controls, observer coverage, electronic monitoring, and data sharing and communication. The alternatives include diverse strategies to address different geographic locations and bycatch species, levels of risk, and levels of resources needed. Some of the alternatives have associated reporting requirements. NOAA Fisheries has used monitoring areas in the past for these purposes, e.g., the Northeastern United States Pelagic Longline Monitoring Area and the Spring Gulf of Mexico Pelagic Longline Monitoring Area (85 FR 18812; April 2, 2020). Before deploying sets in a monitoring area, vessel owners and/or operators would be required to indicate their intention to do so during the pre-trip or in-trip VMS hail-out.

Monitoring areas would provide special access for vessels meeting certain requirements to collect data in spatial management areas. The Agency would have the authority to further restrict or end access to the monitoring areas for those vessels if warranted by conservation and management concerns raised by unexpectedly high bycatch, high data collection efforts, fishing effort that is overly clustered temporally or spatially, or other relevant considerations. Access to spatial management areas could be prohibited in-season or, in the case of effort caps or bycatch caps, the Agency could choose not to re-open once caps reset (e.g., on January 1st in the case of effort caps). NMFS would file such actions with the Office of Federal Register for publication. Preferred Alternatives C2, C4 and E2 would provide for review of spatial management areas and considerations for those reviews. After reviewing an area, NMFS may consider changes or modifications to the area or its management measures, as appropriate, through framework adjustments (see proposed § 635.34). For example, if bycatch is lower than expected for a period of time, the Agency could increase effort caps for the following year(s).

3.2.3.1 Sub-Alternative B3a: Effort caps– Preferred Sub-Alternative for low-bycatch-risk areas in the Charleston Bump and East Florida Coast spatial management areas

This sub-alternative would limit the amount of fishing effort by a particular gear in a monitoring area as an indirect means to limit the amount of potential bycatch of a particular species or multiple species. This sub-alternative could be implemented in addition to or in place of bycatch caps (Sub-Alternative B3b), but bycatch caps are not currently preferred. Under this sub-alternative, NOAA Fisheries would monitor the number of longline sets occurring in the monitoring area. If the number of sets reaches the effort "cap", or is projected to reach that cap, NOAA Fisheries would prohibit fishing with the relevant gear type in the monitoring area as described above. NOAA Fisheries may also close the monitoring area before the effort cap is reached and/or not reopen areas, if warranted by conservation and management concerns raised by unexpectedly high bycatch, high data collection efforts, fishing effort that is overly clustered temporally or spatially, or other relevant considerations.

This sub-alternative uses the number of longline sets, and not the number of hooks, as the effort control/cap. We decided to use the number of longline sets because of the diversity of the longline fisheries (which includes vessels of various sizes), the diversity of area-specific fishing strategies (which includes a range in the number of hooks fished), and to facilitate monitoring and enforcement of effort caps. Additionally, the number of sets are easier to count and track than hooks due to the smaller number.

Four considerations discussed below are important when designing effort caps: 1) effort cap calculation; 2) timing of triggered reduction or prohibition of fishing effort (e.g., immediate closures, future quarter or year closures); and 3) reporting and monitoring.

Effort cap calculation: The level of the effort cap specified for a monitoring area is based on the amount of fishing effort of the larger geographic area in which the monitoring area is located. This larger geographic area is called the "reference area" (also used in the context of the impacts analysis in Chapter 5). The Atlantic region pelagic longline reference area occurred within the U.S. EEZ from 35° N. lat. to 22° N. lat. and east of 81° 47' 24" W. long., whereas the pelagic longline reference area in the Gulf of Mexico region occurred within the U.S. EEZ west of 81° 47' 24" W. long (Figure 3.20 and Figure 3.21). The bottom longline reference area occurred within the U.S. EEZ from 38° 55' 52" N. lat. to 32° 02' 02" N. lat. (Figure 3.22). Specifically, the monitoring area effort cap is set as a proportion of the average annual effort in the reference area for East Florida Coast and DeSoto Canyon Monitoring Areas because they are occurring year-round. However, for the Charleston Bump Monitoring Area and the Mid-Atlantic Shark Monitoring Area the monitoring area effort cap is set as a proportion of the average annual effort in the reference area for February through April and November through May, respectively because those months represent the durations of each monitoring area. The proportion used to derive the monitoring area effort cap would be equal to the size of the monitoring area relative to the size of the reference area. First, the average annual number of sets in the reference area from 2011 through 2020 where swordfish or tuna were targeted would be calculated using logbook data. Next, a percentage would be calculated using the size of the monitoring area relative to the reference area in square nautical miles. Lastly, this percentage would be applied to the average number of sets in the reference area to derive the effort cap. The effort caps for each area are listed in the table below.

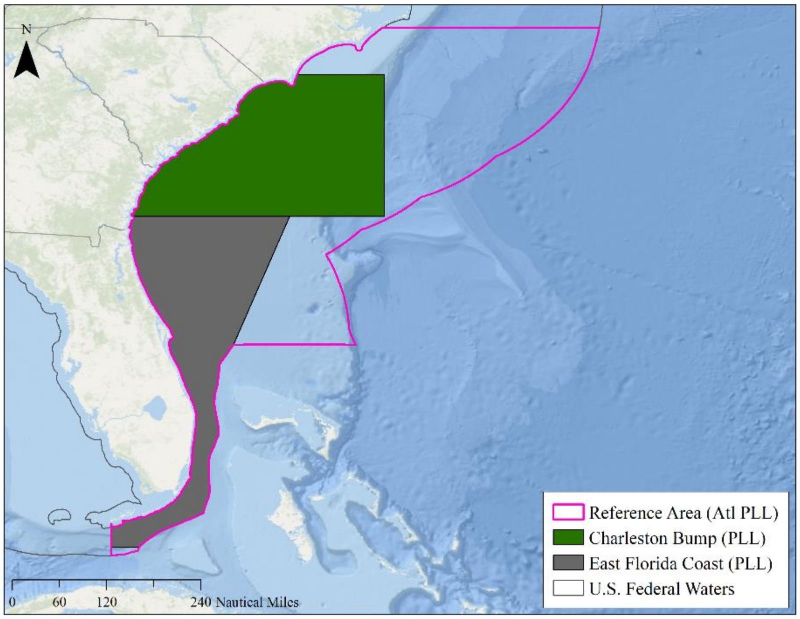

Figure 3.20. Atlantic region reference area for the pelagic longline and associated pelagic longline closed areas in the region.

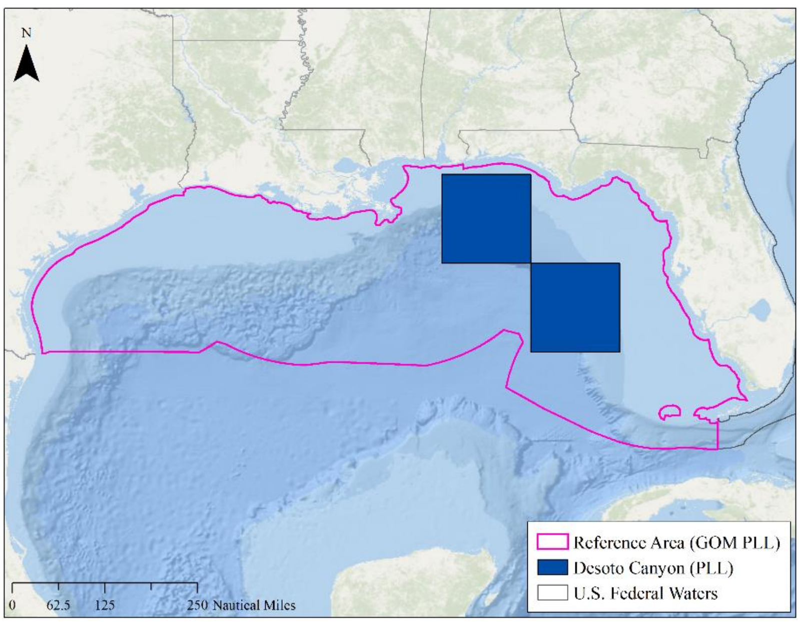

Figure 3.21. Gulf of Mexico region reference area for the pelagic longline and associated pelagic longline closed area in the region.

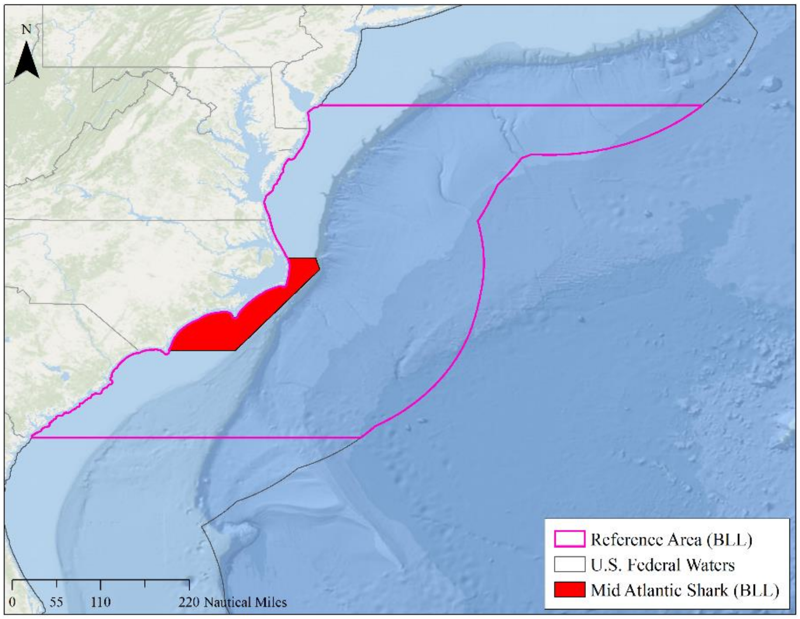

Figure 3.22. Reference area for the bottom longline and associated bottom longline closed area.

Table 3.5. Pelagic and Bottom Longline Monitoring Area Effort Caps

Monitoring Area	**Average Annual Number of Sets in Reference Area 2011-2020**	**Size of monitoring area/size of reference area (%)**	**Effort Cap (sets)**
Pelagic Longline Monitoring Areas			
Charleston Bump Monitoring Area	511**	13.4	69**
East Florida Coast Monitoring Area	1,891	6.5	124
DeSoto Canyon Monitoring Area	2,167	4.8	104
Bottom Longline Monitoring Area			
Mid-Atlantic Shark Monitoring Area	18*	5.4	1*

*Unlike for the East Florida Coast Monitoring Area and DeSoto Canyon Monitoring Area, the Mid-Atlantic Shark Monitoring Area would only occur for seven months of the year (November-May); therefore, the average annual number of sets and annual effort cap are for only those seven months for the Mid-Atlantic Shark Monitoring Area.
** Similar to the above note, the Charleston Bump Monitoring Area would only occur for three months of the year (February-April); therefore, the average annual number of sets and annual effort cap are for only those three months for the Charleston Bump Monitoring Area.

Timing of triggered reduction or prohibition of fishing effort: Under this sub-alternative, when NOAA Fisheries determines that the effort cap in a monitoring area is reached or is projected to be reached, the Agency would file a closure with the Office of the Federal Register, prohibiting use of the relevant gear in the monitoring area for the remainder of the time period within that year. After such a closure, the East Florida Coast monitoring area would generally be closed until January 1 of the following year. For the Charleston Bump, normal pelagic longline fishing would be allowed starting May 1, then the Monitoring Area would become effective again on February 1. However, NOAA Fisheries may file for publication with the Office of the Federal Register a closure of a monitoring area before its effort cap is reached, and/or an action to not reopen an area, if warranted by conservation and management concerns raised by unexpectedly high bycatch, high data collection efforts, fishing effort that is overly clustered temporally or spatially, or other relevant considerations.

Reporting and monitoring: Specific reporting and monitoring requirements are required to support implementation of effort caps to provide information with which to monitor effort in the short and long term and support adaptive management. This sub-alternative would be implemented in conjunction with a requirement for vessel owners and/or operators to report both effort and catch on trips that include sets deployed in monitoring areas. First, vessel owners and/or operators that intend to fish in a monitoring area would need to declare that intention via vessel monitoring system (VMS) through pre-trip or in-trip hail-out. Second, vessel operators would need to report fishing effort (date and area of set and number of hooks) through VMS within 12 hours after the completion of each longline set. Third, in addition to the current bluefin tuna reporting requirements, vessel owners and/or operators would be required to report through VMS within 12 hours after completion of each longline set, the actual length of the following species that are retained and the approximate length of species that are discarded dead or alive: blue marlin, white marlin, roundscale spearfish, sailfish, leatherback sea turtles, loggerhead sea turtles, and shortfin mako sharks. Vessels would be allowed to fish inside and outside of a monitoring area on the same trip, but any fishing effort would be considered to have occurred from within the monitoring area.

Rationale: Effort controls are a useful fishery management tool to limit catch. Limitations on the level of fishing effort can have similar results as gear modifications or retention limits, but may be easier to monitor and enforce. Further, effort controls, when used as a proxy for retention limits or bycatch caps, may be implemented in circumstances where there is limited historical data on bycatch. The reliance of effort data may facilitate NOAA Fisheries oversight of monitoring areas due to the different methods and timing of reporting and data compilation associated with effort data (than catch data). Reporting requirements would support monitoring of both effort and bycatch along with modification of access or closure of the area to fishing if necessary. Effort controls support the diverse objectives of monitoring areas.

3.2.3.2 Sub-Alternative B3b: Bycatch caps

This sub-alternative would set limits on the catch of specific bycatch species of concern from within the monitoring area. All catch, regardless of disposition, would count toward the bycatch cap. Once the bycatch cap has been caught, it would trigger a subsequent management action such as reduction or elimination of fishing effort in the monitoring area. As explained further below, if multiple bycatch caps were set for a single monitoring area, the catch of several of the caps would trigger the reduction of fishing effort or prohibition of fishing in the monitoring area.

Five considerations are important when designing bycatch caps: 1) which species to include; 2) bycatch cap calculation; 3) selection of fishery-wide or vessel-specific caps; 4) time period of bycatch caps (e.g., monthly, quarterly, annual); 5) management responses to reaching a bycatch cap - timing of triggered reduction or elimination of fishing effort (e.g., immediate closures, future quarter or year closures); and 6) reporting and monitoring.

Species: Under this sub-alternative, the bycatch of seven species would be monitored in pelagic longline monitoring areas: leatherback sea turtles, loggerhead sea turtles, shortfin mako sharks, blue marlin, white marlin/roundscale spearfish, sailfish, and longbill spearfish. The bycatch of three species would be monitored in the bottom longline monitoring area: sandbar sharks, dusky sharks, and scalloped hammerhead sharks. These are the same species included in the HMS PRiSM models and their importance to each closed area is detailed in Chapter 2 (Section 2.3).

Bycatch cap calculation: The level of the bycatch cap specified for a monitoring area is based on the amount of catch of the species (using observer program data) in the larger geographic area and relevant time period in which the monitoring area is located. This larger geographic area is called the “reference area” (also used for the calculation of the effort cap above and in the context of the impacts analysis in Chapter 5). Bycatch in the monitoring area was determined using the ratio between the total number of individuals caught in the observer program and the number of observer program sets made from 2010 through 2019 in the reference area for the months of each monitoring area. We then multiplied this ratio by the monitoring annual effort cap calculated in Sub-Alternative B3a to derive the bycatch cap in the monitoring area. For example, of the 2,152 observer program sets that occurred in the Atlantic pelagic longline reference area, 51 leatherback sea turtles were caught as bycatch giving a ratio value of 0.024. Then multiplying 0.024 by 124 sets (the East Florida Coast monitoring area annual effort cap; Table 3.6), the monitoring area bycatch cap for leatherback sea turtles in the East Florida Coast monitoring area is 3. These calculations were conducted for each species to produce a bycatch cap. If the bycatch cap was less than 1, a cap of 1 was set. The bycatch cap for each species is listed in the tables below (Table 3.6, Table 3.7).

Table 3.6. Pelagic Longline Monitoring Area Bycatch Caps

Pelagic Longline Monitoring Areas			
Monitoring Area	**Species**	**Ratio of Observer Program catch to sets**	**Bycatch Cap (number of individuals)**
Charleston Bump Monitoring Area	Leatherback sea turtles	0.018**	1**
	Loggerhead sea turtles	0.035**	2**
	Shortfin mako sharks	0.197**	14**
	Blue marlin	0.262**	18**
	White marlin/roundscale spearfish	0.615**	42**
	Sailfish	0.092**	6**
	Longbill spearfish	0.004	1
East Florida Coast Monitoring Area	Leatherback sea turtles	0.024	3
	Loggerhead sea turtles	0.030	4
	Shortfin mako sharks	0.140	17
	Blue marlin	0.348	43
	White marlin/roundscale spearfish	0.500	62
	Sailfish	0.238	29
	Longbill spearfish	0.004	1
DeSoto Canyon Monitoring Area	Leatherback sea turtles	0.041	4
	Loggerhead sea turtles	0.005	1
	Shortfin mako sharks	0.128	13
	Blue marlin	0.203	21
	White marlin/roundscale spearfish	0.415	43
	Sailfish	0.204	21
	Longbill spearfish	0.002	1

** The Charleston Bump Monitoring Area would only occur for threes month of the year (February-April); therefore, the ratio of observer program catch to sets and annual bycatch cap are for only those three months for the Charleston Bump Monitoring Area.

Bottom longline monitoring area bycatch caps are calculated in the same way as pelagic longline caps with the exception of sandbar sharks. Although sandbar shark interactions were modeled in HMS PRiSM, the species is targeted in the shark research fishery and is quota limited. Thus, sandbar sharks are not included as a species with a bycatch cap.

Table 3.7. Bottom Longline Monitoring Area Bycatch Caps

Bottom Longline Monitoring Area			
Monitoring Area	**Species**	**Ratio of Observer Program catch to sets**	**Annual Bycatch Cap (number of individuals)**
Mid-Atlantic Shark Monitoring Area	Dusky sharks	10.86*	11*
	Scalloped hammerhead sharks	1.119*	1*
	Loggerhead sea turtle	0.119*	1*

* The Mid-Atlantic Shark Monitoring Area would only occur for seven months of the year (November-May); therefore, the ratio of observer program catch to sets and annual bycatch cap are for only those seven months for the Mid-Atlantic Shark Monitoring Area.

Fishery-wide bycatch or vessel specific caps: Under this sub-alternative, bycatch caps would apply to the entire pelagic or bottom longline fishery within the spatial management area and relevant time period. Given that interactions with bycatch species are relatively rare events compared with catch rates of target species, applying a bycatch cap to each vessel would likely result in bycatch caps that represent less than one individual for most of the bycatch species. Further, individual bycatch caps would increase the complexity of the monitoring area rules and increase the administrative burden for NOAA Fisheries. The increased complexity and administrative burden may not result in corresponding increases in protections for bycatch species. The allocation of bycatch among vessels is less important than total catch when limiting impacts on bycatch species.

Time period of bycatch caps: Under this sub-alternative, bycatch caps would be applied annually for DeSoto Canyon and East Florida Coast and for the relevant duration for the Charleston Bump and Mid-Atlantic Shark spatial management areas. Applying bycatch caps on a different timeframe (such as quarterly or monthly) would increase the complexity of the monitoring area rules and increase the administrative burden for NOAA Fisheries. The increased complexity and administrative burden may not result in corresponding increases in protections for bycatch species. Distribution of bycatch species changes throughout the year and application of a shorter time period would require consideration of these changes in fishing effort distribution.

Management responses to reaching bycatch cap: The timing of management responses to reaching a bycatch cap within a monitoring area is limited by the timing of data availability.

The timing of when data is available is dependent on the methods used to report and monitor bycatch species, as well as time required for quality control. Reporting of bycatch via VMS is essentially real-time, whereas logbook, EM, or observer data used to obtain information on catch may require a substantial amount of time before it is available. The management response to reaching a bycatch cap could happen both within the year for which the bycatch cap is set or based on at least one year of data, depending on the data used. Generally, the triggered management response would not occur based on catch of a single bycatch species, but would occur based on the catch of several species. This method provides a balance between protection of bycatch species and maintenance of access to the monitoring area for the purpose of data collection and operation of the commercial fishery. Based on the ratio of the catch of bycatch species (observer program data) to the number of longline sets (Table 3.5), the catch of the bycatch species are relatively rare events. Triggered management responses based on multiple bycatch species allows for fluctuations in bycatch levels and prevents the triggering of fishing restrictions based on a single species or an atypical bycatch event.

In most cases, reaching the bycatch cap for a single bycatch species during a single year would not result in any triggered response to curtail catch. If one species' bycatch cap is exceeded in a single year, it may represent a chance occurrence rather than a persistent bycatch problem. Instead, reaching the bycatch cap for any three species in one year or the same species in two consecutive years would lead to a closure of all gear-specific fishing in the monitoring area in subsequent years. A threshold of three species in one year was chosen because it would indicate that data collection activities are more broadly interacting with bycatch species than predicted by HMS PRiSM. For example, if the bycatch caps for shortfin mako shark, blue marlin, and loggerhead sea turtle in the East Florida Coast monitoring area were specified for the year 2026, the total catch for 2026 would be tabulated in 2027, and if it is determined that the 2026 bycatch caps were exceeded, there would be no pelagic longline fishing allowed in the monitoring area in 2028. If the tabulated results in 2027 indicated that the 2026 bycatch caps were significantly exceeded and if 2027 VMS reported data on those bycatch species indicate similar trends in 2027, then NOAA Fisheries may decide to close the monitoring area for the remainder of 2027. Closing the monitoring area would backstop conservation protection for the bycatch species and allow NOAA Fisheries to determine the cause of the cap overage and to consider next steps.

If three species' bycatch caps are exceeded in one year, it may indicate that geographic or temporal boundaries of the monitoring area are not optimizing protection of the bycatch species. However, if the same species' bycatch cap is exceeded two years in a row, it may indicate that the geographic or temporal boundaries of the monitoring area are not optimizing protection of the bycatch species.

While the Agency goal would be to take action only if multiple bycatch caps are exceeded, there may be rare instances where the level of bycatch on a single species is excessive and requires action to ensure conservation goals are met.

Reporting and Monitoring: Specific reporting and monitoring requirements are required to support implementation of bycatch caps to provide information with which to monitor bycatch in the short and long term and support adaptive management. This sub-alternative to implement bycatch caps would be implemented in conjunction with a requirement for vessel owners and/or operators to notify NOAA Fisheries through pre-trip or in-trip hail-out via VMS of their intent to fish in a monitoring area. Within 12 hours after the completion of each longline set, vessel owners and/or operators would also be required to report the following through VMS: fishing effort (date and area of set and number of hooks) and interactions with any of the species for which bycatch caps are set for the monitoring area. Vessels would be allowed to fish inside and outside of a monitoring area on the same trip, but any bycatch would be considered to have occurred from within the monitoring area..

Rationale: The primary goal of the current longline closed areas is to reduce bycatch of species or age-classes of concern. To ensure that fishing in a spatial management monitoring area minimizes catch of non-target species and/or age-classes, bycatch caps set specific limits on catch. Reporting requirements would support close monitoring of effort and bycatch, and closure of the area to fishing if necessary. The management responses take into consideration the fact that many bycatch caps may be small, there are a variety of data sources, and support the diverse objectives of the monitoring area.

3.2.3.3 Sub-Alternative B3c: Trip-level effort controls

This sub-alternative would limit the number of hooks per longline set and the number of sets per trip within monitoring areas. Under this sub-alternative, NOAA Fisheries would specify hook and set limits for vessels fishing in a monitoring area based on recent averages in the fishery. This alternative could be combined with other Monitoring Area sub-alternatives.

Four considerations discussed briefly below are important when designing trip-level effort caps: 1) effort cap calculation; 2) timing of triggered reduction or prohibition of fishing effort (e.g., immediate closures, future quarter or year closures); and 3) reporting and monitoring.

Effort cap calculation: The sub-alternative specifies the maximum number of hooks as the average number of hooks on pelagic longline sets targeting swordfish and bottom longline sets targeting sharks. From 2017 through 2019, the average number of hooks per pelagic longline set targeting swordfish was 748. Rounding to the nearest hundred hooks (for ease of implementation and enforcement) results in a hook limit of 700 per set. The average number of sets per pelagic longline trip (2017-2019) was 6.1. Rounding to the nearest whole number results in a limit of six sets per trip.

Similarly, from 2017 through 2019, the average number of hooks per bottom longline set targeting sharks was 247. Rounding to the nearest hundred hooks results in a hook limit of 200 per set. The average number of sets per bottom longline trip (2017-2019) was 1.6. Rounding to the nearest whole number results in a limit of 2 sets per trip.

Using average values as upper limits for the trip-level effort controls in each fishery is expected to prevent vessels from increasing their trip-level effort above normal practices (e.g., setting more hooks or conducting more sets than normal) while accessing the monitoring areas. Set and hook counts can be monitored by VMS.

Timing of triggered reduction or prohibition of fishing effort: Under this sub-alternative, a vessel would be prohibited from making additional sets on a trip after the maximum number of sets on that trip has been made.

Reporting and monitoring: Specific reporting and monitoring requirements are required to support implementation of trip-level effort caps to provide information with which to monitor bycatch in the short and long term and support adaptive management. This sub-alternative would be implemented in conjunction with a requirement for vessel owners and/or operators to notify NOAA Fisheries through pre-trip or in-trip hail out via VMS of their intent to fish in a monitoring area. Within 12 hours after the completion of each longline set, vessel owners and/or operators would also be required to report the following through VMS: fishing effort (date and area of set and number of hooks) and catch of the species for which bycatch caps are set for that monitoring area.

Rationale: An effort limit applied at the level of an individual fishing vessel is intended to further reduce the potential for excessive bycatch, by ensuring that individual vessels would not deploy a disproportionately large amount of effort in a monitoring area. If an overall effort limitation is in place, an individual fishing vessel may be incentivized to increase their fishing effort if/when they are concerned about the overall cap being attained. Trip-level effort caps support the diverse objectives of monitoring areas.

3.2.3.4 Sub-Alternative B3d: Observer Coverage

Under this sub-alternative, vessels fishing within the monitoring area would be required to carry an observer. If an observer was assigned to the vessel through the typical observer process, all or portions of the trip could occur in the monitoring area. If the vessel has not been assigned an observer and would like to fish in the monitoring area, vessel owners and/or operators would need to arrange for an observer. Vessel owners and/or operators could contact NOAA Fisheries or a NOAA Fisheries designee (e.g., contracting companies supporting the SEFSC) to see if an observer arrangement is feasible with sampling costs, to be paid for by the owners and/or operators. If not, then the vessel cannot fish in the monitoring area.

Rationale: Human observers can provide detailed information on catch and fishing practices, including bycatch information. In general, the accuracy of observer data is relatively high. An observer requirement supports the diverse objectives of monitoring areas.

3.2.3.5 Sub-Alternative B3e: Electronic Monitoring– Preferred Sub-Alternative for low-bycatch-risk areas in the Charleston Bump and East Florida Coast spatial management areas

This sub-alternative would require that longline vessels fishing for all, or a part of a trip in a monitoring area have 100 percent of the EM data reviewed for that trip, and paid for by the owner of the vessel. Currently, all pelagic longline vessels are required to utilize electronic monitoring (video cameras, etc.) to record haulback of all sets, however, only a subset of those recordings are reviewed for bluefin tuna and shortfin mako sharks, to provide verification of catch reports. Under this sub-alternative, video cameras and other EM system equipment would be required to meet existing installation and operational requirements. However, when sending video data in for review, the owner or operator of the fishing vessel must request that 100 percent of the video and data from the trip be reviewed and arrange for direct payment. The vessel owner would be responsible for these costs regardless of whether NOAA Fisheries selects Alternative F1 or F2 (Sections 3.6.1 and 3.6.2), which address the overall structure and funding of the EM Program.

Rationale: An electronic monitoring requirement for the review of all sets for trips into a monitoring area, paid for by the vessel owner would provide detailed information on bycatch. Further, NOAA Fisheries may be able to utilize other EM information on various metrics such as set soak time, number of sets, set location, etc. with which NOAA Fisheries could utilize to evaluate monitoring areas (at its own expense). This sub-alternative supports the diverse objectives of monitoring areas. NOAA Fisheries may also close the monitoring area before the effort cap is reached and/or not reopen areas, if warranted by conservation and management concerns raised by unexpectedly high bycatch, high data collection efforts, fishing effort that is overly clustered temporally or spatially, or other relevant considerations.

3.2.3.6 Sub-Alternative B3f: Data Sharing and Communication

Sub-Alternative B3f would require that all vessels operating in the monitoring area abide by a monitoring area bycatch fleet communication and relocation protocol. Vessels that intend to fish in the monitoring area would be required to send a text or email prior to trip departure to a third party indicating their vessel name and data of trip start. Subsequently, during the trip, vessels would text or email the third party if they encounter any of the bycatch species in Table 3.6 with information of the latitude and longitude of the bycatch and the date of interaction. The third party would compile this information, and communicate with all vessels currently fishing in the monitoring area in order to inform them of the location of the bycatch. The protocol would require vessels to report the location of bycatch interactions of the species listed in Table 3.6 over the radio to other vessels in the area and that subsequent fishing sets by that vessel on that fishing trip must be at least 1 nautical mile (nm) from where the encounter(s) took place. The protocol would encourage those vessels to move further than 1 nm away from the encounter site if conditions (e.g., water temperature, depth, tide, etc.) indicate that moving a greater distance is warranted to avoid additional bycatch interactions.

Rationale: Data sharing and communication requirements may reduce the risk of vessels interacting with bycatch species and would support the diverse objectives of monitoring areas. Involvement of a third party may enhance trust among fishery participants, and reduce administrative burden on NOAA Fisheries. Similar programs have been successfully implemented in the Atlantic scallop fishery to protect yellowtail flounder. The Mid-Atlantic Fishery Management Council's Yellowtail Bycatch Avoidance Program encourages scallop fishermen to communicate yellowtail flounder bycatch to other vessels in the fleet so those areas can be avoided. The program reduced yellowtail flounder bycatch by 57 percent in the first year (O'Keefe 2015), though is no longer operational.

3.2.4 Alternative B4: Cooperative Research via an EFP– Preferred Alternative for high- and low-bycatch-risk areas in the Charleston Bump and East Florida Coast spatial management areas and high-bycatch-risk area in the DeSoto Canyon spatial management area.

Under this alternative, data would be collected from within a spatial management area, which would otherwise be closed, through the issuance of an EFP (see 50 C.F.R. 635.32). This EFP would be issued to fishing vessels participating in specific research. The EFP would exempt participating vessels from certain regulatory requirements for specific research during a limited timeframe. The specific geographic areas for which an EFP would be applicable could be one of several areas defined in the "A" Alternatives. For example the area defined by one of the current closed areas (No Action sub-alternatives), one of the new areas defined by one of the sub-alternatives, or a combination of the two. In the example below and in the impacts analysis, the EFPs would apply to the "sub-alternative" areas depicted in red of the "A" Alternatives. These areas are the areas that are associated with a higher risk for bycatch interactions, based on HMS PRiSM data.

This alternative differs from the routine Atlantic HMS EFP process in two respects: 1) standard conditions would apply to all EFPs issued for research and data collection in a spatial management area; and 2) the process of applying for an EFP would be facilitated and streamlined because this DEIS analyzes the environmental impacts of EFPs for spatial management areas. More specifically, NOAA Fisheries would accept EFP applications to perform gear-specific research in a spatial management area to gather data that would be useful in assessing spatial management areas. This alternative only covers applications for spatial management area research submitted by academic, environmental NGO (eNGO), industry, recreational, or government scientific researchers and particular consideration would be given to collaborative research projects with participation by two or more industry, recreational, academic, eNGO, or government groups. Note that the current application and reporting forms would not change and applicants would use the same procedure for application submission. However, applicants would be informed that additional conditions would need to be incorporated into the research plan in order to be considered consistent with the Alternative B4 impact analyses. The additional conditions, detailed below, would ensure research activities do not jeopardize conservation goals or result in excessive gear conflicts with other user groups. As with the current EFP program, submission of an application would not guarantee approval. Instead, each application would be considered independently and in the context of Agency objectives and other research applications. This alternative does not preclude researchers from submitting applications with components that are not consistent with this analysis, however, this would be outside the scope of Alternative B4, thus, additional NEPA and other analyses may be needed to consider such applications.

To be considered consistent with the impact analysis for Alternative B4, an application for gear-specific research in closed areas should incorporate the following elements shown below. An underlying premise in the assignment of values for the effort caps and bycatch caps shown is that the relevant geographic area for which the caps apply is the spatial area identified through HMS PRiSM as a higher-bycatch-risk area (for interactions with bycatch species).

- *Effort Cap*: The research plan should include a limit on the number of sets that would be fished in the portion of the spatial management area determined to be high risk based on HMS PRiSM. The effort cap would limit the ecological impact of research activities on bycatch species and reduce the possibility of gear conflict with user groups. The cap on the number of longline sets would be calculated in a similar manner as the effort cap under Alternative B3a, except that the calculated limit is based on the portion of the spatial management area classified as higher risk, and that value is then reduced by 50 percent. This 50-percent reduction is to align with the overall precautionary nature of an EFP. Once the effort cap is reached, all research activities in the area must cease, regardless of under which project the effort occurred. The reduced level in allowed sets provides added precaution, and therefore EFP research may be particularly conducive to areas with higher ecological risk. The effort caps for EFPs are below in Table 3.8.

Table 3.8. Pelagic and Bottom Longline Closed Area Effort Caps

Area	**Average Annual Number of Sets in Reference Area 2011-2020**	**Size of the high-bycatch-risk area/size of reference area (%)**	**Effort Cap (50% reduction from calculated cap)**
Pelagic Longline Spatial Management Area Research			
Charleston Bump High-Bycatch-Risk Area	1,891	16.4	155
East Florida Coast High-Bycatch-Risk Area	1,891	18.2	172
DeSoto Canyon High-Bycatch-Risk Area	2,167	14.4	156
Bottom Longline Spatial Management Area Research			
Mid-Atlantic Shark High-Bycatch-Risk Area	18*	5.4	1*

*Under the "A" preferred alternatives (Section 3.1), the pelagic longline high-bycatch-risk areas would last for the entire year, while, the Mid-Atlantic Shark high-bycatch-risk area would only occur for seven month of the year (November-May); therefore, the average annual number of sets and annual effort cap are for only those seven months for the Mid-Atlantic Shark Monitoring Area.

Since effort in the shark bottom longline fishery is so low, the effort cap calculation resulted in a very low set cap number of one.

- *Bycatch Cap*: The research plan should include a limit on the number of bycatch for the species listed below. The bycatch caps in Table 3.9 and Table 3.10 represent the maximum annual bycatch across all research projects within each area. Once the annual limit of any one species is reached, all research activities in the area must cease, regardless of which project the bycatch occurred under. Researchers are encouraged to further limit bycatch beyond the maximums listed in the table and to include other species as may be relevant to research and management goals.

  Similar to bycatch caps in the monitoring area, the bycatch caps in the context of an EFP would take into account catch of the species in the reference areas using the observer program data. A ratio between the number of individuals caught and the number of observer program sets made from 2010 through 2019 inside the reference area was determined. We then multiplied the ratio by the closed area annual effort cap calculated above to identify the bycatch cap in the closed area. These calculations were conducted for each species and if the bycatch cap was less than 1, a cap of 1 was assumed. The bycatch cap for each species is listed in Table 3.9 and Table 3.10.

  The species in the bycatch cap list were chosen based on a range of criteria. First, the seven species modeled using HMS PRiSM were included. Other species were included if observer program data indicated that the species was sometimes caught in the relevant gear type or if there are indications that the species is in need of increased vigilance. One exception is bluefin tuna caught in pelagic longline gear since catch of the species is already limited and tracked through the IBQ Program.

  Marine mammals (e.g., pilot whale (*Globicephala macrorhynchus*), sperm whale (*Physeter microcephalus)*, bottlenose dolphin (*Tursiops truncates)*) were not included under the bycatch caps because they are currently protected under the MMPA and the Act's take reduction plans. If additional protections are required, take reduction plans have a mechanism to implement new measures

  The bycatch limit for each species was calculated using a precautionary approach. All bycatch limits were calculated using the process detailed above with the exception of Rice's whale (*Balaenoptera ricei,* formerly named Gulf of Mexico Bryde's whale). Due to conservation concerns of the species in the Gulf of Mexico, the bycatch cap for Rice's whale was set equal to one. Impacts to Rice's whale are detailed in Chapter 5.

  Bycatch caps for leatherback sea turtles range from four to six turtles per year, while loggerhead sea turtle bycatch caps range from one to five turtles per year. For context, the incidental take statement (ITS) levels for these species in the 2020

Pelagic Longline BiOp are 996 and 1,080, respectively (see Section 4.10.2 for more information).

Table 3.9. Pelagic Longline Spatial Management Area Bycatch Caps

Pelagic Longline Closed Area Research		
Area	**Species**	**Annual Bycatch Cap**
Charleston Bump	Leatherback sea turtles	4
	Loggerhead sea turtles	5
	Shortfin mako sharks	22
	Blue marlin	54
	White marlin/roundscale spearfish	77
	Sailfish	37
	Longbill spearfish	1
	Manta ray (*Manta birostris*)	9
	Oceanic whitetip sharks (*Carcharhinus longimanus*)	17
East Florida Coast	Leatherback sea turtles	4
	Loggerhead sea turtles	5
	Shortfin mako sharks	24
	Blue marlin	60
	White marlin/roundscale spearfish	86
	Sailfish	41
	Longbill spearfish	1
	Manta ray	10
	Oceanic whitetip sharks	19
DeSoto Canyon	Leatherback sea turtles	6
	Loggerhead sea turtles	1
	Shortfin mako sharks	20

	Blue marlin	32
	White marlin/roundscale spearfish	65
	Sailfish	32
	Longbill spearfish	1
	Manta ray	3
	Oceanic whitetip sharks	2
	Rice's whale	1

Bottom longline monitoring area bycatch caps are calculated in the same way with the exception of sandbar sharks. Although sandbar shark interactions were modeled in HMS PRiSM, the species is targeted in the shark research fishery and is quota limited. Thus, sandbar sharks are not included as a species with a bycatch cap.

Table 3.10. Bottom Longline Spatial Management Area Bycatch Caps

Bottom Longline Closed Area Research		
Area	**Species**	**Annual Bycatch Cap**
Mid-Atlantic Shark Area	Dusky sharks	5
	Scalloped hammerhead sharks	1
	Loggerhead turtles	1

- *Reporting*: The research plan should include a way to report and monitor effort and all catch, including bycatch and incidental catch, and submit that data to NOAA Fisheries or its designee. The reporting methods should support NOAA Fisheries' ability to monitor the fishing activity occurring under the EFP and, if necessary, end the EFP access to the area based on excessive effort or catch of bycatch species. Reports can be submitted by an observer, the on board researchers, or through electronic monitoring reporting functionality.

- *Observers and electronic monitoring*: Researchers should include a plan to monitor research activities through observers, researchers, and/or electronic monitoring. One hundred percent of the research sets should be observed through some combination of the aforementioned methods and must be entirely funded by the research project. For example, regularly assigned pelagic observers cannot be used to meet the 100-percent coverage goal unless prior coordination has occurred with the appropriate longline observer program at the SEFSC.

- *Applicability of Study Design*: The research plan should be designed to provide useful results for management on the affected fisheries. For example, researchers should consider using gear modifications that closely match or could be employed during normal fishing activities; plan for an adequate number of sets to provide statistically meaningful results; and temporally and geographically stratified sampling design.

- *Exclusion Areas*: The research plan should include consideration of areas where research would not occur due to possible high protected resource interactions or to limit gear conflict. For example, researchers may want to consider keeping activities greater than 40 nm offshore to reduce gear conflicts with recreational fishermen.

- *Fleet Communication*: Vessels participating in the research should develop and utilize a method to communicate when and where high bycatch occurs. Once a location and time of high bycatch is identified, a plan must be made for other vessels to avoid the area.

Rationale: EFPs are a mechanism used by NOAA Fisheries to allow highly controlled and monitored fishing activities that would otherwise be prohibited. EFPs are therefore useful for conducting research and collecting data in a very precautionary manner. Conducting research and data collection in spatial management areas under an EFP may be especially useful in areas of higher ecological concern, including those areas designated by HMS PRiSM as high-bycatch-risk areas. This alternative would facilitate the issuance of research and data collection in spatial management areas by standardizing components and streamlining the application process.

3.3 "C" Alternatives: Evaluation Timing of Spatial Management Areas

Introduction to the "C" Alternatives

The "C" Alternatives consider the timing of when to evaluate whether the spatial management areas are effective and meeting their respective management goals. If catch data from spatial management areas become available through data collection programs (as provided by the "B" Alternatives), NOAA Fisheries would be able to evaluate each area to assess whether management goals are being met. The timing alternatives are intended to be combined with the "A" and "B" Alternatives in order to meet the multiple objectives of this DEIS. New regulatory text would not needed to implement Alternatives C1 through C4.

3.3.1 Alternative C1: No Action

Under this alternative, NOAA Fisheries would not commit to a schedule to evaluate the spatial management modifications using data collected under the programs analyzed by this DEIS. Selection of this alternative would not preclude future evaluation, but the timing would not be set through this amendment.

Rationale: This alternative would not implement spatial management area evaluation timing expectations. Also, the CEQ regulations for NEPA require that a "No Action Alternative" be considered for each proposed action.

3.3.2 Alternative C2: Evaluate Once Three Years of Data are Available (or since most recent evaluation)

Under Alternative C2, NOAA Fisheries would evaluate the four spatial management areas once three years of catch and effort data is finalized and available. Subsequent reviews would occur after three full years of data are available after the conclusion of the previous evaluation. During the evaluation, available data such as catch data from inside and outside the spatial management areas would be analyzed. Additional information such as any updated model results may also be utilized to evaluate the spatial management area. The results from the evaluation would inform next steps such as consideration of potential spatial or temporal modification to the area. For example, if higher bycatch occurs during data collection than expected, additional protections or modifications to the high- and low-bycatch-risk areas could be considered. Changes or modifications to spatial management areas implemented in this action would be made, as appropriate, through rulemakings with an opportunity for public comment.

Rationale: Scheduling regular evaluations of spatial management areas would allow for more adaptive management and ensure that the objectives of the monitoring area are met on a continuing basis. Specifying a time for a future evaluation addresses the future status of a spatial management area and reduces uncertainty. An interval of three years between evaluations, which is relatively short, would address potential concerns that spatial management areas would be in place for long periods of time before the costs and benefits are evaluated.

3.3.3 Alternative C3: Evaluate Once Five Years of Data are Available (or since most recent evaluation)

Spatial management area evaluation under Alternative C3 would be the same as Alternative C2, except that the evaluation would occur after five years of data are available post-implementation of modifications and then subsequently in five-year intervals of data availability after the conclusion of the previous evaluation.

Rationale: Scheduling regular evaluations of spatial management areas would allow for more adaptive management and ensure that the objectives of the monitoring area are met on a continuing basis. Specifying a time for a future evaluation addresses the future status of a spatial management area and reduces uncertainty. An interval of five years between evaluations would increase the likelihood that a sufficient amount of time has passed after implementation (or the previous evaluation) to collect sufficient data with which to evaluate the costs and benefits of the spatial management area in a robust manner.

3.3.4 Alternative C4: Triggered Evaluation

Under Alternative C4, spatial management area evaluation would be the same as under Alternatives C2 and C3, with the exception of the timing component. Instead of, or in addition to, scheduled regular evaluation, NOAA Fisheries would monitor data collection activities and may review spatial management areas if specific concerns arise, which may include but are not limited to unexpectedly high or low bycatch, high or low data collection efforts, fishing effort that is overly clustered temporally or spatially, changed conditions within the fishery as a whole, or changed status of relevant stocks.

Rationale: Evaluations of spatial management areas would allow for more adaptive management and ensure that the objectives of the monitoring area are met on a continuing basis. A triggered evaluation provides an adaptive flexible approach to the timing of the evaluation that can respond to unforeseen circumstances.

3.3.5 Alternative C5: Sunset Provision

This alternative would set a default end date for a spatial management area and the area and associated restrictions would be removed unless NOAA Fisheries takes action to maintain or modify the area. The sunset date would be 10 years after implementation of relevant regulations. This alternative could apply to one or more of the preferred spatial management packages of measures.

Rationale: A sunset provision would ensure that the spatial management area and associated restrictions are not in place indefinitely. This approach would allow for flexibility with regard to future management of the area and reduce uncertainty regarding the duration of the spatial management area.

3.4 "D" Preferred Alternative Packages (D1, D2, D3, and D4)

In this section, NOAA Fisheries describes the preferred alternatives and sub-alternatives for each of the four spatial management areas in "D" preferred alternative packages. These Preferred Alternative Packages are designed to work together to achieve the objectives of the spatial management areas, in consideration of the unique aspects of each of the spatial management areas. Given the number of possible combinations of alternatives, to simplify the analyses, Chapter 5 provides impact analyses of each unique alternative and sub-alternative then summarizes impacts for the preferred combination of A, B, and C Alternatives. While this DEIS provides NOAA Fisheries' preferred combination for each of the four spatial management areas, based on public comment and additional analyses, the preferred combinations may change in the FEIS.

3.4.1 D1: Preferred Mid-Atlantic Spatial Management Area Package

The Preferred Mid-Atlantic Spatial Management Area package would modify the geographic boundary and timing of the current Mid-Atlantic shark closed area, where the use of bottom longline gear is prohibited, with the exception of data collection (Figure

3.23). This package would not modify the current data collection program that exists. Specifically, this package combines Sub-Alternative A1d, which would extend the eastern boundary of current Mid-Atlantic shark closed area to the 350-m shelf break, and shift the months from January 1 through July 31, to November 1 through May 31, with the No Action "B" (data collection) Alternative (B1). Current data collection programs in the area would continue and include fishery-independent surveys, and observer data collected from participants in the shark research fishery, who can use bottom longline in the area to target sharks (when operating under the research fishery). This preferred alternative package would require that the revised spatial management area is evaluated every 3 years (Alternative C2, or if necessary evaluated sooner, Alternative C4, Triggered evaluation) (Table 3.11).

Table 3.11. Mid-Atlantic Spatial Management Area - Preferred Alternative Package

Alternative	**Preferred Alternative**
"A" - Evaluation and Modification of Areas	Alternative A1d - Extend eastern boundary; Shift closed timing to November 1 – May 31
"B" - Commercial Data Collection	High-Bycatch-Risk Area: Alternative B1 - No Action
	Low-Bycatch-Risk Area: No low-bycatch-risk area defined
"C"- Evaluation Timing	Alternative C2 - Evaluate every 3 years
	Alternative C4 - Triggered evaluation

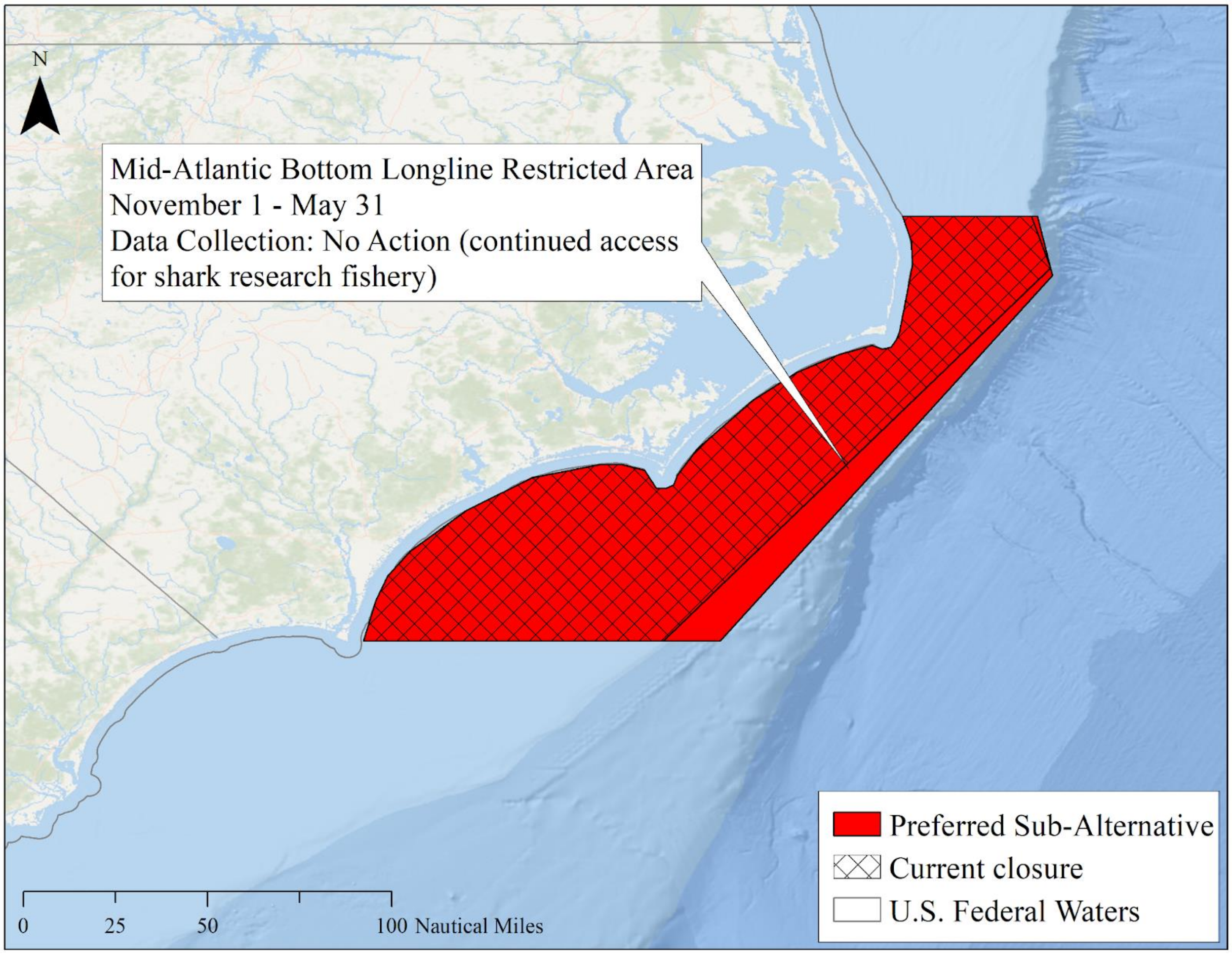

Figure 3.23. Preferred Mid-Atlantic Spatial Management Area Package

Rationale: Sub-Alternative A1d is intended to provide increased protections to bycatch species. Sub-Alternative A1d received a high overall metric score (see Chapter 2, "Methods"). Additional information on the rationale for that alternative is included with that sub-alternative. Extension of the eastern boundary of the closure to the 350-m shelf break is intended to provide greater protections for all 3 species (sandbar, dusky, and scalloped hammerhead sharks) with greater fishery interaction risk along the 350-m shelf break. The timing of the closure would be shifted to align with the time period that has the highest likelihood of fishery interactions.

The Mid-Atlantic shark area closure is unique compared to the other 3 spatial management areas considered in this action because it is specific to bottom longline gear and because some data are currently collected in the area through the shark research fishery. Thus, new data collection programs may not be necessary. Furthermore, due to the low level of shark bottom longline effort in the region, calculated effort and bycatch caps are very low and would not be appropriate for data collection programs that may rely on either, specifically monitoring area or spatial management EFP.

As such, NOAA Fisheries prefers Alternative B1, No Action, for data collection programs across the entire Mid-Atlantic spatial management area.

The preferred evaluation alternatives (C2 and C4) are intended to give NOAA Fisheries flexibility to evaluate the spatial management area as needed, and increase transparency by committing to a regular evaluation schedule.

3.4.2 D2: Preferred Charleston Bump Spatial Management Area Package

The Preferred Charleston Bump Spatial Management Area package would modify the geographic boundary and the duration of the current Charleston Bump closed area, (i.e., closed to the use of pelagic longline gear, with the exception of data collection) (Figure 3.24). This preferred alternative package would include two different data collection alternatives, and require evaluation of the area according to a set schedule (Table 3.12).

Specifically, this package prefers Sub-Alternative A2c, which would shift the current eastern boundary to the west. The redefined area would create a boundary that nearly bisects the current Charleston Bump closed area, with a line that runs from the northeastern corner of the current closure, southwest to a point near the Charleston bump bathymetric feature on the southern boundary. The area inshore of the boundary would be designated high-bycatch-risk area and offshore of that boundary would be designated low-bycatch-risk area. The inshore high-bycatch-risk area would be closed to pelagic longline fishing year-round, with the exception of data collection. In the high-bycatch-risk area, data collection would be conducted via issuance of EFPs (Alternative B4). The low-bycatch-risk area would be classified as a monitoring area (Alternative B3) from February 1 through April 30 each year, with effort caps (Sub-Alternative B3a) and electronic monitoring (Sub-Alternative B3e) as data collection; outside of those months, the area would be open to normal fishing operations. Alternative B4 (Cooperative research via EFP) is also preferred in the low-bycatch-risk area to facilitate additional data collection. The spatial management area would be evaluated every 3 years (Alternative C2), or if necessary evaluated sooner (Alternative C4, Triggered evaluation).

South Atlantic Pelagic Longline Restricted Area: For ease of communication, enforcement, and compliance, the preferred modification of the Charleston Bump closed area would combine the Charleston Bump high-bycatch-risk area with the high-bycatch-risk area of the preferred modification of the East Florida Coast closed area to create the "South Atlantic Pelagic Longline Restricted Area." The modified boundaries of the two areas match-up and both would be closed year-round, creating a spatially and temporally contiguous closed area. Combining the two areas into a single named area simplifies communication, enforcement, and compliance.

Table 3.12. Charleston Bump Spatial Management Area - Preferred Alternative Package

Alternative	Preferred Alternative
"A" - Evaluation and Modification of Areas	Alternative A2c -Shift eastern boundary to diagonal bisect; Inshore portion high-bycatch-risk area year-round; Offshore portion low-bycatch-risk area February 1 - April 30
"B" - Commercial Data Collection	High-Bycatch-Risk Area: Alternative B4 - Cooperative research via EFP
	Low-Bycatch-Risk Area: Alternative B3 - Monitoring Area; Sub-Alternative B3a (effort caps: 69 sets between February 1 and April 30) and Sub-Alternative B3e (electronic monitoring) **Note that the Charleston Bump Monitoring Area would be open to normal pelagic longline fishing May 1 - January 31.** And Alternative B4 - Cooperative research via EFP
"C"- Evaluation Timing	Alternative C2 - Evaluate every 3 years
	Alternative C4 - Triggered evaluation

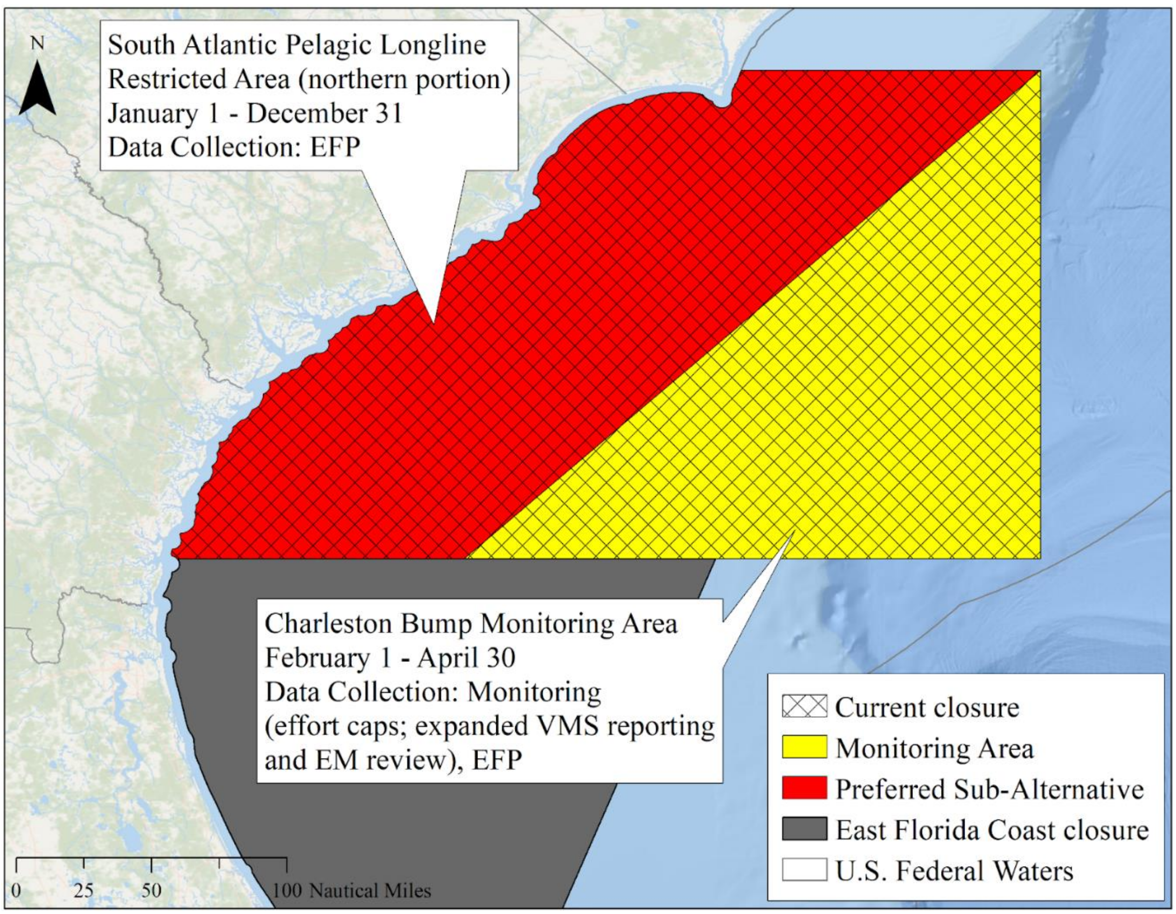

Figure 3.24. Preferred Charleston Bump Spatial Management Area Package

Rationale: As detailed in Section 3.1, this spatial and temporal modification is intended to provide increased conservation protection for the modeled bycatch species. Sub-Alternative A2c had a high metric score (see Chapter 2, "Methods"). Specifically, by reducing the spatial extent and extending the temporal extent of the near-shore portion of the spatial management area, the area would more optimally protect areas where greater fishery interaction risk is estimated to occur for leatherback sea turtles and shortfin mako sharks. Additional information on the rationale for Sub-Alternative A2c is included with that sub-alternative. Different types of data collection would be allowed in the defined areas, based on the risk of interactions with particular bycatch species. This nearshore portion, which includes approximately half of the 400-m shelf break, would be designated high-bycatch-risk area. The 400-m shelf break, including the Charleston Bump bathymetric feature in the southern portion of the spatial management area, is the site of increased fishing activity for commercial and recreational fisheries.

The preferred data collection programs would differ between the high and low-bycatch-risk areas to account for the risk of interactions of particular bycatch species. In the high-bycatch-risk area a research EFP with standardized conditions would provide more timely accounting for effort and bycatch and caps at levels designed to prevent adverse ecological impacts. The standardized EFP criteria include additional safeguards such as reporting, observer, and EM requirements.

In the low-bycatch-risk area, NOAA Fisheries prefers implementation of a monitoring area under Alternative B3 and would include the sub-alternative criteria of B3a (effort caps), B3e (electronic monitoring). Effort caps are more readily monitored inseason than bycatch caps while providing similar protections against excessive bycatch. Electronic monitoring would facilitate data collection. Alternative B4 (cooperative research via EFP) is also preferred in the low-bycatch-risk area to facilitate additional data collection.

The preferred evaluation alternatives (C2 and C4) for evaluation timing, are intended to give NOAA Fisheries flexibility to evaluate the spatial management areas as needed and increase transparency by committing to a regular evaluation schedule.

3.4.3 D3: Preferred East Florida Coast Spatial Management Area Package

The Preferred East Florida Coast Spatial Management Area package would modify the geographic boundary of the current East Florida Coast closed area, (i.e., closed to the use of pelagic longline gear, with the exception of data collection) (Figure 3.25). This preferred alternative package would include two different data collection alternatives, and require evaluation of the area according to a set schedule (Table 3.13).

Specifically, this package includes Sub-Alternative A3d, which would shift the current northeastern boundary to the west to 79° 32' 46" W. long. Sub-Alternative A3d received a high metric score (see Chapter 2, "Methods"). Additional information on the rationale for that alternative is included with that sub-alternative. The area inshore of the boundary would be designated high-bycatch-risk area and offshore of that boundary would be designated low-bycatch-risk area. The inshore high-bycatch-risk area would be closed to pelagic longline fishing year-round, with the exception of data collection. In the high risk bycatch area, data collection would be conducted via issuance of EFPs (Alternative B4), and the low-bycatch-risk area would be classified as a monitoring area year-round, with effort caps (Sub-Alternative B3a) and electronic monitoring (Sub-Alternative B3e). Alternative B4 (Cooperative research via EFP) is also preferred in the low-bycatch-risk area to facilitate additional data collection. The spatial management area would be evaluated every 3 years (Alternative C2) or, if necessary, evaluated sooner (Alternative C4, triggered evaluation).

South Atlantic Pelagic Longline Restricted Area: For ease of communication, enforcement, and compliance, the preferred modification of the East Florida Coast closed area would combine the East Florida Coast high-bycatch-risk area with the high-bycatch-risk area of the preferred modification of the Charleston Bump closed area to create the "South Atlantic Pelagic Longline Restricted Area." The modified boundaries of the two areas match-up and both would be closed year-round, creating a spatially and temporally contiguous closed area. Combining the two areas into a single named area simplifies communication, enforcement, and compliance.

Table 3.13. East Florida Coast Spatial Management Area - Preferred Alternative Package

Alternative	Preferred Alternative
"A" - Evaluation and Modification of Areas	Alternative A3d -Shift northeastern boundary to 79° 32' 46" W. long; Maintain year-round timing of high-bycatch-risk area)
"B" - Commercial Data Collection	High-Bycatch-Risk Area: Alternative B4 - Cooperative research via EFP
	Low-Bycatch-Risk Area: Alternative B3 - Monitoring Area; Sub-Alternative B3a (effort caps: 124 sets/year) and Sub-Alternative B3e (electronic monitoring) And Alternative B4 - Cooperative research via EFP
"C"- Evaluation Timing	Alternative C2 - Evaluate every 3 years
	Alternative C4 - Triggered evaluation

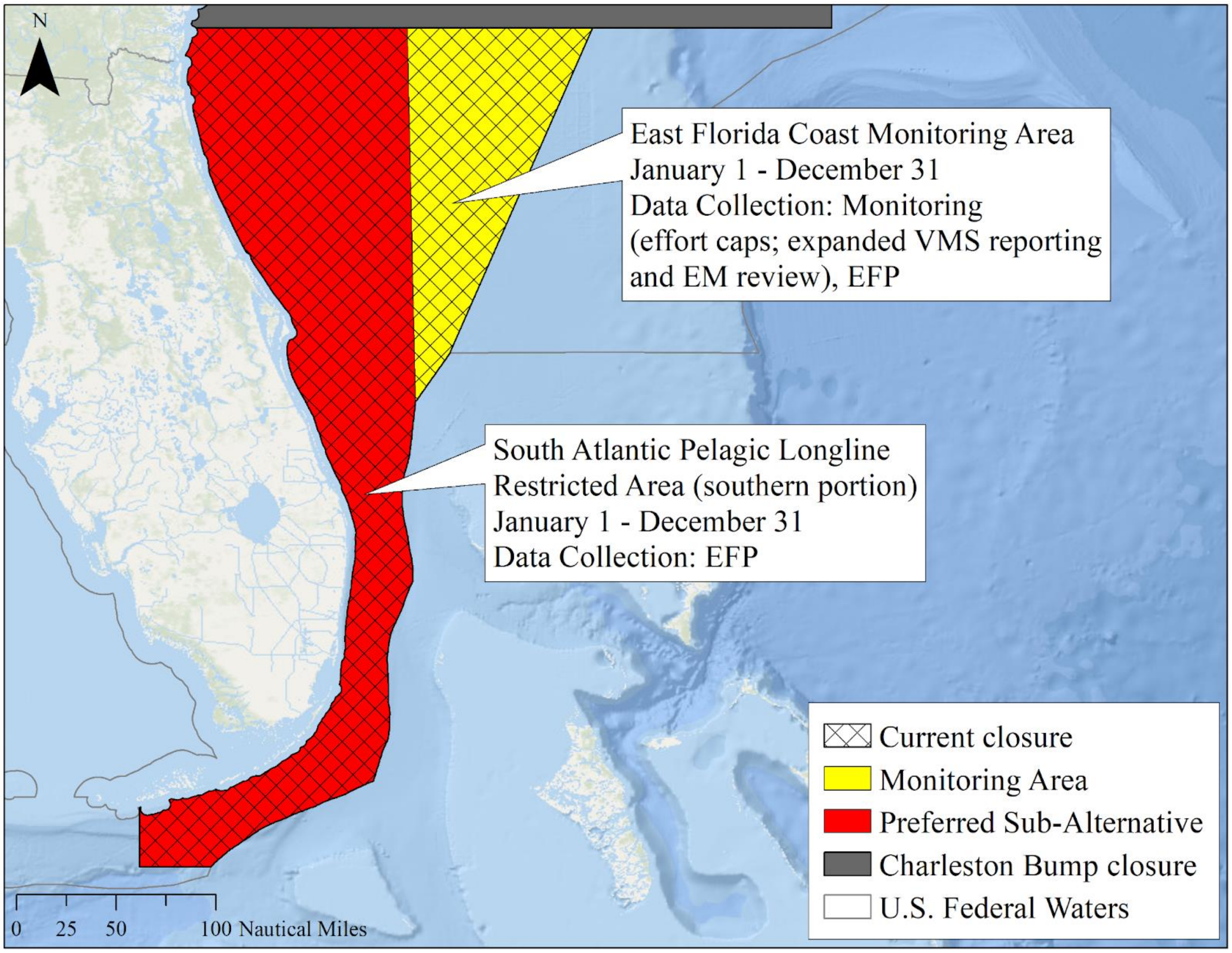

Figure 3.25. Preferred East Florida Coast Spatial Management Area Package

Rationale: Sub-Alternative A3d is intended to provide increased conservation protection for the modeled bycatch species. Specifically, by reducing the spatial extent of the closure, it would more optimally protect areas where greater fishery interaction risk is estimated to occur for leatherback sea turtle and shortfin mako sharks. Sub-Alternative A3d had a high metric score (see Chapter 2, "Methods"). Additionally, the modification would allow for increased data collection and commercial fishing access in the offshore eastern portion of East Florida Coast, while also excluding pelagic longline fishing, except for fishing under an EFP, in the nearshore portion for the entire year.

The preferred data collection programs would differ between the high- and low-bycatch-risk areas. In the high-bycatch-risk areas cooperative research via an EFP would provide a more precautionary approach and timely accounting and safeguards including reporting, observer, and EM requirements.

In the low-bycatch-risk areas, a monitoring area would include the sub-alternative criteria of B3a (effort caps), B3e (electronic monitoring). Effort caps are more readily monitored inseason than bycatch caps while providing similar protections against excessive bycatch.

The preferred evaluation alternatives (C2 and C4) for evaluation timing, are intended to give NOAA Fisheries flexibility to evaluate the spatial management areas as needed and increase transparency by committing to a regular evaluation schedule.

3.4.4 D4: Preferred DeSoto Canyon Spatial Management Area Package

The Preferred DeSoto Canyon Spatial Management Area package would modify the geographic boundary of the current DeSoto Canyon closed area, (i.e., closed to the use of pelagic longline gear, with the exception of data collection)(Figure 3.26). This preferred alternative package would include a method of data collection for the high-bycatch-risk area, and require evaluation of the area according to a set schedule (Table 3.14).

Specifically, this package includes Sub-Alternative A4d, which would redefine the spatial boundaries of the current closed area. Inside the boundaries, this package would maintain a year-round prohibition on the use of pelagic longline gear, with the exception of data collection via an EFP. Outside the boundaries of the parallelogram, the areas that are currently closed, would reopen to normal commercial pelagic longline fishing as usual.

Table 3.14. DeSoto Canyon Spatial Management Area - Preferred Alternative Package

Alternative	Preferred Alternative
"A" - Evaluation and Modification of Areas	Alternative A4d - Parallelogram; Year-round high-bycatch-risk area
"B" - Commercial Data Collection	High-Bycatch-Risk Area: Alternative B4 - Cooperative research via EFP
	Low-Bycatch-Risk Area: Alternative B1 – No Action. The area would open to normal commercial pelagic longline fishing.
"C"- Evaluation Timing	Alternative C2 - Evaluate every 3 years
	Alternative C4 - Triggered evaluation

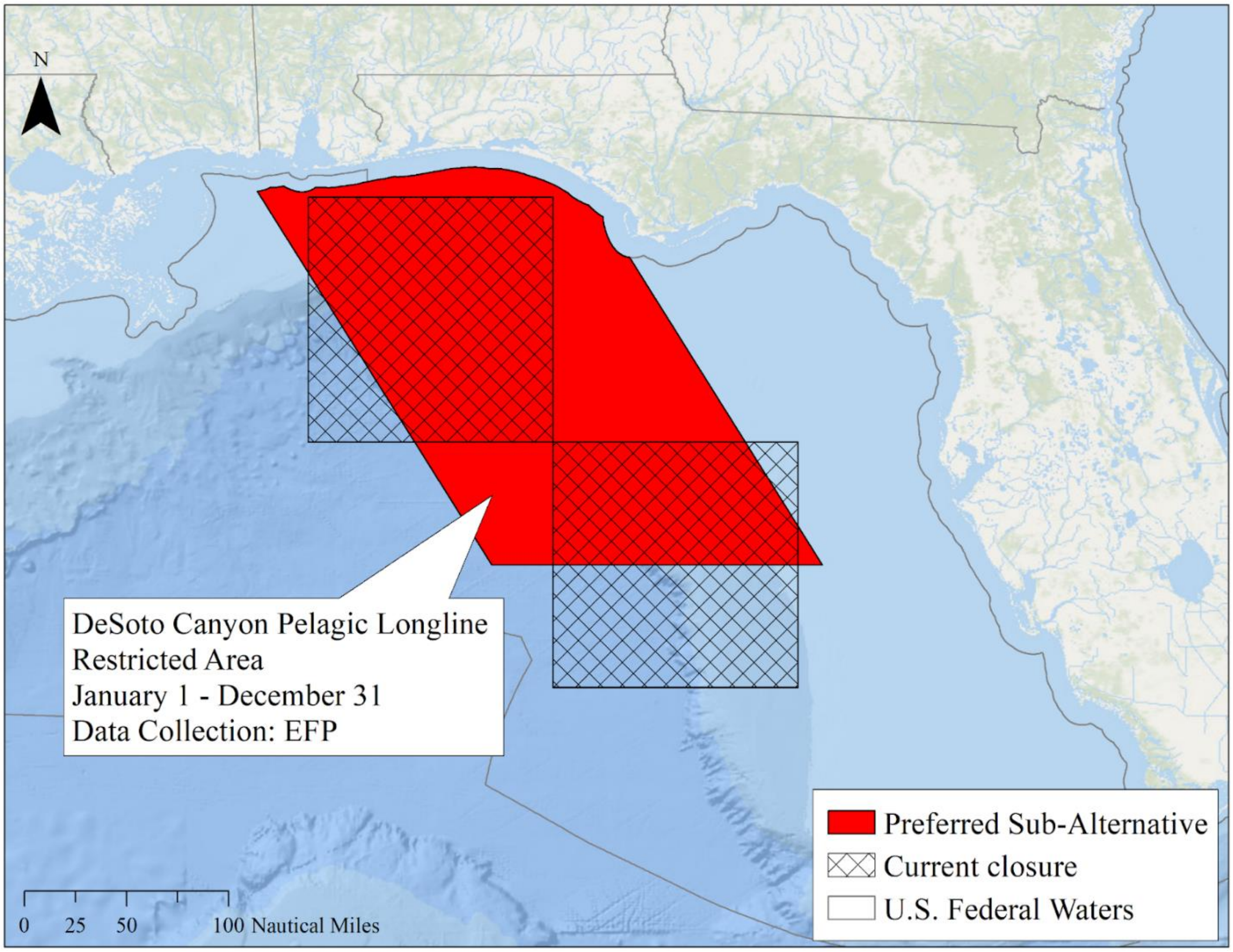

Figure 3.26. Preferred DeSoto Canyon Spatial Management Area Package

Rationale: Sub-Alternative A4d is intended to provide increased protections for bycatch species based on HMS PRiSM results. The high-bycatch-risk area would be defined as a parallelogram that covers most of the existing DeSoto Canyon closure but would extend outside of the current footprint in the medial area and would exclude the southern half of the southern box from the high-bycatch-risk area. Specifically, adjusting the shape of the closure would more optimally protect areas where greater fishery interaction risk is estimated to occur closer to the coast and along the shelf break.

Because the preferred spatial modification extends outside the boundaries of the existing closure, the preferred data collection program is only Alternative B4 (Cooperative research via an EFP), and does not include a monitoring area, in order to simplify data collection. Definition of a low-bycatch-risk area, with an associated monitoring program would be complex, because Sub-Alternative A4d would create three discontiguous low-bycatch-risk areas, two of which encompass small corners of the existing closure but that do not overlap with the canyon bathymetric feature. Furthermore, HMS PRiSM results indicate that the southern portion of the current DeSoto Canyon may not be as important for bycatch protections as the areas in the north. Thus, Alternative B1, No Action, is preferred in the low bycatch areas indicated as the colorless crosshatched areas in Figure 3.26. These areas would open to normal commercial pelagic longline fishing.

The preferred evaluation alternatives (C2 and C4) for evaluation timing, are intended to give NOAA Fisheries flexibility to evaluate the spatial management areas as needed and increase transparency by committing to a regular evaluation schedule.

3.5 "E" Alternatives: Spatial Management Area Regulatory Provisions

Existing regulations at 50 CFR part 635.34(d) contain considerations for framework adjustments to add, change, or modify time/area closures and gear restricted areas. However, there are no provisions for regular review of areas. The "E" Alternatives consider: no action (E1), and adding regulatory factors for review of spatial management areas (E2). The need to assess the effectiveness of spatial management measures is critical due to the static nature of the spatial management measures, the highly dynamic nature of HMS fisheries, and the highly dynamic nature of the ocean environment.

3.5.1 Alternative E1: Spatial Management Area Regulatory Provisions - No action.

This alternative would make no changes to the considerations for framework adjustments for time/area closures and/or gear restricted areas at § 635.34(d) shown below:

> *d) When considering a framework adjustment to add, change, or modify time/area closures and/or gear restricted areas, NMFS will consider, consistent with the FMP, the Magnuson-Stevens Act and other applicable law, but is not limited to the following criteria: Any Endangered Species Act related issues, concerns, or requirements, including applicable BiOps; bycatch rates of protected species, prohibited HMS, or non-target species both within the specified or potential closure area(s) and throughout the fishery; bycatch rates and post-release mortality rates of bycatch species associated with different gear types; new or updated landings, bycatch, and fishing effort data; evidence or research indicating that changes to fishing gear and/or fishing practices can significantly reduce bycatch; social and economic impacts; and the practicability of implementing new or modified closures compared to other bycatch reduction options. If the species is an ICCAT managed species, NMFS will also consider the overall effect of the U.S.'s catch on that species before implementing time/area closures, gear restricted areas, or access to closed areas.*

Rationale: This alternative maintains the current regulatory spatial management organization and high-level aspects of design and evaluation language. Also, the CEQ regulations for NEPA require that a "No Action Alternative" be considered for each proposed action.

3.5.2 Preferred Alternative E2: Add Regulatory Provisions for Review of Spatial Management Areas

Under this alternative, NMFS would add the below regulatory provisions to 50 CFR 635.35(c).

When reviewing a spatial management area, NMFS may consider, but is not limited to consideration of, the following relevant factors:

(i) Fishery metrics such as landings, discards, catch rates, and effort.

(ii) The usefulness of information from catches for biological sampling and monitoring status of target and non-target species.

(iii) Fishery social and economic data regarding fishing vessels and shoreside business, including revenue, costs, and profitability.

(iv) Effects of catch rates on target and non-target species in other regions or on fishing opportunities in other regions or fisheries.

(v) Fishing practices, including tactics, strategy, and gear.

(vi) Biological, ecological, and life history data and research on primary bycatch and target species.

(vii) Variations in seasonal distribution, abundance, or migration patterns of the relevant species.

(viii) Resilience to climate change impacts, including changes in species distribution, fishing effort location, and vulnerable fishing communities.

(ix) Oceanographic data and research including sea surface temperature, chlorophyll a concentrations and bathymetry.

(x) Variations in oceanographic features such as currents, fronts, and sea surface temperature.

(xi) Other design and technical considerations such as ecosystem modeling parameters (e.g., ocean currents, bottom topography), safety, enforceability (e.g., regular shapes), gear conflicts, timing of evaluation, access to the area for data collection, conservation and management objectives, environmental justice, state or other jurisdictional boundaries, efficiency in the size of area (given the highly variable and mobile nature of the HMS fisheries), and non-fishery activity (e.g., transportation, energy production).

(xii) Other considerations as may be applicable to the specific management goals of any particular spatial management area.

Rationale: As described above, for each spatial management area, NOAA Fisheries is evaluating a range of considerations in order to ensure that each spatial management area is meeting the intent for which they were created. The need to assess the effectiveness of spatial management measures is critical due to the static nature of the spatial management measures and the highly dynamic nature of both HMS fisheries and the ocean environment. To ensure that future and existing spatial management areas are designed with this evaluation process in mind, Amendment 15 would also update and modify the regulatory language to include the high-level design elements of specific objectives, timing of evaluation, data collection and access.

3.6 "F" Alternatives: Electronic Monitoring Program

The Electronic Monitoring (EM) Program is currently used in the pelagic longline fishery to monitor bluefin tuna interactions and disposition (i.e., alive or dead) under the Individual Bluefin Quota (IBQ) Program and to verify that shortfin mako sharks are released with a minimum of harm. This section considers modifications to the program in order to fulfill the following objective of this amendment: *Modify the HMS EM program as necessary to augment spatial management and address the requirements of relevant NOAA Fisheries policies regarding EM.*

On May 7, 2019, NOAA Fisheries issued Procedure 04-115-02 "*Cost Allocation in Electronic Monitoring Programs for Federally Managed Fisheries*." This cost allocation policy document (policy) outlines guidance and directives for EM cost allocation framework between fishery participants and the Agency. More detailed information about the policy is available in Chapter 9. The "F" Alternatives consider ways to bring the EM program into alignment with the 2019 cost allocation policy, and consider changes to the current HMS EM Program in light of the cost policy and knowledge gained about the HMS EM Program from 2015 through the present. Under the No Action (F1) and preferred (F2) alternatives, third-party vendors conduct EM system installation, maintenance, and repair, as well as data storage, video review, and analyses. However, while all the EM data collected currently is treated as a federal record (Alternative F1), under Alternative F2, NOAA Fisheries would not have direct access to all of the raw video, imagery and related metadata, and would only have access to what the vendors transmit to the agency.

Cost Responsibilities

The policy identifies two broad categories of costs: sampling and administrative costs. For all EM programs, NOAA Fisheries would be responsible for the administrative costs, including the costs of setting standards for such programs, monitoring program performance, and providing administrative support to address science, enforcement, and management needs. The policy requires the fishing industry to be responsible for sampling costs (as defined in the 2019 NOAA EM Cost Allocation Policy), and considers EM equipment, data storage, data review, and all associated costs to be sampling costs. Table 3.15 and Table 3.16 provide a detailed breakdown of these sampling and administrative cost categories, respectively.

The current HMS EM Program was implemented in 2015 in support of the IBQ Program, which is a limited access privilege program (LAPP). LAPPs are required to have a cost recovery program (see section 303A of the Magnuson-Stevens Act), and HMS regulations provide for such a program to cover incremental costs of management, data collection and analysis, and enforcement activities directly related to and in support of the IBQ Program (see 50 C.F.R. 635.15(m)). NOAA Fisheries' EM administrative costs, described below, would be included in its estimation of recoverable costs (see Amendment 13 FEIS, p. 60 and Section 9.6 of this document). However, NOAA Fisheries will not assess fees, if the amount of fees that may be recovered is similar to or less than the estimated cost of implementing the cost recovery program. *See* 50 C.F.R. 635.15(m) (describing annual process for estimating costs and ex-vessel value of IBQ species (bluefin tuna) and determining fees).

Table 3.15. Electronic Monitoring Sampling Cost Categories* - paid for by the industry

Equipment purchases, leases and installation- including, but not limited to, the cameras, hard drives, video screens, software, and other materials needed to outfit the vessel to comply with the requirements of the EM program(s)
Equipment maintenance and upkeep, including, but not limited to, regular software and system upgrades, ensuring that cameras are clean and free of debris, replacing cameras, monitors, and other equipment as needed, and periodically checking the system to ensure operation
Training for captain and crew (as appropriate) to use, troubleshoot, and maintain EM equipment and systems while at sea
Development and implementation of vessel monitoring plans (VMPs) (in coordination with NOAA Fisheries or a NOAA Fisheries-approved contractor), including identification of camera placement, catch handling protocols, and other requirements to facilitate third party video review
Data transmittal, i.e., transmitting data collected through the EM system, including raw video, imagery, and associated metadata, to the appropriate review entity (or entities), whether by physical transfer of hard drives or sending data electronically, and tracking and oversight of data transmittal and storage
Video processing and storage, including initial review, processing, and storage of data from EM video, imagery, and associated metadata. Processing may include both manual and automated methods to summarize the collected data.
Service provider fees and overhead, including any fees or overhead the service provider charges as part of its EM system service contract with industry

*Based on NMFS Procedure 04-115-02, May 7, 2019

Table 3.16. Electronic Monitoring Administrative Cost Categories* - paid for by NOAA Fisheries

Program administration support to address science, enforcement, and management needs, including staff time and equipment to develop and implement regulations, review VMPs, troubleshoot system issues that arise; facilitate communication between industry participants and EM service providers, as needed
Certification of EM service providers, including staff time to review EM provider contracts and data from EM video and imagery to ensure data quality standards are met
EM program sample design and performance monitoring, including costs to develop the required data elements to meet specific management objectives (e.g., bluefin tuna and the IBQ Program, shortfin mako shark monitoring, spatial management, or other), audit service provider reviewers, review video to determine optimal sampling rates, manage vessel selection processes, as needed, and analyze data to ensure quality and effective program performance
Data analysis and storage of Federal records, including analysis of data that are transmitted to NOAA Fisheries and storage of that data consistent with federal record retention requirements

*Based on NMFS Procedure 04-115-02, May 7, 2019

3.6.1 Alternative F1- No Action

Under the No Action Alternative, NOAA Fisheries would continue to fund the EM Program (both administrative and sampling costs) and utilize contracts with one or more vendors to conduct EM system installation, maintenance, and repair, as well as data storage, video review, and analyses. The regulations under § 635.9 specify various roles for the EM Program, including NOAA Fisheries, NOAA Fisheries-approved contractors, and vessel owners, and specific requirements for vessel operators. The No Action alternative applies only to the current sampling design and regulatory requirements, resulting from the requirements associated with the IBQ Program and to verify that shortfin mako sharks are released with a minimum of harm (see § 635.21(c)(1)(iv)).

Rationale: Alternative F1 would not implement any changes to the HMS pelagic longline EM cost allocation. Also, the CEQ regulations for NEPA require that a "No Action Alternative" be considered for each proposed action.

3.6.2 Alternative F2 - Transfer Electronic Monitoring Sampling Costs to Industry (Phased-In) - Preferred Alternative

This alternative would transfer 100 percent of EM sampling costs to the industry, over a three-year period (phased-in) and would include components designed to create a standardized EM program that may be implemented by NOAA certified vendors. In conjunction with the phase-in of sampling costs, this alternative would include four distinct components: 1) vendor requirements; 2) vessel requirements; 3) vessel monitoring plan requirements; and 4) modification of current IBQ Program's EM spatial/temporal requirements to require EM within EM Data Review Areas in order to operationalize the sampling plan design.

NOAA Fisheries notes that many requirements of the current EM regulations would not be substantively changed under Alternative F2. Requirements for vessel monitoring plans are in current 50 C.F.R. § 635.9(e) and for EM system components in § 635.9(c). Vessel owner and operator requirements are currently set forth § 635.9(b)(2) and (e). Data maintenance, storage and viewing text is in § 635.9(d)).

3.6.2.1 Phase-In of Sampling Costs

Under Alternative F2, the owner of vessel fishing with pelagic longline gear would be required to pay for all sampling costs (Table 3.15) associated with the EM Program requirements, in order to align with the cost allocation policy. To allow the fishery time to adapt to this change, the shift in cost would be phased in over three years with the proportion of sampling costs that the industry is responsible for increasing each year. The policy includes a provision that, in programs in which industry is responsible for certain costs where NOAA Fisheries has historically been paying those costs, the costs should transition to industry over time. As such, under this alternative, in the first year after implementation, vessel owners would be responsible for 25 percent of the sampling costs and NOAA Fisheries would fund the remaining 75 percent of the sampling costs (and 100 percent of the administrative costs). In year 2, vessel owners would be responsible for 50 percent of the sampling costs. In year 3, vessel owners would be responsible for 75 percent of the sampling costs. Finally, in year 4, vessel owners would be responsible for 100 percent of the sampling costs. Table 3.17 summarizes the phased-in approach.

Table 3.17. Three-Year Phase-In of Industry Responsibility for EM Sampling Costs

Year of Implementation	Industry Responsibility	Agency Responsibility
Year 1	25%	75%
Year 2	50%	50%
Year 3	75%	25%
Year 4	100%	0%

3.6.2.2 Vendor Requirements

The vendor requirements component of Alternative F2 is intended to create a standardized EM program in which sampling costs are the responsibility of the vessel owners. Based on requirements established under Amendment 15 and its implementing regulations, NOAA Fisheries would certify EM service vendors. Vessel owners would then make arrangements directly with a certified vendor(s) to provide the services needed to comply with the relevant regulations. NOAA Fisheries may certify more than one vendor to provide EM services to vessels.

Vendor Certification

NOAA Fisheries would solicit vendors to perform the tasks included in Table 3.15 (e.g., install and maintain EM equipment; review EM video data, etc.), consistent with the vendor technical performance standards (Table 3.18). To be considered for approval, vendors would need to submit the information requested by NOAA Fisheries. This information could include the following: 1) verification that that they are capable of performing the variety of sampling tasks listed in Table 3.18, or other similar tasks noted in the vendor solicitation; 2) information on the organization's ownership and management structure; and 3) demonstrated technical ability and capacity to meet the vendor performance standards detailed below.

NOAA Fisheries would approve vendors and publish a list of approved vendors in the Federal Register and make the list available to vessel owners. This approval process would occur as needed based on various factors such as the number of certified vendors, the fishing industry demand for certified vendors, evaluation of the EM program(s), regulatory changes, input from the HMS Advisory Panel or members or the fishing industry, or events such as a certification request from a vendor or NOAA Fisheries' determination to decertify a vendor. NOAA Fisheries may remove vendors from its list of approved vendors if they fail to meet EM vendor responsibilities and duties or have a conflict of interest.

Vendor Technical Performance Standards

To receive NOAA Fisheries certification, a prospective vendor must have demonstrated technical ability and capacity to perform the functions in Table 3.18, or similar tasks associated with HMS program requirements as specified in the regulations or vendor solicitation, and support the vessel owners in performing the tasks included in Table 3.15 - Electronic Monitoring Sampling Cost Categories. The vendor must be able to perform the various required functions that enable vessel operators to adhere to the regulations in effect, and at a level that supports the sampling protocols of the regulations, or NOAA Fisheries, and enables NOAA Fisheries oversight. NOAA Fisheries would communicate the programmatic details indicated below as part of its solicitation of vendors, and does not anticipate substantive modifications of the programmatic details during a particular fishing year (calendar year). The programmatic details result from the regulations in effect, the sample design, and NOAA Fisheries' oversight role.

Table 3.18 Vendor Technical Performance Standards

Technical ability and capacity
Vendor must install and maintain EM equipment; receive and access video data; store video and metadata for length of time required under performance standards; and identify species in performance standard list.
Video Review
At the end of each quarter, vendors must review 10% of the sets submitted (randomly selected) and at least one set from each vessel; and 100% of sets submitted from vessels that fished in Monitoring Areas (described in “D” packages above Review under this requirement is separate from any enhanced review requirements considered in the “B” Alternatives for data collection in spatial management areas. Vendor must review sets in time to meet the deadline for quarterly report requirements detailed below. Sets are not selected for review based on a SEFSC sampling plan as is currently done, but selected randomly from EM Data Review Areas (see Modification of EM Spatial/Temporal Requirements).
Video must be reviewed by competent staff trained in species identification and data processing and handling procedures. The EM vendor is responsible for training, and maintaining the skills of, staff who carry out EM field and data services.
Must agree to additional video review at the request of NOAA Fisheries to verify catch reports, and agree to provide information that NMFS needs for other conservation and management purposes, including regulatory enforcement.
Work with vessel owners
Must assist with the development of a VMP for each vessel, as detailed in the VMP section.
Data integrity and storage
Must store and archive video and metadata for 2 years after the date received.
Communication with NOAA Fisheries
Must submit reports to NOAA Fisheries within 3 months of the end of each quarter that must include the following information: • List of vessels, trips, and sets submitted for review. • List of vessels that did not submit any trips or sets for review • Location, date, and time of all sets submitted for review. • Identification of sets reviewed. • Species caught and amounts (retained and discarded) from sets reviewed and disposition (dead or alive) of catch that is discarded. Sets outside Monitoring Areas (described in “D” packages above) must include bluefin tuna and shortfin mako sharks. Sets from Monitoring Areas must include all species. • Information of technical difficulties including poor video, no video, unreviewable video, misaligned camera angles and any other issues that prevent effective video review of catch.

• Information on how technical difficulties were addressed on the vessel and during the video review process. • Metadata from all submitted trips and sets must accompany quarterly reports.
Must promptly notify NOAA Fisheries of any other issues (e.g., inability to obtain hard drives from a vessel) that may prevent proper functioning of the EM program.

While this alternative does not include a formal vendor audit program, the alternative does include components that provide NOAA Fisheries with the ability to double check video review reports or to confirm vessel operator reports (e.g., certified vendors must agree to additional video review at the request of NOAA Fisheries to verify catch reports, provide information for enforcement, or for other management purposes). These components should provide NOAA Fisheries with a way to monitor vendor's compliance with the performance standards and to double check the accuracy of video review catch reports and species identification without the expense or administrative burden that a more formal process might entail. Vendors that do not comply with the requirements of the certification or who cause fishing vessels to be non-compliant with the regulations could be subject to enforcement action in addition to decertification.

3.6.2.3 Vessel Owner and/or Operator Requirements

The vessel owner and/or operator subject to the relevant EM regulations would need to comply with the requirements outlined in Table 3.19, or as applicable under the "B" Alternatives for data collection in spatial management areas, and implement and comply with the approved VMP. Non-compliance with these requirements could result in enforcement action against the vessel owner or, if appropriate, such as in the case of vendor-identified non-compliance, against the vendor.

Table 3.19 Vessel Requirements

Cost responsibility and equipment
Vessel owners would be responsible for obtaining required EM services and for EM sampling costs. It would be up to the vessel owner and approved EM vendor to agree upon a cost structure, e.g., flat cost per set submitted, an invoice for only those sets reviewed, or an annual subscription.
Equipment currently installed on pelagic longline vessels would remain the property of NOAA Fisheries, however, vessel owners and/or operators could continue to use currently-installed equipment until no longer operable. Any replacement or repair of equipment or system components would be the responsibility of the vessel owner. Equipment or components that are no longer operational or useful must be surrendered to NOAA Fisheries.
Operational requirements
Before embarking on a trip, vessel owners and/or operators must: • Have onboard and available for inspection an approved VMP (would is only valid when there is an existing, signed contract between vessel owner and vendor for EM services).

• Have implemented all of the requirements of the VMP by the dates noted in the VMP.
Before deploying pelagic longline sets in Monitoring Areas (described in "D" packages above) or EM Data Review Areas (see Section 3.6.2.4), a vessel owner and/or operator must declare such intent through pre-trip or in-trip hail out using VMS.
Vessels may not embark on a trip outside of an EM Data Review if the EM system is not functioning properly, as determined by captain inspection, pre-trip system test, notification from vendor about poor or missing video, or other indications.
Vessels must abide by the relevant EM requirements triggered by the gear or location. Requirements in current 50 C.F.R. 635.9 on EM system components, activating EM, ensuring proper continuous functioning of the EM system, and handling of fish remain the same
Reporting
Vessel owners and/or operators of a vessel fishing with pelagic longline gear within Monitoring Areas must report through VMS within 12 hours of the completion of each pelagic longline set: date and area of the set, number of hooks, actual length of the following species that are retained and approximate length of species that are discarded dead or alive: bluefin tuna, blue marlin, white marlin, roundscale spearfish, sailfish, leatherback sea turtles, loggerhead sea turtles, and shortfin mako sharks.
Vessels must also comply with other applicable notification, catch, and effort reporting requirements that may apply when fishing in Monitoring Areas.

3.6.2.4 Vessel Monitoring Plan

Existing 50 C.F.R. 635.9(e) sets forth required content for VMPs. Under preferred Alternative F2, approved EM vendors would be required to develop VMPs with vessel owners with whom they had contracts. NOAA Fisheries or a NOAA Fisheries-designated entity would approve VMPs that meet the management requirements of the EM program. A VMP would only be valid when there is an existing, signed contract between the vendor and vessel owner. Before embarking on a trip, the vessel operator must have an approved VMP onboard. If the vessel owner switches vendors, the VMP must be updated and a new one approved before the vessel can embark on a trip. Once the VMP is approved, the vessel owner would have a set amount of time to install any new, required equipment as specified in the VMP.. Following is a partial list of currently required information:

- information on the locations of EM system components (including any customized camera mounting structure).
- contact information for technical support.
- instructions on how to conduct a pre-trip system test; instructions on how to verify proper system functions.
- location(s) on deck where fish retrieval should occur to remain in view of the cameras.
- specifications and other relevant information regarding the dimensions and grid line intervals for the standardized reference grid.

- procedures for how to manage EM system data submission.
- catch handling procedures.
- periodic checks of the monitor during the retrieval of gear to verify proper functioning.
- reporting procedures.

3.6.2.4 Modification of EM IBQ Spatial/Temporal Requirements

NOAA Fisheries currently uses an internal process for selecting pelagic longline sets for video review (Alternative F1 (No Action)). While this approach works when NOAA Fisheries has direct contracts with EM vendors, it would not work under Alternative F2, where various EM vendors would have arrangements with different vessel owners. Below is a description of the current process and how NOAA Fisheries proposes to operationalize it under Alternative F2 through use of EM Data Review Areas.

The current EM regulations require vessels fishing with pelagic longline gear onboard to have an operational EM system powered on during the full duration of all trips, to record video of all haul-backs, and to send in the hard drive (with the recorded video and metadata) to a NOAA-contracted vendor. At the end of each sampling time period, the SEFSC selects sets for video review under a stratified sampling plan. The first step in selecting sets for review is to filter sets that occurred in a time and area where bluefin tuna interactions are likely. Sets that occur in areas of unlikely bluefin tuna interactions are not considered when selecting sets for review under the stratified sampling plan. From the narrowed list of sets that occurred in areas and times of likely bluefin tuna catch, the SEFSC selects sets for review and notifies the NOAA-contracted vendor to review the associated videos. The stratified sampling plan cannot be carried out until after all the pelagic longline sets have been deployed and reported. Under Alternative F2, this process would not be operationally feasible given that vessel owners would directly contract with EM vendors and there may be several approved vendors providing services. Neither the vendor nor the vessel owner would know which sets would ultimately require video review, thus, would be unable to negotiate a price for video review at the time of video submission. Furthermore, video review may be unequally distributed among the multiple vendors, with some vendors receiving more video review requests than expected and some less. This unpredictability could result in higher prices to cover the possibility of higher video costs or could disincentivize vendors from entering the HMS EM pelagic longline market. Modification of the EM spatial and temporal requirements could address these problems by limiting video submission to times and areas of likely bluefin tuna catch, allowing vendors to simply review 10 percent of the submitted sets. This would reduce uncertainty for the vendor and simplify the process for selecting sets for video review. Modification of the EM spatial and temporal requirements are designed around the current SEFSC sampling program, would reduce complexity in the selection of pelagic longline sets for review, and should reduce the costs associated with the EM requirements and with the IBQ Program, while maintaining the effectiveness of the EM Program. The objectives of the EM Program in support of the IBQ Program would remain the same (i.e., to verify the accuracy of counts and identification of bluefin tuna reported by the vessel operator). NOAA Fisheries also considered ease of communication, compliance, and enforcement when developing the EM Data Review Areas, and does not believe that the areas pose concerns in these regards.

Under the current sampling plan, sets that occur in areas and times of unlikely bluefin tuna catch are generally not included for review while sets that occur in areas and times of likely bluefin tuna catch are considered for review. Using this approach in coordination with the results from HMS PRiSM (see Section 2.1 and Appendix 3), NOAA Fisheries has identified areas where EM data would be most useful to meet bluefin tuna catch reporting compliance goals. NOAA Fisheries has designated these spatial/temporal areas as "EM Data Review Areas" (Figure 3.27). Under this alternative, vessels operators would be required to activate EM and submit video only when operating in locations and times of EM Data Review Areas during all or a portion of a trip. Trips that engage in fishing in multiple areas must abide by the more restrictive requirement (e.g., if any fishing occurs in an area that requires EM, the entire trip must use EM and all videos must be submitted even when fishing in areas that do not require EM). Before deploying sets in an EM Data Review Area, vessel operators would be required to indicate their intention to do so during the pre-trip or in-trip VMS hail-out. Vessels that operate exclusively outside of these EM Data Review Areas would not be required to use EM. Modification of times and areas of EM requirements under this alternative mirrors the process currently used by the SEFSC for selecting sets for review by ensuring that video is submitted only from sets eligible for review. When designing the spatial extent and timing of these areas, NOAA Fisheries considered ease of communication, compliance, and enforcement, while ensuring that bluefin tuna catch reporting compliance goals continue to be met. This sampling strategy would reduce the overall amount of video and metadata that is recorded, and therefore reduce costs to the vessel owners, and may incentivize avoidance of areas where vessels are more likely to interact with bluefin tuna.

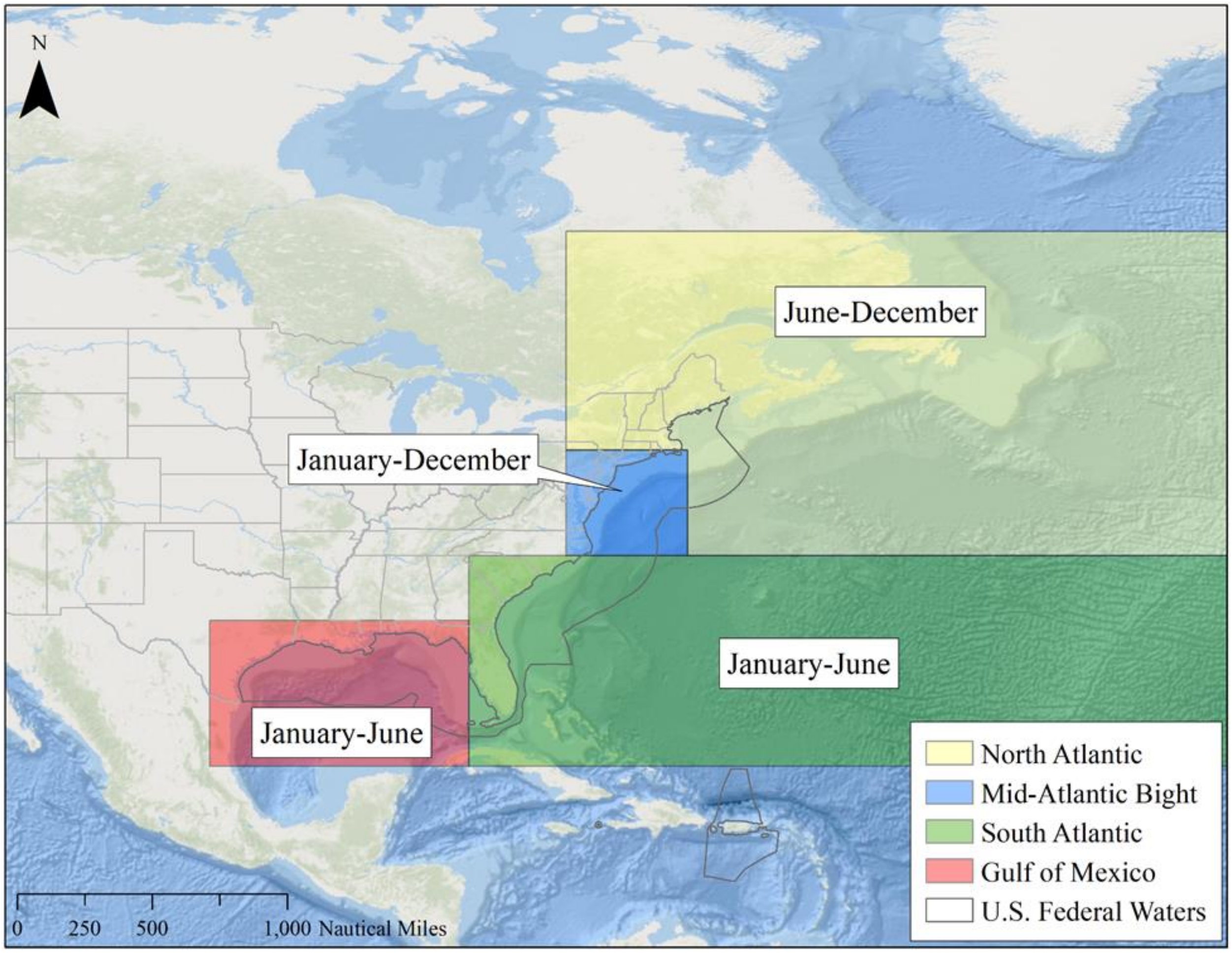

Figure 3.27. EM Data Review Areas

To ensure continued effectiveness of the EM Program, NOAA Fisheries would regularly review the sampling approach and, as needed, modify it through a regulatory action based on a similar methodology and data as used in this amendment. Among other things, NOAA Fisheries would take into consideration changes in fishing techniques or effort, the ocean environment, and management goals such as the need to monitor other species (e.g., shortfin mako). At this time, the sampling program is designed for bluefin tuna data collection and review. Because the retention limit is zero for shortfin mako sharks and no vessel may retain any shortfin mako shark regardless of disposition (87 FR 39373; July 1, 2022), NOAA Fisheries is not using EM to verify that only dead shortfin mako sharks are retained. Instead, NOAA Fisheries is using EM to verify shortfin mako are released with a minimum of harm. If retention of shortfin mako sharks is allowed in the future, NOAA Fisheries would again use EM to monitor shortfin mako shark disposition and may need to modify the sampling program accordingly.

Rationale: As a result of NOAA Fisheries' policy regarding EM funding, vessel owners would be required to pay the sampling costs associated with the EM program. This requirement would be phased in over three years to provide time for vessel owners to adjust to this new cost over time. Instead of NOAA Fisheries contracting directly with EM service vendors and paying for EM administrative and sampling costs, the vessel owner would make their own individual arrangements with a NOAA Fisheries-certified vendor(s) to provide the services needed to comply with the relevant regulation. Restructuring of the EM program requires standardized elements for the vendors and vessel operators. To implement a similar sampling design as is currently used by SEFSC, the alternative would establish EM Data Review Areas and associated reporting requirements. This approach reduces complexity in the process, provides additional flexibility to vessel owners, and reduces sampling costs.

3.6.3 Alternative F3 - Remove Current EM Regulations Regarding Bluefin Tuna and Shortfin Mako Sharks

This alternative would remove all of the current EM program requirements applicable to pelagic longline vessels. Bluefin tuna interactions with pelagic longline gear would be monitored using a combination of VMS data, logbook data, observer reports, and landings data from dealers. Release of shortfin mako sharks with minimum harm would not be verified through EM, though releases would still be recorded in logbooks and monitored by at-sea observers.

Rationale:
At the time the EM requirements were put in place in 2015, there had been years of extensive discarding of bluefin tuna occurring in the fishery, and EM was a component of the suite of management measures implemented to reduce bluefin tuna discarding and transition to individual accountability under a limited access privilege program. Now, the IBQ Program has been in place for a number of years and has been successful at reducing bluefin tuna discards. Thus, this alternative considers whether the EM Program is still needed. The IBQ Program has measures that require vessel accountability and serve as effective disincentives to interact with bluefin tuna. In the absence of EM data, other data (VMS data, logbook data, observer data and dealer landings data) would continue to be available for use in detecting inaccurate reporting of bluefin tuna catch and potential changes in the rates of bluefin tuna interactions and discards in the pelagic longline fishery.

As explained above, release of shortfin mako sharks with minimum of harm is verified through EM, however, the species is not currently authorized for retention and so EM may not be critical for shortfin mako shark conservation in the short term. Since they are valuable, a large portion of bluefin tuna caught by pelagic longline fishermen are landed and sold to a dealer. Thus, dealer reports may provide a sufficient mechanism, in combination with logbook data, to check compliance with IBQ reporting requirements.

3.7 Management Options Considered But Not Further Analyzed

The management options in this section were considered for Amendment 15, but were eliminated from further detailed analysis for various reasons as described below.

3.7.1 Data Collection: Fishery-independent scientific research plan

This alternative would use NOAA scientific research vessels, and/or chartered commercial vessels, to conduct standardized fishery-independent longline surveys of each closed area under a NOAA-designed scientific research plan. A survey plan would be developed, similar to existing NOAA surveys (e.g., NEFSC coastal shark longline survey), using standardized sets to characterize catch rates and species compositions. This alternative would create a new data collection program and would not modify or affect NOAA's ongoing data collection programs including fishery-independent longline and trawl surveys or any NOAA research involving chartered vessels.

Reasons for not analyzing further:

While this method of data collection would likely produce high quality, robust information, it would be prohibitively expensive for the Agency with a high administrative burden. Furthermore, data collected from an Agency or Agency-chartered research vessel is unlikely to match catch in normal commercial fishery operations, limiting the utility of fishery-independent data for use in management.

3.7.2 Evaluation Timing of Spatial Management Areas: Dynamic/Continuous Evaluation

This alternative would dynamically adjust the spatial and temporal components of the four spatial management areas considered in this action. At regular intervals, but at least annually, HMS PRiSM models would be re-run using the latest catch and oceanographic data. Catch data from inside the spatial management areas would help increase the accuracy of model predictions and updated catch and oceanographic data would allow the HMS PRiSM models to more closely track changes in the fishery and environment. As updated model results are available, NOAA Fisheries would continually update the boundaries and timing of the high- and low-bycatch-risk areas within each spatial management area. Changes would be implemented through regulatory actions published in the Federal Register.

Reasons for not analyzing further:

Dynamic evaluation and management of spatial management area boundaries and timing could allow for more responsive protections for migratory species, especially as ocean conditions change. However, establishing and administering this alternative is resource- and time-intensive. While NOAA Fisheries is not including this alternative at this time, it may consider dynamic management approaches in the future.

3.7.3 Hybrid Cost Allocation of HMS Pelagic Longline Electronic Monitoring Sampling Costs

This alternative would shift only a portion of the HMS pelagic longline EM sampling costs to vessel owners and NOAA Fisheries would continue to pay the remainder of the sampling costs. Different levels of sampling cost transfers were considered including 50 percent of the sampling costs or limiting the cost transfer to a percentage of fishery revenue. Hybrid cost allocation of sampling costs could reduce economic impacts to the pelagic longline fleet.

Reasons for not analyzing further:

Limiting the transfer of sampling costs is not consistent with Procedure 04-115-02 "*Cost Allocation in Electronic Monitoring Programs for Federally Managed Fisheries*." Generally, the policy directs administrative costs to be paid for by the Agency and sampling costs to be paid for by industry.

Chapter 4 DESCRIPTION OF AFFECTED ENVIRONMENT

This section of the DEIS provides pertinent information on the context of the management measures under consideration, which informs the analysis of impacts of the alternatives in this amendment. This information includes data on the valuable ecosystem components. The topics include:

- The ecology, life history, stock status and habitat of highly migratory species.
- Protected resources such as marine mammals, turtles, and other Endangered Species Act-listed species occurring in or around spatial management areas.
- Fishing community profiles, including social vulnerability indices.
- Information on the recreational fishery, including the private angler, charter/headboat, and tournament fisheries.
- Information on the commercial fishery, including the pelagic longline and bottom longline fisheries.
- Bycatch information.
- Description and history of the current spatial management areas.
- Information on seafood dealers.
- Import/export information.

4.1 ECOLOGY, LIFE HISTORY, AND HABITAT

Ecology and Life History

Detailed descriptions of the life histories of HMS managed by NOAA Fisheries are presented in Chapter 3 of the Final 2006 Consolidated HMS FMP (NOAA Fisheries 2006), Chapter 3 in all subsequent amendments, and in the 2021 HMS SAFE Report (NOAA Fisheries 2022), which are all incorporated by reference. The 2006 Consolidated HMS FMP and its amendments encompass the federal conservation and management measures for Atlantic highly migratory species. The 2006 Consolidated HMS FMP can be found online (HMS FMP). The 2006 Consolidated HMS FMP and amendments provide details about each of these managed species, including Atlantic swordfish, western Atlantic bluefin tuna, Atlantic BAYS tunas (bigeye, albacore (*Thunnus alalunga)*, yellowfin, and skipjack (*Katsuwonus pelamis)*), Atlantic billfish (blue marlin, white marlin, roundscale spearfish, Atlantic sailfish, and longbill spearfish), and Atlantic sharks. There are 42 federally managed Atlantic shark species, which include large coastal sharks (sandbar, silky (*Carcharhinus falciformis)*, tiger (*Galeocerdo cuvier)*, blacktip, bull, spinner, lemon (*Negaprion brevirostris)*, nurse (*Ginglymostoma cirratum)*, smooth hammerhead (*Sphyrna zygaena)*, scalloped hammerhead, and great hammerhead sharks (*Sphyrna mokarran)*), small coastal sharks (Atlantic sharpnose, blacknose, finetooth, and bonnethead sharks), pelagic sharks (shortfin mako, thresher, oceanic whitetip, porbeagle (*Lamna nasus)*, and blue sharks (*Prionace glauca)*), and prohibited species (whale (*Rhincodon typus)*, basking (*Cetorhinus maximus)*, sandtiger (*Carcharias taurus)*, bigeye sandtiger (*Odontaspis noronhai)*, white (*Carcharodon* *carcharias)*, dusky, night (*Carcharhinus signatus)*, bignose (*Carcharhinus altimus)*, Galapagos (*Carcharhinus galapagensis)*, Caribbean reef (*Carcharhinus perezii)*, narrowtooth (*Carcharhinus brachyurus)*, longfin mako (*Isurus paucus)*, bigeye thresher (*Alopias superciliosus)*, sevengill (*Heptranchias perlo)*, sixgill (*Hexanchus griseus)*, bigeye sixgill (*Hexanchus nakamurai)*, Caribbean sharpnose (*Rhizoprionodon porosus)*, smalltail (*Carcharhinus porosus)*, and Atlantic angel sharks (*Squatina dumeril)*). For each of the species, the 2006 Consolidated HMS FMP provides details about the species' life history parameters and relevant biological metrics. That detailed information is not repeated here.

Habitat

Most HMS reside in the upper part of the water column, with habitat preferences and distributions most frequently associated with hydrographic features. For example, boundaries of currents or features that influence currents including landforms such as Cape Hatteras or undersea topographic features like the Charleston Bump, or even surface structure (e.g., floating Sargassum mats). Other types of oceanographic fronts or areas of convergence may also be important such as temperature convergence zones. The scales of these features may vary. For example, the river plume of the Mississippi River extends for miles into the Gulf of Mexico and is a fairly predictable feature, depending on the season. Fronts that set up over the DeSoto Canyon in the Gulf of Mexico, or over the Charleston Bump or the Baltimore Canyon in the Mid-Atlantic, may be of a much smaller scale. The locations of many fronts or frontal features are statistically consistent within broad geographic boundaries. These locations are influenced by riverine inputs, movement of water masses, and the presence of topographic structures underlying the water column, thereby influencing habitat for Atlantic HMS.

The region of the Atlantic Ocean within which EFH for federally managed Atlantic HMS is identified spans the area between the Canadian border in the north to the Dry Tortugas in the south. The distribution of marine species along the Atlantic seaboard is strongly affected by the cold Labrador Current in the north, the warm Gulf Stream in the middle and southern portions of the region, and generally by the combination of high summer and low winter temperatures. For many species, Cape Hatteras forms a strong zoogeographic boundary between the Mid- and South Atlantic areas, while the Cape Cod/Nantucket Island area is a somewhat weaker zoogeographic boundary in the north.

High densities of fish resources are associated with particular habitat types (e.g., east Mississippi Delta area, Florida Big Bend seagrass beds, Florida Middle Grounds, mid-outer shelf, and the DeSoto Canyon area). The highest values of surface primary production are found in the upwelling area north of the Yucatan Channel and in the DeSoto Canyon region. In terms of general biological productivity, the western Gulf is considered to be more productive in the oceanic region compared to the eastern Gulf. Productivity of areas where Atlantic HMS are known to occur varies between the eastern and western Gulf, depending on the influence of the Loop Current.

Deviations in major currents can also influence the distribution of HMS in the Atlantic Ocean. The Gulf Stream produces meanders, filaments, and warm and cold core rings that significantly affect the physical oceanography of the continental shelf and slope. The Gulf Stream system is made up of the Yucatan Current that enters the Gulf of Mexico through the Yucatan Straits, the Loop Current which is the Yucatan Current after it separates from Campeche Bank and penetrates the Gulf of Mexico in a clockwise flowing loop, the Florida Current as it travels through the Straits of Florida and along the continental slope into the South Atlantic Bight, and the Antilles Current as it follows the continental slope (Bahamian Bank) northeast to Cape Hatteras. From Cape Hatteras it leaves the slope environment and flows into the deeper waters of the Atlantic Ocean. Inshore and offshore distribution of HMS following the edge of the Gulf Stream can be greatly influenced by the patterns of meanders, filaments, and eddies. The Gulf Stream and the Gulf of Mexico Loop Current are also affected by bathymetric and geophysical features (e.g., the Charleston Bump, the Straits of Florida, and the Yucatan Straits) that may influence circulation patterns and direction.

Although HMS primarily occupy open ocean waters, they often utilize coastal or inshore habitats. This is especially true for several species of sharks that move inshore, often into shallow coastal waters and estuaries, to aggregate, pup, or give birth; these areas may then become nursery areas as the young develop. Areas that are known nursery or spawning grounds, or areas of Atlantic HMS aggregation for feeding or other reasons, are considered to be essential fish habitat for these species. It should be noted that characteristics of coastal and offshore habitats may be affected by activities and conditions occurring outside of those areas (further up-current) due to water flow or current patterns that may transport materials that could cause negative impacts.

In the U.S. Caribbean, high and diverse concentrations of biota are found where habitat is abundant. Coral reefs, sea grass beds, and mangrove ecosystems are the most productive of the habitat types found in the Caribbean, but other areas such as soft-bottom lagoons, algal hard grounds, mud flats, salt ponds, sandy beaches, and rocky shores are also important in overall productivity. These diverse habitats allow for a variety of floral and faunal populations. Coral reefs and other coral communities are some of the most important ecological (and economic) coastal resources in the Caribbean. Seagrass beds are highly productive ecosystems that are quite extensive in the Caribbean; some of the largest seagrass beds in the world lie beyond the shore on both sides of the Florida Keys. Outer shelf regions may also provide important habitat for Atlantic HMS. U.S. Caribbean waters are primarily influenced by the westward flowing North Equatorial Current, the predominant hydrological driving force in the Caribbean region. It flows from east to west along the northern boundary of the Caribbean plateau and splits at the Lesser Antilles, flowing westward along the northern coasts of the islands. It is believed that no upwelling occurs in the waters of the U.S. Caribbean (except perhaps during storm events) and, since the waters are relatively stratified, they are severely nutrient-limited.

4.1.1 Essential Fish Habitat (EFH)

Section 303(a)(7) of the Magnuson-Stevens Act requires FMPs and their amendments to describe and identify EFH, minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitat. The Magnuson-Stevens Act defines EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity.” (16 U.S.C. § 1802(10)). Implementing regulations for EFH provisions are at 50 CFR 600, Subpart J.

Adverse effects from fishing may include physical, chemical, or biological alterations of the substrate, and loss of, or injury to, benthic organisms, prey species, and their habitat, and other components of the ecosystem. Based on an assessment of the potential adverse effects of all fishing equipment types used within an area identified as EFH, NOAA Fisheries must propose measures to minimize fishing effects if there is evidence that a fishing practice is having more than minimal and lasting adverse effect on EFH.

NOAA Fisheries originally described and identified EFH and related EFH regulatory elements for all HMS in the management unit in 1999, some of which were updated in 2003 via Amendment 1 to the 1999 HMS FMP (68 FR 45237; August 1, 2003). EFH boundaries were updated first in Amendment 1 to the 2006 Consolidated HMS FMP (82 FR 42329; September 7, 2017) and most recently in Amendment 10 to the 2006 Consolidated HMS FMP (NOAA Fisheries 2017c). Amendment 10 included a complete review and update of the 10 components of EFH, which includes updates to EFH boundaries and text descriptions and an updated review of fishing and non-fishing impacts to EFH. Information presented in this section is summarized from Amendment 10, which reflects the best scientific information available. Amendment 10 incorporates by reference several analyses that were completed in earlier 2006 Consolidated HMS FMP amendments. The HMS Management Division recently initiated a 5-year review to update EFH based on new information since Amendment 10 (87 FR 19667; April 5, 2022).

Most HMS species reside in the water column. Although there is no substrate or hard structure in the traditional sense, these water column habitats can be characterized by their physical, chemical and biological parameters. The water column can be defined by a horizontal and vertical component. Horizontally, salinity gradients strongly influence the distribution of biota. Horizontal gradients of nutrients, decreasing seaward, affect primarily the distribution of phytoplankton and, secondarily, the organisms that depend on this primary productivity. Vertically, the water column may be stratified by salinity, oxygen content, and nutrients. The water column is especially important to larval transport. While the water column is relatively difficult to define in terms of habitat characteristics, it is no less important since it is the medium of transport for nutrients and migrating organisms between estuarine, inshore, and offshore waters.

NOAA Fisheries completed reviews of fishing gear impacts in the 1999 HMS FMP, Amendment 1 to the 1988 Billfish FMP, the 2006 Consolidated HMS FMP, and Amendments 1 and 10 to the 2006 Consolidated HMS FMP. These analyses determined that the majority of HMS gears are fished within the water column and do not make contact with the sea floor. Because of the magnitude of water column structures and the processes that create them, there is little effect expected from the HMS fishing activities with pelagic longline gear undertaken to pursue these animals. Excessive dead discards could induce minor, localized increases in biological oxygen demand. However, deployment of pelagic longline gear is not anticipated to permanently affect the physical characteristics that define HMS EFH such as salinity, temperature, dissolved oxygen, and depth. Because pelagic longline gear is fished in the water column and does not come in contact with the benthic environment, the pelagic longline fishery is anticipated to have minimal to no impact on EFH (for Atlantic HMS or for other species managed under Council FMPs) associated with the benthic environment.

For more information, please refer to the following websites:

- Amendment 10 Website.
- EFH boundaries may be viewed on the NOAA Fisheries Habitat Mapper.

- Shape files, metadata, a species list, and a preview map may be viewed on the EFH Data Inventory Website.

4.2 COMMUNITY PROFILES

4.2.1 Introduction to Community Profiles

The National Environmental Policy Act (NEPA) requires federal agencies to consider the interactions of natural and human environments by using a "systematic, interdisciplinary approach which will ensure the integrated use of the natural and social sciences...in planning and decision-making" (§102(2)(A)). Moreover, agencies need to address the aesthetic, historic, cultural, economic, social, or health effects, which may be direct, indirect, or cumulative. Consideration of social impacts is a growing concern as fisheries experience increased participation and/or declines in stocks. The consequences of management actions need to be examined to better ascertain and, to the fullest extent possible, mitigate regulatory impacts on affected constituents.

Social impacts are generally the consequences to human populations resulting from some type of public or private action. Those consequences may include alterations to the ways in which people live, work or play, relate to one another, and organize to meet their needs. In addition, cultural impacts, which may involve changes in values and beliefs that affect people's way of identifying themselves within their occupation, communities, and society in general are included under this interpretation. Social impact analyses help determine the consequences of policy action in advance by comparing the status quo with the projected impacts. Community profiles are an initial step in the social impact assessment process.

The Magnuson-Stevens Act outlines a set of National Standards that apply to all fishery management plans and the implementation of regulations. Specifically, National Standard 8 notes that:

"Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities by utilizing economic and social data that meets the requirements of paragraph (2) [National Standard 2], in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities." (§ 301(a)(8)). See also 50 CFR § 600.345 (National Standard 8 Guidelines).

"Sustained participation" is defined to mean continued access to the fishery within the constraints of the condition of the resource (50 CFR § 600.345(b)(4)). The Magnuson-Stevens Act defines a "fishing community" as: "a community which is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew, and United States fish processors that are based in such communities." (§ 3(17)).

Specific to development and amendment of Highly Migratory Species (HMS) FMPs, the Magnuson-Stevens Act, paragraphs 304(g)(1)(C) and (G)(ii)-(iii) require the Secretary to:

- Evaluate the likely effects, if any, of conservation and management measures on participants in the affected fisheries and minimize, to the extent practicable, any disadvantage to U.S. fishermen in relation to foreign competitors.
- Ensure that conservation and management measures:
    - Take into consideration traditional fishing patterns of fishing vessels of the United States and the operating requirements of the fisheries; and
    - Are fair and equitable in allocating fishing privileges among United States fishermen and do not have economic allocation as the sole purpose.

NOAA Fisheries guidelines for social impact assessments (NMFS-01-111-02, 2007) specify that the following elements are utilized in the development of FMPs and FMP amendments:

1. The size and demographic characteristics of the fishery-related work force residing in the area; these determine demographic, income, and employment effects in relation to the workforce as a whole, by community and region.
2. The cultural issues of attitudes, beliefs, and values of fishermen, fishery-related workers, other stakeholders, and their communities.
3. The effects of final actions on social structure and organization; that is, on the ability to provide necessary social support and services to families and communities.
4. The non-economic social aspects of the final action or policy; these include life-style issues, health and safety issues, and the non-consumptive and recreational use of living marine resources and their habitats.
5. The historical dependence on and participation in the fishery by fishermen and communities, reflected in the structure of fishing practices, income distribution and rights.

4.2.2 Methods – Previous Community Profiles and Assessments

Background and summary information on the community studies conducted to choose the communities profiled in this document is not repeated here and can be found in other documents, such as HMS Stock Assessment and Fishery Evaluation (SAFE) Reports. The NOAA Fisheries Office of Science and Technology presents community profiles by region online. Information on community vulnerability and resilience is presented by the same office in a technical memo available online. Jepson and Colburn (2013) originally developed a series of social indicators of vulnerability and resilience for over 3,800 U.S. coastal communities. These indices are regularly updated based on new data, and the most recent indices and scores can be found on the NOAA Fisheries Social Indicators webpage listed above. Nine social indicators are presented in this document for 25 communities selected for having a greater than average number of Atlantic HMS permits associated with them. These indicators are presented below with discussion in Table 4.1 and Table 4.2. This series of indices developed by NOAA Fisheries used social indicator variables that could assess a coastal community's vulnerability or resilience to potential economic disruptions such as those resulting from drastic changes in fisheries quotas and seasons or natural and anthropogenic disasters. Indices and index scores were developed using factor analyses of data from the U.S. Census, permit sales, landings reports, and recreational fishing effort estimates from the Marine Recreational Information Program (MRIP) survey (Jepson and Colburn 2013). The nine social indices developed by Jepson and Colburn (2013) can be divided into two categories: 1) fishing engagement and reliance and 2) social vulnerability. For each index, the community is ranked as scoring high (one standard deviation or more above the mean score), medium high (0.5-0.99 standard deviations above the mean score), medium (0-0.49 standard deviations above the mean score), or low (below the mean score) on the index scale.

Fishing Reliance and Engagement Indices

Jepson and Colburn (2013) developed two indices each to measure community reliance and engagement with commercial and recreational fishing, respectively. Commercial fishing engagement was assessed based on pounds of landings, value of landings, number of commercial fishing permits sold, and number of dealers with landings. Commercial fishing reliance was assessed based on the value of landings per capita, number of commercial permits per capita, dealers with landings per capita, and data on the percentage of people employed in agriculture, forestry, and fishing from the Bureau of Labor Statistics. The recreational fishing engagement index was measured using MRIP estimates of the number of charter, private boat, and shore recreational fishing trips originating in each community. The recreational fishing reliance index was generated using the same fishing trip estimates adjusted to a per capita basis. MRIP data are not available for the State of Texas, so the recreational indexes for Texas were instead calculated based on recreational permit data from NOAA Fisheries and boat ramp data from the State of Texas. As such, recreational index scores for Texas communities are only comparable to other communities within the state.

In Table 4.1, fishing reliance and engagement index scores are presented for 25 Atlantic HMS communities. Five of the 25 Atlantic HMS communities scored either high or medium high on at least three indicators of fishing reliance and engagement, and another 13 scored at least medium high on two of the four indices. Three communities that scored high on all four indices included Barnegat Light, New Jersey; Cape May, New Jersey; and Grand Isle, Louisiana, indicating that these communities have greater than normal dependence on the recreational and commercial fishing sectors for jobs and economic support. Eleven communities scored high or medium high on both fishing engagement indices while scoring medium or low on both fishing reliance indices, indicating that while both have a significant fishing community, it is not a massive component of either city's overall population. Conversely, Atlantic Beach, North Carolina; Islamorada, Florida; Orange Beach, Alabama; and Port Aransas, Texas, all scored high on the recreational fishing indices while scoring low or medium on both commercial fishing indices, suggesting these communities have greater than normal dependence on the recreational fishing sector for jobs and economic support.

Social Vulnerability Indices

Five indices of social vulnerability developed by Jepson and Colburn (2013) are presented in Table 4.2. The personal disruption index includes the following community variables representing disruptive forces in family lives: percent unemployment, crime index, percent with no diploma, percent in poverty, and percent separated females. The population composition index shows the presence of populations that are traditionally considered more vulnerable due to circumstances associated with low incomes and fewer resources. The poverty index includes several variables measuring poverty levels within different community social groups, including the percent receiving government assistance, percent of families below poverty line, percent over age 65 in poverty, and percent under age 18 in poverty. The labor force index characterizes the strength and stability of the labor force and employment opportunities that may exist. A higher ranking indicates fewer employment opportunities and a more vulnerable labor force. Finally, the housing characteristics index is a measure of infrastructure vulnerability and includes factors that indicate housing that may be vulnerable to coastal hazards such as severe storms or coastal flooding.

Communities that scored high or medium high on four indices include New Bedford, Massachusetts; Fort Pierce, Florida; and Freeport, Texas. Three other Atlantic HMS communities scored high or medium high on three social vulnerability indices: Pompano Beach, Florida; Dulac, Louisiana; and Grand Isle, Louisiana. These scores suggest these communities would likely experience greater difficulty recovering from economic hardships caused by job losses in the recreational and commercial fishing sectors. Additional information on vulnerability indices may be accessed through the NOAA Fisheries Community Social Vulnerability Indicator Toolbox.

Table 4.1. Four Social Indicators of Engagement and Reliance for 25 HMS Communities (shading indicates medium high and high levels)

Community	Pop (2019)	Commercial Engagement	Commercial Reliance	Recreational Engagement	Recreational Reliance
Gloucester, MA	30,162	High	Medium	High	Low
Nantucket, MA	11,399	Medium	Low	High	Medium
New Bedford, MA	95,348	High	Medium	Medium	Low
Narragansett, RI	15,500	High	Medium	High	Medium
Montauk, NY	3,685	High	Medium High	High	High
Barnegat Light, NJ	369	High	High	High	High
Brielle, NJ	4,697	Low	Low	High	Medium
Cape May, NJ	3,463	High	High	High	High
Ocean City, MD	6,972	High	Medium	High	Medium
Atlantic Beach, NC	1,747	Medium	Medium	High	High
Beaufort, NC	4,343	High	Medium	Medium High	Medium
Morehead City, NC	9,413	Medium High	Low	High	Medium
Wanchese, NC	1,732	High	Medium Low	High	High
Fort Pierce, FL	45,329	High	Low	High	Low
Islamorada, FL	6,433	Medium	Low	High	High
Pompano Beach, FL	112,122	Medium High	Low	High	Low
Port Salerno, FL	11,486	Medium High	Low	Medium	Low
Apalachicola, FL	2,514	Medium High	Medium	Medium High	Medium
Destin, FL	13,702	High	Low	High	Medium
Madeira Beach, FL	4,300	Medium High	Medium	Medium High	Medium
Panama City, FL	36,640	High	Low	High	Medium
Orange Beach, AL	6,019	Low	Low	High	High
Dulac, LA	1,154	High	Medium High	Medium	High

Community	Pop (2019)	Commercial Engagement	Commercial Reliance	Recreational Engagement	Recreational Reliance
Grand Isle, LA	740	High	High	High	High
Freeport, TX	12,147	Medium	Low	High	Medium
Port Aransas, TX	4,123	Medium	Low	High	High

Note: Social indicator scores are based on the MRIP, commercial landings, and permit data and on U.S. Census Bureau data. Source: Jepson and Colburn 2013.

Table 4.2. Five Social Indicators of Resilience and Vulnerability for 25 HMS Communities (shading indicates medium high and high levels)

Community	Pop (2019)	Personal Disruption	Population Composition	Poverty	Labor Force	Housing
Gloucester, MA	30,162	Low	Low	Low	Low	Low
Nantucket, MA	11,399	Low	Low	Low	Low	Low
New Bedford, MA	95,348	Medium High	Medium High	High	Low	Medium
Narragansett, RI	15,500	Low	Low	Low	Medium	Low
Montauk, NY	3,685	Low	Low	Low	Medium	Low
Barnegat Light, NJ	369	Low	Low	Low	High	Low
Brielle, NJ	4,697	Low	Low	Low	Low	Low
Cape May, NJ	3,463	Low	Low	Low	Medium High	Medium
Ocean City, MD	6,972	Low	Low	Low	Medium	Medium High
Atlantic Beach, NC	1,747	Low	Low	Low	Low	Medium High
Beaufort, NC	4,343	Medium	Low	Medium High	Medium	Medium
Morehead City, NC	9,413	Medium	Low	Medium	Medium	Medium High
Wanchese, NC	1,732	Low	Medium	Low	Low	Medium High
Fort Pierce, FL	45,329	High	High	High	Medium	Medium High
Islamorada, FL	6,433	Low	Low	Low	Medium	Low
Pompano Beach, FL	112,122	Medium High	Medium High	Medium High	Medium	Medium
Port Salerno, FL	11,486	Medium	Low	Medium	Medium	Medium
Apalachicola, FL	2,514	Medium	Low	Medium	Medium	Medium High
Destin, FL	13,702	Low	Low	Low	Low	Medium
Madeira Beach, FL	4,300	Low	Low	Low	Medium High	Medium
Panama City, FL	36,640	Low	Low	Medium	Medium High	Medium
Orange Beach, AL	6,019	Low	Low	Low	Medium	Medium
Dulac, LA	1,154	High	Medium	High	High	N/A
Grand Isle, LA	740	Medium High	Low	Medium	Medium High	Medium High

Community	Pop (2019)	Personal Disruption	Population Composition	Poverty	Labor Force	Housing
Freeport, TX	12,147	High	High	High	Low	Medium High
Port Aransas, TX	4,123	Low	Low	Low	Low	Medium

Note: Social indicator scores are based on the MRIP, commercial landings, and permit data and on U.S. Census Bureau data. Source: Jepson and Colburn 2013.

4.3 Atlantic HMS Stock Status

Relevant background information, the status of HMS stocks, and references to stock assessment reports are presented in the annual HMS Stock Assessment and Fishery Evaluation Report (SAFE) published by NOAA Fisheries (HMS SAFE Reports).

The term "stock of fish" means a species, subspecies, geographical grouping, or other category of fish capable of management as a unit (Magnuson-Stevens Act § 3(42) 16 U.S.C. 1802(42)). "Stock" may also refer to a multispecies complex managed as a single unit due to the occurrence of two or more species being harvested together (50 CFR 600.310(d)). Stock assessments measure the impact of fishing on stocks and project harvest levels that maximize the number of fish that can be caught sustainably while preventing overfishing and, where necessary, rebuilding depleted stocks. Stock status determination criteria (SDC) are measurable and objective factors that are used to determine if overfishing has occurred, or if a stock is overfished. The Magnuson-Stevens Act (§ 3(34)) defines both "overfishing" and "overfished" to mean a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce Maximum Sustainable Yield on a continuing basis. To avoid confusion, the National Standard (NS) 1 guidelines second of SDC clarifies that "overfished" relates to biomass of a stock or stock complex, and "overfishing" pertains to a rate or level of removal of fish from a stock or stock complex" (50 CFR 600.310(e)(2)(i)(A)). This section of the NS1 guidelines also provides a definition of overfished and overfishing. The criteria, or thresholds used to determine the status of Atlantic HMS stocks are included in the SAFE Reports.

Domestic shark assessments are primarily conducted through the Southeast Data, Assessment, and Review (SEDAR) process. On the international level, ICCAT has assessed numerous HMS stocks, and has conducted several ecological risk assessments for various HMS species, among other things. Stock assessments and management recommendations are listed on ICCAT's website. International cooperation is critical to the effective conservation and management of several HMS stocks, given the species' highly migratory nature. ICCAT conservation and management occurs both through stock assessments and recommendations.

On May 6, 2022, the HMS Management Division released the Best Scientific Information Available (BSIA) Framework for HMS stock assessments and stock status determinations. Consistent with the Magnuson-Stevens Act National Standard 2, the framework clarifies and increases transparency regarding how BSIA determinations are made and documented in the context of stock status determinations and catch specifications. For Atlantic HMS management, which is not conducted through a regional Fishery Management Council and Scientific and Statistical Committee (SSC) process, "catch specifications" may include rules that establish quotas, implement annual quota adjustments for overharvest or underharvest, and implement annual catch limits (ACLs) and accountability measures (AMs).

4.4 Summary of Atlantic Highly Migratory Species Management

The HMS Management Division develops regulations for Atlantic HMS fisheries. See Chapter 1, paragraphs 1 and 2 for explanation of Magnuson-Stevens Act, ATCA and ICCAT. Because of the highly migratory nature of HMS, NOAA Fisheries manages HMS fisheries in federal waters (domestic) and the high seas (international). For most HMS fisheries (directed and incidental), federally-permitted HMS fishermen must also comply with federal regulations in state waters, unless state regulations are at least as restrictive as relevant federal regulations. NOAA Fisheries works closely with States, Councils, and the interstate fisheries management commissions to ensure complementary regulations are implemented across state jurisdictions. States are invited to send representatives to HMS Advisory Panel meetings and to participate in stock assessments, public hearings, or other fora.

4.5 The Pelagic Longline Fishery

4.5.1 Description of the Pelagic Longline Fishery

The pelagic longline fishery for Atlantic HMS primarily targets swordfish, yellowfin tuna, and bigeye tuna in various areas and seasons. Secondary target species include dolphinfish (*Coryphaena hippurus*), skipjack tuna, and albacore tuna. Although this gear can be modified (e.g., depth of set, hook type, hook size, bait) to target swordfish, tunas, or other fish, it is generally a multi-species fishery. These vessel operators are opportunistic, switching gear style and making subtle changes to target the best available economic opportunity on each individual trip. Pelagic longline gear sometimes attracts and hooks non-target finfish with little or no commercial value as well as species that cannot be retained by commercial fishermen due to regulations. For example, the pelagic longline fishery interacts with multiple managed or restricted bycatch species, including bluefin tuna, shortfin mako shark, dusky shark, sandbar shark, and billfish. Pelagic longline gear may also interact with protected species such as marine mammals, sea turtles, and seabirds. Thus, this gear has been classified as a Category I fishery with respect to the Marine Mammal Protection Act (MMPA). Any species (or undersized catch of permitted species) that cannot be landed due to fishery regulations are required to be released, regardless of whether the catch is dead or alive.

Pelagic longline gear is composed of several parts (Figure 4.1). The primary fishing line, or mainline of the longline system, can vary from five to 40 miles in length, with approximately 20 to 30 hooks per mile. The depth of the mainline is determined by ocean currents and the length of the floatline. The floatline connects the mainline to several buoys and periodic markers which can have radar reflectors or radio beacons attached. Each individual hook is connected by a leader, or gangion, to the mainline. Light sticks, which contain light emitting chemicals, are used, particularly when targeting swordfish. When attached to the hook and suspended at a certain depth, light sticks attract baitfish, which may, in turn, attract pelagic predators (NOAA Fisheries 1999).

When targeting swordfish, pelagic longline gear is generally deployed at sunset and hauled at sunrise to take advantage of swordfish nocturnal, near-surface feeding habits (NOAA Fisheries 1999). In general, longlines targeting tunas are set in the morning, fished deeper in the water column, and hauled back in the evening. Except for vessels of the distant water fleet, which undertake extended trips, fishing vessels preferentially target swordfish during periods when the moon is full to take advantage of increased densities of pelagic species near the surface.

Figure 4.2 illustrates basic differences between swordfish (shallow) and tuna (deep) pelagic longline sets. Swordfish sets are buoyed to the surface, have fewer hooks between floats, and are relatively shallow. This same type of gear arrangement is used for mixed target species sets. Tuna sets use a different type of float placed much further apart. Compared with swordfish sets, tuna sets have more hooks between the floats and the hooks are set much deeper in the water column. It is believed that tuna sets hook fewer turtles than the swordfish sets because of the difference in fishing depth. In addition, tuna sets use bait only, while swordfish sets use a combination of bait and light sticks. Compared with vessels targeting swordfish or mixed species, vessels specifically targeting tuna are typically smaller and fish different grounds.

Regulations for the U.S. Atlantic pelagic longline fishery include minimum sizes for swordfish, yellowfin tuna, bigeye tuna, and bluefin tuna; gear and bait requirements; limited access vessel permits; an IBQ program to limit incidental take of bluefin tuna; gear restricted areas; closed areas; observers, protected species incidental take limits; reporting requirements (including logbooks); mandatory workshop requirements; regional quotas for swordfish; and shark landings restrictions. The retention of billfish by commercial vessels, or the sale of billfish from the Atlantic Ocean, is prohibited. As a result, all billfish caught on pelagic longline gear must be released or discarded, and are considered bycatch. Many of the management strategies implemented have a spatial component. For example, some gear requirements are designated for certain areas (e.g., weak hooks in the Gulf of Mexico, certain gear and bait combination requirements for the Northeast Distant Gear Restricted Area (NED)). The pelagic longline fishery is also bound to certain other regulations under the Magnuson-Stevens Act and other laws.

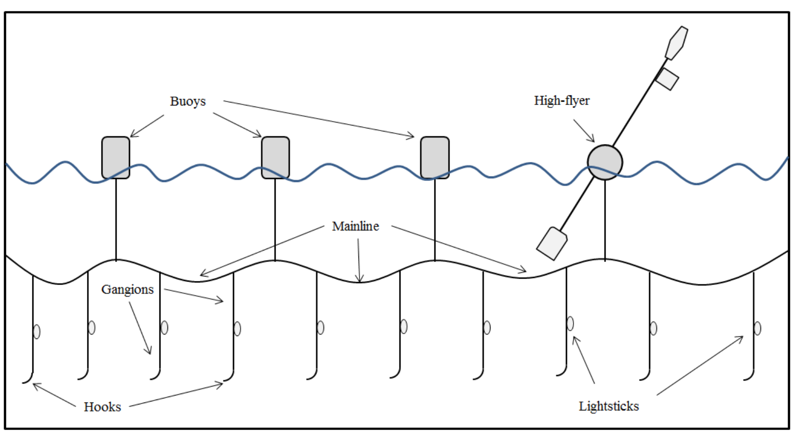

Figure 4.1. Typical U.S. pelagic longline gear, Source: Redesign from original in Arocha (1997).

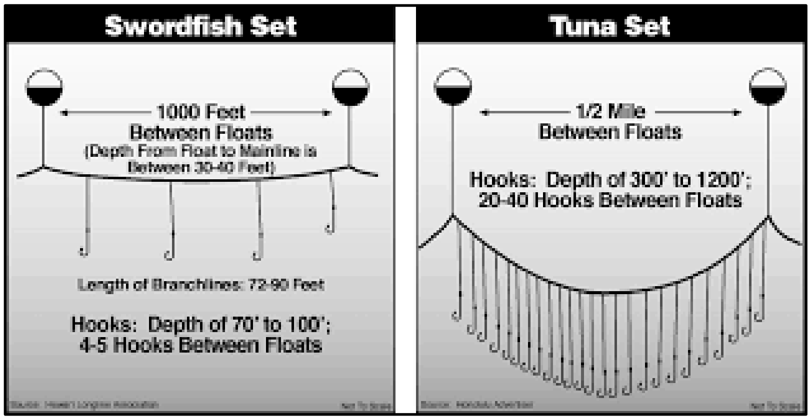

Figure 4.2. Pelagic longline gear deployment techniques

Note: This figure shows basic differences in pelagic longline gear configuration and to illustrate that this gear may be altered to target different species. Source: Hawaii Longline Association and Honolulu Advertiser.

4.5.2 Permit Information

Vessels that fish with pelagic longline gear are required to have an Atlantic Tunas Longline category permit, which is a limited access permit. Atlantic HMS limited access permits can only be obtained by transferring an existing permit from a current permit holder. New permits are not issued. The Atlantic HMS limited access permit program issues two types of limited access tunas permits, three types of limited access swordfish permits, and two types of limited access shark permits.

Several of these permits were designed to be held in combination to reduce regulatory discards and monitor bycatch in the pelagic longline fishery. Requiring a combination allows for limited retention of species that might otherwise have to be discarded due to regulations not allowing fishermen to retain the fish. For example, tunas and sharks are commonly caught when pelagic longline fishing for swordfish; if only a swordfish permit is held, then discarding tunas and sharks would be required. Therefore, Swordfish Directed and Swordfish Incidental permits are valid only if the permit holder also holds both an Atlantic Tunas Longline category and a Shark Directed or Incidental permit. This minimizes tuna and shark regulatory discards.

The number of Atlantic Tunas Longline category permits issued from 2016 through 2021 is shown in Table 4.3. Although the number of permits issued has been stable since 2016, the number of permitted vessels has declined since the implementation of the closed areas. Subsequent to the implementation of the limited access program in 1999, as of December 30, 1999, prior to the implementation of the closed areas in 2000, there were 451 Atlantic Tunas Longline category permit holders (NOAA Fisheries 2000). Further, it is important to note that the number of permit holders that actively fish is substantially lower than the number of vessels issued permits.

Table 4.3. Number of Atlantic Tunas Longline category permits issued; 2016 through 2021 (Source: Atlantic HMS Permits Data).

Year	Number of Permits
2016	280
2017	280
2018	280
2019	280
2020	281
2021	284

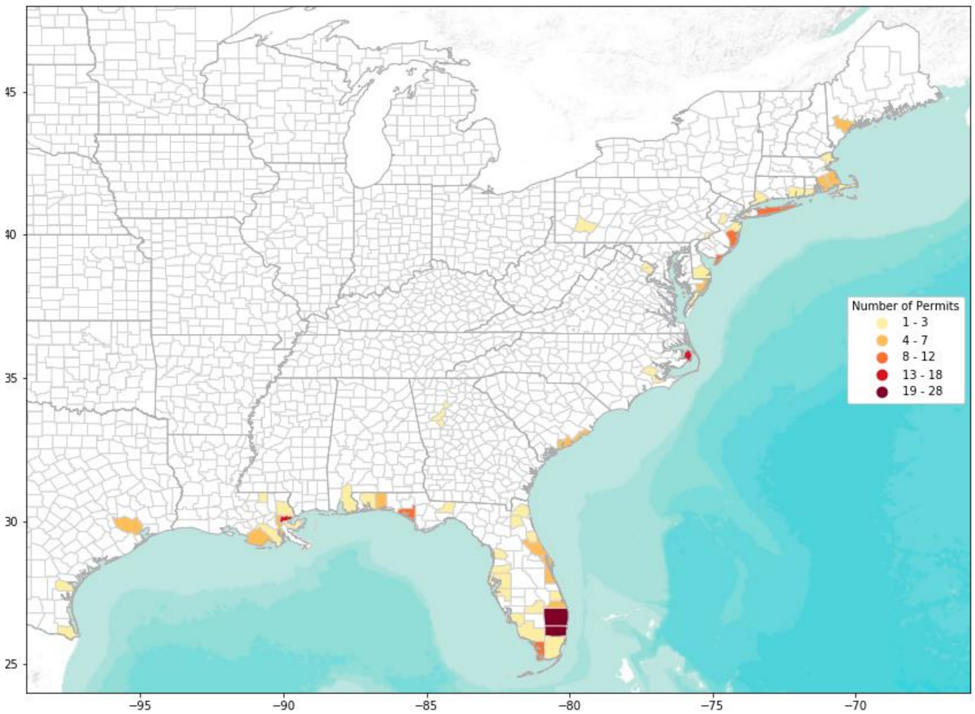

Figure 4.3. Distribution of Atlantic Tunas Longline category permits as of October 2021. Source: NOAA Fisheries Southeast Region Permit Database

4.5.3 Fishing Effort and Catch Information

Vessel logbook data was analyzed in order to document relevant trends in the fishery, and provide context for the pelagic longline alternatives under consideration. The number of pelagic longline trips has declined every year since 2012, with the exception of 2017, with slightly higher trips than in 2016 (Table 4.4).

Table 4.4. Annual Totals of the number of pelagic longline fishing trips. Source: Logbooks.

Year	Number of Trips
2012	1,592
2013	1,575
2014	1,422
2015	1,185
2016	1,025
2017	1,078
2018	921

Year	Number of Trips
2019	871
2020	811

Similarly, the number of active vessels has declined in recent years. As of 2015, in support of the IBQ Program, vessels fishing with pelagic longline gear were required to report information for each pelagic longline trip taken. Table 4.5 shows the total number of distinct vessels that reported through VMS.

Table 4.5. Number of pelagic longline vessels submitting VMS reports; 2015 through 2021

Year	Number of Vessels
2015	93
2016	73
2017	87
2018	73
2019	65
2020	65

Source: NOAA Fisheries VMS Data

The number of pelagic longline sets and hooks follow a similar trend. In 2000 there were 11,065 sets (NOAA Fisheries 2002), whereas in 2019 there were 4,188 sets (NOAA Fisheries VMS data). Effort expressed as the number of hooks fished, declined by 49.5 percent during 2016 through 2020 from 1997–1999 (NOAA Fisheries 2022).

Pelagic longline catch, on an individual vessel basis including bycatch, incidental catch, and target catch, whether kept or discarded, is largely related to vessel characteristics, gear configuration, and fishing strategy. The reported catch, in numbers of fish, is summarized in Table 4.6 for the entire pelagic longline fishery. Table 4.7 provides a summary of U.S. Atlantic pelagic longline landings as reported to ICCAT.

Table 4.6. Reported numbers of catch and hooks in the U.S. pelagic longline fishery in 2016 through 2020.

Species, Disposition, and Hooks	2016	2017	2018	2019	2020
Swordfish kept	26,388	24,885	25,101	27,495	26,546
Swordfish discarded	4,681	7,596	8,004	4,307	4,937
Blue marlin discarded	1,051	1,566	858	984	841
White marlin discarded	2,156	2,223	1,587	1,467	1,065
Sailfish discarded	855	658	810	402	520
Spearfish discarded	745	687	459	469	299
Bluefin tuna kept	411	475	465	447	261
Bluefin tuna discarded	582	229	310	347	293
BAYS tunas kept	57,123	68,709	37,944	50,291	50,370
BAYS tunas discarded	7,899	6,721	3,230	3,649	3,553
Pelagic sharks kept	2,190	2,564	875	566	453

Species, Disposition, and Hooks	2016	2017	2018	2019	2020
Pelagic sharks discarded	27,471	25,155	14,656	12,733	4,955
Large coastal sharks kept	50	79	36	117	32
Large coastal sharks discarded	8,675	11,042	5,639	4,466	5,545
Dolphinfish kept	46,530	29,300	27,515	36,979	13,240
Dolphinfish discarded	1,108	816	830	681	277
Wahoo kept	1,769	1,479	1,275	987	762
Wahoo discarded	180	188	115	84	59
Sea turtle interactions	229	162	86	66	41
Number of hooks (x 1000)	5,219	5,328	4,056	3,649	3,076

BAYS = Bigeye, albacore, yellowfin, and skipjack. Source: SEFSC Unified Data Processing

Table 4.7. Reported landings (mt ww) in the U.S. pelagic longline fishery, 2016-2020

Species	2016	2017	2018	2019	2020
Yellowfin tuna	1,300	1,431	855	877	797
Skipjack tuna	1.1	0.6	0.4	0.4	0.2
Bigeye tuna	386	568	389	580	500
Bluefin tuna	105	115	103	92	57
Albacore tuna	203	209	93	190	284
North Atlantic swordfish	1,389	1,302	1,106	1,478	1,498
South Atlantic swordfish	0	0	0	0	0
Total	3,384	3,625	2,547	3,216	3,136

mt ww = Metric tons whole weight. *Includes landings and estimated discards from scientific observer and logbook sampling programs as reported to ICCAT. Source: NOAA Fisheries 2022.

4.5.4 Economic Information

Revenue from pelagic longline gear represented approximately 59 percent of the total ex-vessel revenue of Atlantic HMS species in 2020 (NOAA Fisheries 2022). In 2020 the total revenue from Atlantic HMS species was $30,941,942.

Primary expenses associated with operating an Atlantic HMS permitted pelagic longline commercial vessel include labor, fuel, bait, ice, groceries, and other gear, as well as light sticks for swordfish trips. Unit costs are collected on some of the primary variable inputs associated with trips from vessel logbook data. The median input costs per trip for the major variable inputs associated with Atlantic HMS trips taken by pelagic longline vessels are provided in Table 4.8. Fuel costs are one of the largest variable expenses. Total median pelagic longline vessel fuel costs per trip decreased 3.9 percent from 2019 through 2020.

Table 4.8. Median input costs (dollars) for pelagic longline vessel trips, 2016–2020

Input Costs	2016	2017	2018	2019	2020
Fuel	$1,850	$2,169	$2,445	$2,000	$1,923
Bait	$2,244	$2,000	$2,077	$2,000	$2,000
Light sticks	$700	$740	$840	$646	$684
Ice	$900	$1,080	$1,183	$900	$900

Input Costs	2016	2017	2018	2019	2020
Groceries	$900	$900	$900	$900	$900
Other	$800	$880	$1,000	$989	$800

Source: SEFSC Unified Data Processing.

Labor costs are also an important component of operating costs for Atlantic HMS pelagic longline vessels. Table 4.9 lists the number of crew on a typical pelagic longline trip. The median number of three crew members has been consistent from 2016 through 2020. Most crew and captains are paid based on a lay system (crew paid a fraction of profits). According to Atlantic HMS Logbook reports, owners are typically paid 50 percent of revenues. Captains receive a 25-percent share, and crew in 2020 received 27 percent on average. These shares are typically paid out after costs are netted from gross revenues. Median total shared costs per trip on pelagic longline vessels over the last five years ranged from a low of $6,033 in 2016 to a high of $6,889 in 2018.

Table 4.9. Median labor inputs for pelagic longline vessel trips, 2016-2020

Labor	2016	2017	2018	2019	2020
Number of Crew	3	3	3	3	3
Days at sea	10	12	11	9	9
Owner share (%)	50	50	50	50	50
Captain share (%)	25	25	25	25	25
Crew share (%)	25	25	25	25	27
Total shared costs ($)	6,033	6,425	6,889	6,368	6,855

Source: SEFSC Unified Data Processing.

In 2020, median reported total trip sales were $18,050. In 2019, median reported total trip sales were $17,263. In 2018, median reported total trip sales were $20,193. In 2017, median reported total trip sales were $19,638. After adjusting for operating costs, median net earnings per trip were $11,214 in 2017. Median net earnings per trip decreased to $9,858 in 2018. Median net earnings per trip decreased to $9,544 in 2019. Median net earnings per trip decreased to $8,571 in 2020.

A brief discussion of the international trade of pelagic longline species is contained in Section 4.8.

4.6 Bottom Longline Fishery

4.6.1 Description of Bottom Longline Fishery

Bottom longline is the primary commercial gear deployed for targeting large and small coastal sharks throughout the Atlantic Ocean. The bottom longline fishery includes the shark research fishery. Section 6.3.6.1 under the bycatch reduction measures for bottom longline, provides a description of the shark research fishery.

Current commercial regulations include limited access vessel permits requirements, commercial quotas, vessel retention limits, a prohibition on landing 20 species of sharks (one of these species can be landed in the shark research fishery), numerous closed areas, gear restrictions, landing restrictions (including requiring all sharks be landed with fins naturally attached), fishing regions, VMS requirements, dealer permits, and vessel and dealer reporting requirements.

Shark Research Fishery

The bottom longline fishery also includes the shark research fishery. The shark research fishery is a voluntary program that allows selected commercial fishermen the opportunity to fish for, retain, and land sandbar sharks that are not available outside the research fishery, provided they operate under a NOAA Fisheries-developed scientific research plan and abide by conservation measures specific in the program. The only commercial vessels authorized to land sandbar sharks are those participating in the shark research fishery. Participating vessels are required to take an observer on all shark research fishery trips, but can fish without an observer when not on a shark research fishery trip. The scientific data collected by fishery observers is used in shark stock assessments and other scientific research. Permits are issued on an annual basis, and the specific conditions of the permit, including trip limits, gear requirements, and number of trips per month, depend, among other things, on the number of selected vessels, available quota, and the objectives of the research fishery. While the shark research fishery is not limited to the use of bottom longline gear, the vast majority of vessels that have participated in the fishery have used only bottom longline gear.

The shark research fishery was established, in part, to maintain time series data for stock assessments and to meet NOAA Fisheries' research objectives. Since the shark research fishery was established in 2008, it has allowed for: The collection of fishery-dependent data for current and future stock assessments; the operation of cooperative research to meet NOAA Fisheries' ongoing research objectives; the collection of updated life-history information used in the sandbar shark (and other species) stock assessment; the collection of data on habitat preferences that might help reduce fishery interactions through bycatch mitigation; evaluation of the utility of the Mid-Atlantic shark closed area on the recovery of dusky sharks and collection of hook-timer and pop-up satellite archival tag information to determine at-vessel and post-release mortality of dusky sharks; and collection of sharks to determine the weight conversion factor from dressed weight to whole weight.

4.6.2 Permit Information

In federal waters, fishing vessels need either a shark directed or shark incidental permit to target and land non-smoothhound sharks. Generally, shark directed permits allow fishermen to target authorized large coastal sharks, small coastal sharks, and pelagic shark species, while shark incidental permits allow fishermen who normally fish for other species to land a limited number of those non-smoothhound shark species during the course of those fishing trips. Since implementation in 1999, shark limited access permits have declined in number. The majority of the shark directed and incidental permit holders have been inactive (i.e., have not landed any shark species). The majority of the active permit holders have been fishing in the Atlantic region (NOAA Fisheries 2022). For shark directed permit holders, active permits declined 36 percent, with the peak in 2014 (114) and the low in 2019 (73). For shark incidental permits, the number of inactive permits has remained stable throughout the period. However, active permits followed the trend of shark directed permits, declining 50 percent, with the peak in 2014 (66) and the low in 2019 (34). Overall, the total number of shark directed and incidental permits (active and inactive) declined by 10 percent (NOAA Fisheries 2022).

4.6.3 Fishing Effort and Catch Information

The reported bottom longline effort for fishermen targeting sharks by region from 2016 through 2020 is provided in Table 4.10. A targeted shark trip is defined as a trip where 75 percent of the landings by weight were sharks. Few vessels target sharks in the Atlantic, with only 13 active vessels in 2020.

Table 4.10. Reported bottom longline effort targeting sharks, 2016-2020

Specifications	Region	2016	2017	2018	2019	2020
Number of vessels	Gulf of Mexico	16	13	13	6	12
	Atlantic	13	18	14	12	13
Number of trips	Gulf of Mexico	261	322	340	119	226
	Atlantic	282	325	212	118	149
Average sets per trip	Gulf of Mexico	1.2	1.2	1.3	1.8	1.9
	Atlantic	1.4	1.4	1.5	1.8	2.0
Total number of set hooks	Gulf of Mexico	89,723	112,295	121,992	83,335	155,125
	Atlantic	104,665	109,851	85,307	34,322	37,673
Average number of hooks perset	Gulf of Mexico	272.3	292.1	275.9	403.3	281.7
	Atlantic	269.6	260.0	276.1	204.4	135.9
Total soak time (hours)	Gulf of Mexico	1,416	2,140	2,058	1,039	1,392
	Atlantic	2,041	3,054	1,410	866	682
Average mainline length (miles)	Gulf of Mexico	2.6	2.9	3.0	6.6	3.7
	Atlantic	3.6	3.6	3.7	3.2	1.9

Source: SEFSC Unified Data Processing

In 2020, the Bottom Longline Observer Program placed observers on five vessels—four of the vessels were selected within the shark research fishery and one was selected in the non-research shark bottom longline fishery. A total of 85 bottom longline sets (defined as setting gear, soaking gear for some duration of time, and retrieving gear) and 38 trips (defined as from the time a vessel leaves the port until the vessel returns to port and lands catch, including multiple hauls therein) were observed from January through December 2020. Gear characteristics of trips varied by area (Gulf of Mexico or the U.S. Atlantic Ocean) and target species (non-sandbar large coastal sharks or sandbar shark) (Mathers et al. 2020a, unpublished).

The non-research shark fishery data cannot be further described due to vessel data confidentiality requirements under the Magnuson-Stevens Act. Additionally, Atlantic and Gulf of Mexico trips cannot be separated for the same reason.

Fishermen in the 2020 shark research fishery targeted sandbar sharks in the Gulf of Mexico and southern Atlantic regions. There were 79 sets on 36 trips, all of which were observed, that caught mostly sandbar sharks, with blacktip, tiger, and nurse sharks being the next most-caught species (Table 4.11). Trips in the shark research fishery used a bottom longline gear that was an average length of 9.1 km (5.7 miles) with 25-301 hooks attached. The average soak duration was 5 hours. Fishermen targeting sandbar sharks with bottom longline gear most commonly used the 20/0 circle hook (46.8 percent of the time) followed by 18/0 circle hooks (36.7 percent of the time) (Mathers et al. 2020b, unpublished).

Table 4.11. Non-prohibited shark species caught on bottom longline trips in the shark research fishery in the Gulf of Mexico and Southern Atlantic in 2020 (Source: Mathers et al. 2020b, unpublished)

Species	Total Caught (number)	Kept (%)	Discarded Dead (%)	Discarded Alive (%)	Disposition Unknown (%)
Sandbar shark	946	97.7	0.3	0.2	1.8
Blacktip shark	161	95.0	4.4	0.0	0.6
Tiger shark	211	34.1	1.9	62.6	1.4
Nurse	126	32.5	0.0	64.3	3.2
Atlantic sharpnose shark	128	65.6	34.4	0.0	0.0
Bull shark	106	95.3	0.0	0.0	4.7
Great hammerhead shark	26	42.3	7.7	46.2	3.9
Blacknose shark	41	14.6	34.2	51.2	0.0
Scalloped hammerhead shark	27	22.2	3.7	74.1	0.0
Lemon shark	34	94.1	0.0	0.0	5.9
Spinner shark	7	100.0	0.0	0.0	0.0
Hammerhead shark	1	0.0	0.0	100.0	0.0
Silky shark	5	80.0	20.0	0.0	0.0
Thresher shark					
Bonnethead shark					
Sharks, unclassified	6	0.0	100.0	0.0	0.0
Total	1,825				

4.6.4 Economic Information

The primary expenses associated with operating an Atlantic HMS-permitted bottom longline commercial vessel include labor, fuel, bait, ice, groceries, and other miscellaneous expenses. These expenses are reported in the Southeast Coastal Fisheries Logbook for vessels that have been selected for reporting economic information. Bottom longline trips primarily target shark species and are of short duration. Table 4.12 provides the median reported trip input costs from 2016 through 2020.

Table 4.12. Reported landings (mt ww) in the U.S. pelagic longline fishery, 2016-2020

Input Costs	2016	2017	2018	2019	2020
Fuel	$120	$124	$156	$144	$120
Bait	$61	$60	$50	$100	$60
Ice	$50	$36	$20	$24	$30
Groceries	$40	$20	$20	$10	$50
Misc. trip costs	$20	$20	-	$20	$52
Number of crew	2	2	2	3	2
Days at sea	1	1	1	1	1

Source: Southeast Coastal Fisheries Logbook.

Table 4.13 Median reported trip sales and median net earnings (revenue minus costs), by year, for the shark bottom longline fishery

	2017	2018	2019	2020
Median reported trip sales	$1,110	$976	$2,000	$851
Median net earnings	$801	$609	$1,192	$614

Source: Southeast Coastal Fisheries Logbook.

Gillnet Fishing and the Mid-Atlantic Shark Closed Area

Some vessels fish in the Mid-Atlantic shark closed area with gillnet gear. Gillnet gear is the primary gear for vessels landing small coastal sharks and smooth dogfish (*Mustelus canis)*, although such vessels can also catch other shark species. Vessels participating in the shark gillnet fishery typically possess permits for other Council- or State-managed fisheries in addition to their federal permit. Many of the commercial regulations for the Atlantic shark fishery are the same for both the bottom longline and gillnet fishery, including seasons, quotas, species complexes, permit requirements, authorized/prohibited species, and retention limits. The majority of the vessels and trips fishing with gillnet gear in the northeast and mid-Atlantic regions catch and land smooth dogfish. Interactions in this fishery are recorded by observers with the Northeast Fisheries Observer Program (NEFOP). The smooth dogfish gillnet fishery is a mixed fishery with a large portion of trips catching and retaining a variety of additional species dominated by winter skate (*Leucoraja ocellata*), bluefish (*Pomatomus saltatrix*), and spiny dogfish (*Squalus acanthias*). In 2020, the NEFOP observed 4 vessels making 30 sets on 9 trips targeting smooth dogfish. Smooth dogfish was recorded caught on a total of 21 sets.

4.7 Seafood Dealers

Seafood dealers comprise an important part of the HMS commercial fisheries. Consumers spent an estimated $12.1 billion on domestically processed fishery products from domestic and imported products in 2019. This includes $11.7 billion on edible fishery products, including fresh, frozen, canned, and cured, and $392.4 million on industrial fishery products. Atlantic tunas are included in the top five species processed, with landings of 391 million pounds valued at $904 million (NOAA Fisheries Office of Science and Technology 2021).

Atlantic HMS dealer permits are open access and required for the "first receiver" of Atlantic tunas, swordfish, and sharks. A first receiver is any entity, person, or company that takes, for commercial purposes other than to solely transport, immediate possession of the fish or any part of the fish as the fish are offloaded from a fishing vessel. Annual totals of Atlantic tunas, swordfish, and shark dealer permits are reported in Table 4.14. Totals by state for 2020 are in Table 4.15.

Table 4.14. Number of domestic Atlantic dealer permits for tunas, swordfish, and sharks, 2016-2021*

Year	Bluefin only	BAYS only	Bluefin and BAYS	Atlantic Swordfish	Atlantic Sharks	Total
2016	29	74	291	182	111	687
2017	32	70	291	189	113	695
2018	30	70	287	193	108	698
2019	34	65	278	200	104	681
2020	101	66	335	200	92	794
2021*	63	63	319	197	89	731

Note: The actual number of permits per state may change as permit holders move or sell their businesses. BAYS = Bigeye, albacore, yellowfin, and skipjack tunas. *As of October 2021. Source: Southeast Regional Office; Greater Atlantic Regional Fisheries Office.

Table 4.15. Number of domestic Atlantic dealer permits for tunas, swordfish, and sharks by state in 2021*

State/Territory	Bluefin only	BAYS only	Bluefin and BAYS	Atlantic Swordfish	Atlantic Sharks	Total
Maine	34	-	24	-	-	58
New Hampshire	8	-	11	2	-	21
Vermont	-	-	1	-	-	1
Massachusetts	13	8	86	15	5	127
Rhode Island	-	5	17	8	3	33
Connecticut	1	1	6	1	-	9
New York	3	21	46	8	9	87
Pennsylvania	-	-	4	1	-	5
New Jersey	-	7	42	12	9	70
Delaware	-	-	4	1	-	5
Maryland	-	-	7	4	3	14
Virginia	-	4	11	3	3	21
North Carolina	3	3	25	25	15	71
South Carolina	-	-	5	11	9	25
Georgia	-	-	1	1	1	3
Florida	-	8	19	91	26	144
Alabama	-	1	-	4	2	7
Louisiana	-	1	3	5	3	12

State/Territory	Bluefin only	BAYS only	Bluefin and BAYS	Atlantic Swordfish	Atlantic Sharks	Total
Texas	-	1	2	2	1	6
Puerto Rico	-	1	1	-	-	2
US Virgin Islands	-	1	1	-	-	2
Missouri	-	-	-	1	-	1
Illinois	-	-	-	2	-	2
Indiana		1		-	-	1
California	1	-	1	-	-	3
Hawaii	-	-	2	-	-	2

Note: The actual number of permits per state may change as permit holders move or sell their businesses. BAYS = Bigeye, albacore, yellowfin, and skipjack tunas. *As of October 2021. Source: Southeast Regional Office; Greater Atlantic Regional Fisheries Office.

NOAA Fisheries does not currently have specific information regarding the costs and revenues for Atlantic HMS dealers. In general, dealer costs include purchasing fish, paying employees, processing fish, managing reporting obligations, rent or mortgage, and supplies to process the fish. Some dealers may provide loans to the vessel owner, money for vessel repairs, fuel, ice, bait, or facilitate the IBQ leasing market. In general, dealer expenditures and revenues are not as variable or unpredictable as those of a vessel owner. However, dealer costs may fluctuate depending upon supply of fish, labor costs, and equipment repair.

Although NOAA Fisheries does not have specifics regarding HMS dealers, there is some information on the number of plants and employees for processors and wholesalers in the United States provided by the U.S. Bureau of Labor Statistics (2021). Table 4.16 provides a summary of available information.

Table 4.16. Processors and wholesalers: plants and employment (number of employees) in 2021[1]

Area and State	Region	Processing Plants[1]	Processing Employment[1]	Wholesale Plants[2]	Wholesale Employment[2]	Total Plants	Total Employment
ME	New England	29	690	177	1,212	206	1,902
NH		7	-	16	102	23	-
MA		45	2,835	158	2,119	203	4,954
RI		8	168	32	155	40	323
CT		4	83	22	-	26	-
Region Total		93	3,776	405	3,588	498	7,179
NY	Mid-Atlantic	17	290	283	1,761	300	2,051
NJ		14	420	84	853	98	1,273
PA		4	95	29	624	33	719
DE		4	-	8	12	12	-
D.C.		1	-	4	-	5	-
MD		20	300	53	973	73	1,273
VA		32	1,010	80	443	112	1,453
Region Total		92	2,115	541	4,466	633	6,769
NC	South Atlantic	27	732	72	851	99	1,583
SC		5	18	29	169	34	187
GA		10	705	31	695	41	1,400
FL		37	1,601	347	2,750	384	4,351
Region Total		79	3,056	479	4,465	558	7,521
AL	Gulf of Mexico	29	1,004	13	236	42	1,240
LA		24	2,211	26	128	50	2,339
MS		60	1,517	107	646	167	2,163
TX		50	1,474	167	1,380	217	2,854
Region Total		163	6,206	313	2,390	476	8,596
Inland states/Other Areas**, total		382	17,145	979	10,464	1,361	27,609

[1]Based on North American Industry Classification System 3117 as reported to the Bureau of Labor Statistics.
[2]Based on North American Industry Classification System 42446 as reported to the Bureau of Labor Statistics.
**Includes Puerto Rico and the U.S. Virgin Islands. Source: NOAA Fisheries 2022.

4.8 TRADE: IMPORTS AND EXPORTS

The value of Atlantic HMS exports is dominated nationally by tuna products. U.S. trade data collected for most Atlantic HMS combine products from both the Atlantic and Pacific Ocean, which are not identified by area of catch. Therefore, Atlantic-specific trade trends for those species cannot be accurately determined. However, for swordfish, bluefin tuna, and frozen bigeye tuna, data from international trade-tracking consignment document programs can be used to differentiate area of catch, and determine the amount of product originating from the Atlantic.

Swordfish

The low cost and year-round availability of swordfish imports into the United States are believed to have reduced the marketability of U.S. domestic swordfish. A modest export market for U.S. swordfish product exists, but total exports have been decreasing with minor fluctuations since the start of the time series (2010). U.S. exports of swordfish were 252 mt in 2010 and 67 mt in 2020 (NOAA Fisheries 2022). The total amount of imported and exported swordfish is shown in Table 4.17 along with domestic landings for reference.

Table 4.17. Total imports, exports, and domestic landings of swordfish products, 2010-2020

Year	Swordfish Products Imports (mt)	Swordfish Products Exports (mt)	Domestic Landings (mt)
2010	7,939	252	2,412
2011	9,258	269	2,774
2012	8,993	168	3,610
2013	8,093	196	2,944
2014	9,442	156	1,962
2015	10,890	148	1,718
2016	10,367	140	1,498
2017	11,150	102	1,377
2018	11,684	166	1,275
2019	10,456	107	1,758
2020	8,163	67	1,498

Source: U.S. Census Bureau and NOAA Fisheries 2022.

Imports of yellowfin and bigeye tuna have been somewhat steady since 2010 with a noticeable decrease in 2020. Landings and exports of both species have fluctuated over the timeframe. The total amount of imported and exported yellowfin and bigeye tuna is shown in Table 4.18 along with domestic landings for reference.

Table 4.18. Total imports, exports, and domestic landings of yellowfin and bigeye tuna products, 2010-2020

Year	Yellowfin			Bigeye		
	Yellowfin Imports (mt)	Yellowfin Exports (mt)	Yellowfin Domestic Landings (mt)	Bigeye Imports (mt)	Bigeye Exports (mt)	Bigeye Domestic Landings (mt)
2010	18,062	281	2,482	4,340	179	571
2011	18,033	334	3,010	3,498	243	719
2012	17,905	846	4,100	4,304	679	867
2013	18,633	848	2,332	4,521	172	880

Year	Yellowfin			Bigeye		
	Yellowfin Imports (mt)	Yellowfin Exports (mt)	Yellowfin Domestic Landings (mt)	Bigeye Imports (mt)	Bigeye Exports (mt)	Bigeye Domestic Landings (mt)
2014	18,183	886	3,197	4,465	73	896
2015	18,189	847	2,798	5,029	39	1,082
2016	19,757	483	4,104	4,253	43	568
2017	19,663	1,814	4,444	4,070	331	836
2018	20,127	1,474	2,720	3,435	164	921
2019	19,695	900	2,625	4,974	64	831
2020	14,604	1,737	3,664	1,942	13	817

Source: U.S. Census Bureau and NOAA Fisheries 2022.

Sharks

The Atlantic Shark Fishery Review (SHARE) includes a detailed description of the fishery, and economic data. Overall, shark products account for a small portion of HMS exports and imports, and an even smaller portion of overall seafood products. Shark fins account for the lowest amount of HMS exports or imports. Given how few shark products the United States contributes to the global market, domestic shark regulations that create barriers and restrictions on the import or export of shark products, especially state shark fin bans, have little to no impact on the global market (NOAA Fisheries 2021a).

4.9 Atlantic HMS Recreational Fisheries

While this Amendment would not change any regulatory requirements for recreational fishermen, because recreational fishermen could be affected by shifting commercial effort into areas that are open to recreational fishing and not longline fishing, it is important to understand recreational fishing activities' impact on the environment. Atlantic HMS recreational fishing provides significant recreational opportunities and positive economic impacts to coastal communities derived from individual angler expenditures, recreational charters, tournaments, and the shoreside businesses that support those activities. The three principal types of Atlantic HMS recreational fisheries are angling from privately owned vessels, charter/headboat fishing, and tournaments. A brief description of each follows, including the number of participants and economic information.

4.9.1 Recreational Angling – Private Vessels

The HMS Angling permit is required to recreationally fish for, retain, or possess any federally regulated Atlantic HMS from a privately owned vessel (i.e., not a chartered trip). This requirement includes catch-and-release fishing. The permit does not authorize the sale or transfer of HMS to any person for a commercial purpose. Starting in 2018, vessel owners issued an HMS Angling permit intending to fish for sharks were required to obtain a shark endorsement. HMS Angling permit distribution among states is shown Table 4.19 and in Figure 4.4. In 2021 there were 23,632 HMS Angling permits issued.

Table 4.19. Number of HMS Angling Permits by State or County in 2021[1]

State/County	Permits by Home Port[2]	Permits by Residence[3]	State/County	Permits by Home Port[2]	Permits by Residence[3]
Alaska	3	1	Montana	-	4
Alabama	411	386	Nebraska	-	2
Arkansas	11	14	North Carolina	1,411	1,333
Arizona	1	4	New Hampshire	274	314
California	5	14	New Jersey	4,197	3,735
Colorado	3	14	New Mexico	-	2
Connecticut	984	1,058	Nevada	3	1
District of Columbia	2	7	New York	2,735	2,811
Delaware	905	626	Ohio	12	28
Florida	4,402	4,071	Oklahoma	10	115
Georgia	94	172	Oregon	2	-
Hawaii	1	-	Pennsylvania	200	1,136
Iowa	-	2	Puerto Rico	315	321
Idaho	-	2	Rhode Island	833	590
Illinois	9	21	South Carolina	496	478
Indiana	3	13	South Dakota	1	3
Kansas	3	8	Tennessee	23	42
Kentucky	6	11	Texas	569	623
Louisiana	488	479	Utah	1	2
Massachusetts	2,566	2,604	Virginia	808	877
Maryland	1,152	1,091	U.S. Virgin Islands	18	9
Maine	450	391	Vermont	17	29
Michigan	25	36	Washington	4	6
Minnesota	2	8	Wisconsin	7	17
Missouri	11	19	West Virginia	7	13
Mississippi	146	172	Canada	4	2
			Not Reported		14
2021 Total					23,632

[1]As of October 2021. [2]The vessel port or other storage location.[3] The permit holder's billing address. Source: 2021 HMS SAFE Report (NOAA Fisheries 2022).

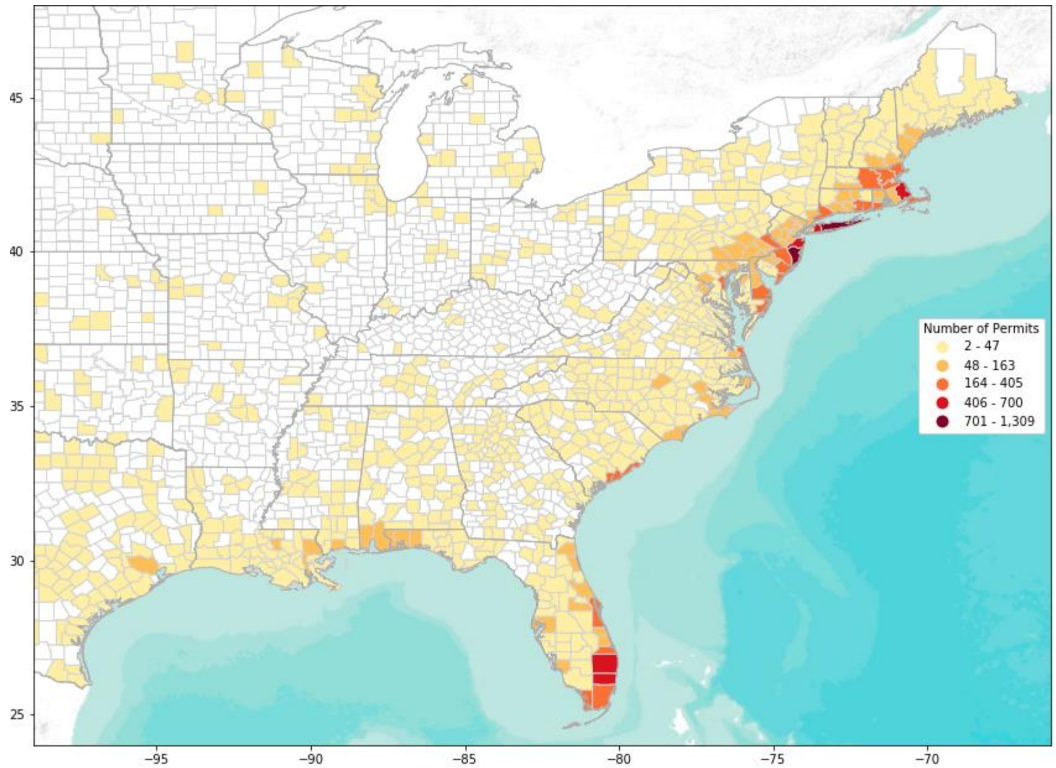

Figure 4.4. Distribution of Atlantic Highly Migratory Species Angling Category Permits as of October 2021

Recreational Catch – Private Vessels

Recreational fishermen target various Atlantic HMS using a variety of handgear: rod and reel, handline, and speargun. HMS Angling and HMS Charter/Headboat permit holders are required to report all non-tournament recreational swordfish and billfish landings, as well as bluefin tuna landings and dead discards, within 24 hours of the landings or end of each trip through an online catch reporting system, a smartphone app, or phone number. In Maryland and North Carolina, vessel owners are required to report their billfish, bluefin tuna, and some shark landings through the submission of catch cards at state operated landings stations. More information is available on the NOAA Fisheries catch reporting website. These reports are in addition to any information submitted by federally permitted dealers.

Each of the following data tables contain estimates of total harvest derived from multiple data sources, some survey based (i.e., Marine Recreational Information Program, Large Pelagics Survey (LPS), Louisiana Creel survey ("LA Creel"), Texas Parks and Wildlife Survey, and Southeast Regional Headboat Survey), and some census based (Automated Tournament Reporting, Automated Landings Reporting System, Maryland and North Carolina Catch Cards). Note that survey-based estimates include estimates of precision (i.e., statistical variance) that allow for the calculation of percent standard errors (PSEs) and confidence intervals, while census-based count data do not. Estimates of PSEs are not included in the following tables because it is computationally difficult to combine variance estimates across surveys using different sampling designs, and impossible to do so between surveys and census-based approaches. As a rule, surveys like the LPS generate lower estimates of variance for Atlantic HMS species because they survey a more targeted audience of offshore anglers while MRIP surveys target anglers fishing for all saltwater fish species. Within any given survey, variance estimates will also be consistently lower for species that are more commonly caught and observed (i.e., higher sample sizes) such as yellowfin tuna, Atlantic sharpnose sharks, bonnethead sharks, shortfin mako sharks, and blacktip sharks than for species that are less commonly caught and observed.

Tuna and swordfish landings for Atlantic HMS recreational rod and reel fisheries from 2016 through 2020 are presented in Table 4.20.

Table 4.20. Domestic landings (mt ww) for the Atlantic tunas and swordfish recreational rod and reel fishery, 2016 to 2020.

Species	Region	2016	2017	2018	2019	2020
Bluefin tuna*	Northwest Atlantic	143.7	140.1	112.5	179.9	192.6
	Gulf of Mexico	1.7	1.7	1.6	1.9	0
	Total	145.4	141.8	114.1	181.8	192.6
Bigeye tuna**	Northwest Atlantic	170.5	259.7	493.9	204.9	278.1
	Gulf of Mexico	0.2	0	0.7	30.6	19.9
	Caribbean	0	0	0	0	0
	Total	170.7	259.7	494.6	235.5	298.0
Albacore**	Northwest Atlantic	41.4	27.5	8.9	29.5	45.0
	Gulf of Mexico and Caribbean	1.2	0	0	0	0
	Total	42.6	27.5	8.9	29.5	45.0
Yellowfin tuna**	Northwest Atlantic	1,936.2	2,427.4	1,463.9	1,446.7	2,374.0
	Gulf of Mexico	776.3	463.8	306.3	254.8	433.6
	Caribbean	30.3	13.2	0.0	0	0
	Total	2,742.7	2,904.4	1,770.2	1,701.5	2,807.6
Skipjack tuna**	Northwest Atlantic	130.1	80.9	63.5	34.6	59.9
	Gulf of Mexico	34.0	113.2	12.6	7.5	7.1
	Caribbean	11.4	1.0	0	0	0
	Total	175.5	195.1	76.1	42.1	67.0
Swordfish	Total	45.8	33.8	36.2	87.7	52.5

mt ww = Metric tons whole weight. *Rod and reel catch and landings estimates of bluefin tuna < 73 inches curved fork length are based on statistical surveys of the U.S. recreational harvesting sector. **Rod and reel catches and landings for Atlantic tunas represent estimates of landings and dead discards based on statistical surveys of the U.S. recreational harvesting sector. Source: NOAA Fisheries 2022.

Table 4.21 provides a summary of reported billfish and swordfish landings from 2016 through 2020. Due to the rare nature of billfish encounters and the difficulty of monitoring landings outside of tournament events, reports of recreational billfish landings are sparse. However, Automated Tournament Reporting (ATR) provides a preliminary source for analyzing recreational billfish tournament landings. Recreational report totals are developed from analysis of multiple datasets, including an Automated Landings Reporting

System, LPS, Maryland and North Carolina catch cards, ATR, and MRIP. These datasets include tournament data, non-tournament data, or both.

In 2012, NOAA Fisheries established a new accounting protocol that analyzes tournament and non-tournament landings reports of billfishes using all available programs (see sources in Table 5.34). The "Total landings of marlin and roundscale spearfish" by year and "Balance remaining from 250 limit" rows reflect the U.S. landings limits established at ICCAT. Under ICCAT Recommendation 19-05, and as specified in Section 635.27(d)(1), the U.S. recreational marlin fishery is limited to a maximum of 250 combined Atlantic blue and white marlin landings per year. Roundscale spearfish is included in this count. Sailfish and swordfish are presented underneath the ICCAT accounting rows and do not count towards the 250-marlin limit. The number of registered tournaments and reported tournament landings by state are shown in Table 4.21.

Table 4.21. Atlantic HMS recreational swordfish and billfish landings in numbers of fish, 2016 - 2020

Species	Reporting	2016	2017	2018	2019	2020
Swordfish	Tournament[1]	42	50	42	62	68
	Non-tournament[2]	458	518	619	1,234	872
	Total	500	568	661	1,296	940
Sailfish	Tournament[1]	0	1	4	14	0
	Non-tournament[2]	114	104	94	96	50
	Total	114	105	98	110	50
Blue marlin	Tournament[1]	63	45	75	51	52
	Non-tournament[2]	17	17	15	28	22
	Total	80	62	90	79	74
White marlin	Tournament[1]	46	50	51	44	76
	Non-tournament[2]	14	11	27	31	19
	Total	60	61	78	75	95
Roundscale spearfish	Tournament[1]	21	6	20	33	66
	Non-tournament[2]	1	0	0	2	0
	Total	23	6	20	35	66
Total marlin & Roundscale spearfish		162	129	188	189	235
Balance remaining from 250 limit[3]		88	121	62	61	15

[1]ATR and Reporting, Maryland and North Carolina HMS catch cards, LPS, and MRIP; [2]Automated Landings Reporting System, Maryland and North Carolina HMS catch cards, LPS, and Marine Recreational Information Program; [3] Marlin and roundscale spearfish limit. Source 2021 HMS SAFE Report (NOAA Fisheries 2022).

Recreational Economic Information – Private Vessels

In 2014, NOAA Fisheries conducted a partial update of the National Marine Recreational Fishing Expenditure Survey that collected data on marine angler expenditures for fishing equipment and durable goods related to recreational fishing (e.g., boats, vehicles, tackle, electronics, second homes). This survey covered Atlantic HMS anglers from Maine to Texas. Atlantic HMS anglers in the Northeast, from Maine to Virginia, were found to spend

$12,913 on average for durable goods and services related to marine recreational fishing. Of that, $5,284 could be attributed to Atlantic HMS angling, based on their ratio of Atlantic HMS trips to total marine angling trips. The largest expenditure items for marine angler durable goods among HMS anglers in this Northeast region were for new boats ($3,305), used boats ($2,835), boat maintenance ($1,532), and boat storage ($1,486). Atlantic HMS anglers in the Northeast were estimated to have spent a total of $61 million on durable goods for Atlantic HMS angling, which in turn was estimated to generate $73 million in economic output and support 697 regional jobs in 2014 (Lovell et al. 2016).

Atlantic HMS anglers from North Carolina to Texas were found to spend $29,532 on average for durable goods and services related to marine recreational fishing. Of that, $15,296 could be attributed to Atlantic HMS angling, based on their ratio of HMS trips to total marine angling trips. The largest expenditures items for marine angler durable goods among Atlantic HMS anglers in this Southeast region were for new boats ($8,954), used boats ($6,579), boat maintenance ($3,028), boat storage ($1,813), and rods and reels ($1,608). Atlantic HMS anglers were estimated to have spent a total of $108 million on durable goods for Atlantic HMS angling. These expenditures in turn were estimated to generate $152 million in economic output and support 1,331 regional jobs in 2014 (Lovell et al. 2016). An updated durable goods expenditures survey of HMS Angling permit holders from Maine to Texas was conducted in the fall of 2019.

In 2015, researchers with the Virginia Institute of Marine Sciences funded by NOAA Fisheries conducted a survey of HMS Angling permit holders from Maine to North Carolina to estimate the economic value of recreational bluefin tuna fishing (Goldsmith et al. 2018). Survey participants were presented with examples of hypothetical fishing trips that varied by the size of bluefin tuna caught, bag limit regulations, and trip costs. They found the overall average willingness-to-pay amount for a bluefin tuna trip to be $1,285 per angler trip. Increasing the bag limit by one school-sized bluefin tuna increased the willingness-to-pay by approximately $160, while increasing the bag limit by a large school/small medium or large medium/giant bluefin tuna increased the willingness-to-pay amount by approximately $289–360 per angler trip. Overall, the 2015 bluefin tuna private boat fishery was estimated to have a value of $14 million in addition to the angling expenditures of $8.7 million.

In 2016, NOAA Fisheries conducted another update to the National Marine Recreational Fishing Expenditure Survey to collect national level data on trip expenditures related to marine recreational fishing and estimate the associated economic impact (NOAA Fisheries 2018). Nationally, marine anglers were estimated to have spent $4.3 billion on trip related expenses (e.g., fuel, ice, bait) and $26.6 billion on fishing equipment and durable goods (i.e., fishing rods, tackle, and boats). Using regional input-output models, these expenditures were estimated to have generated $67.9 billion in total economic impacts and supported 472,000 jobs in the United States in 2016.

This survey also included a separate survey of HMS Angling permit holders from Maine to Texas (Hutt and Silva 2019). Estimated non-tournament trip-related expenditures and the resulting economic impacts for Atlantic HMS recreational fishing trips are presented in Table 4.22. For the Atlantic HMS Angler Expenditure Survey, randomly selected HMS Angling permit holders were surveyed every two months and asked to provide data on the most recent non-tournament related fishing trip in which they targeted Atlantic HMS. Anglers were asked to identify the primary Atlantic HMS they targeted and their expenditures related to the trip. Of the 1,806 Atlantic HMS anglers who returned a survey, 63 percent indicated their primary target on their most recent private boat trip was either bluefin tuna, yellowfin tuna, bigeye tuna, or albacore tuna, or they simply indicated they had fished for tuna in general without identifying a specific species. Of the rest of those surveyed, 14 percent reported trips targeting billfish (i.e., blue marlin, white marlin, or sailfish), 12 percent reported trips targeting shark (i.e., shortfin mako shark, thresher shark, or blacktip shark), 6 percent reported trips targeting swordfish, and 5.6 percent reported trips that did not target Atlantic HMS or failed to indicate what species they targeted. Average trip expenditures ranged from $623/trip for shark trips to $1,015/trip for billfish trips. Boat fuel was the largest trip-related expenditure for all Atlantic HMS trips and made up about 56 percent of average trip costs overall. Total trip-related expenditures for 2016 were calculated by expanding average trip-related expenditures with estimates of total directed boat trips per region from the LPS and MRIP survey. Total expenditures were then divided among the appropriate economic sectors and entered into an input-output model to estimate total economic output and employment supported by the expenditures within coastal states from Maine to Texas. Overall, $46.7 million of Atlantic HMS angling trip-related expenditures generated approximately $103 million in economic output, $30.5 million in household income, and $54.8 million in value-added impacts. The expenditures also supported 577 full-time jobs from Maine to Texas in 2016. An update to the Atlantic HMS Angler Expenditure Survey was conducted in 2022 and data will be analyzed following collection.

Table 4.22. Recreational angler expenditure survey results of estimated non-tournament expenditures and economic contributions, regionally, and nationally in 2016

Region	Average Trip Expenditures	Total Atlantic HMS Trips[1]	Total Expenditures	Jobs	Total Sales Output[2]
New England	$502	10,132	$5,172,293	37	$4,867,047
Mid-Atlantic	$678	15,753	$10,676,438	75	$10,891,525
South Atlantic	$680	30,149	$20,498,004	187	$21,427,876
Gulf of Mexico	$821	12,254	$10,055,265	105	$16,979,295
Total U.S.	$682	68,468	$46,675,320	577	$103,372,357

[1]Atlantic HMS-directed non-tournament angling trips were estimated in New England and the Mid-Atlantic using data from the LPS, in the South Atlantic using the Marine Recreational Information Program, and in the Gulf of Mexico using data from MRIP, the Louisiana Recreational Creel survey, and the Texas Parks and Wildlife Division. [2]Total sales output represents all business sales within the regional economy supported by Atlantic HMS trip-related expenditures, either through direct expenditures by Atlantic HMS anglers, indirect expenditures by supported business, or household expenditures by individuals whose employment and income is supported by the above expenditures. Source: LPS; MRIP; LA Creel; Texas Parks and Wildlife Division.

4.9.2 Tournaments

An Atlantic HMS tournament is defined at 50 CFR 635.2 as any fishing competition involving Atlantic HMS in which participants must register or otherwise enter or in which a prize or award is offered for catching or landing such fish. Atlantic HMS tournaments vary by size and are conducted from ports along the U.S. Atlantic coast, Gulf of Mexico, and U.S. Caribbean. They may range from relatively small "members-only" club events with as few as 10 participating boats (40–60 anglers) to larger, statewide tournaments with 250 or more participating vessels (1,000–1,500 anglers). Larger tournaments often involve corporate sponsorship from tackle manufacturers, marinas, boat dealers, marine suppliers, beverage distributors, resorts, radio stations, publications, chambers of commerce, restaurants, and other local businesses. It is estimated that Atlantic HMS tournaments support approximately 1,000 jobs and over $130 million in total economic output, according to data from the Atlantic HMS Tournament Economic Study (2016).

Since 1999, federal regulations have required that tournaments register with NOAA Fisheries at least four weeks prior to the start of tournament fishing activities. Some foreign tournaments (i.e., those held outside of U.S. waters) voluntarily register with NOAA Fisheries because many of their participants are U.S. citizens. Tournament registration information and forms are available at highly-migratory-species/atlantic-highly-migratory-species-tournaments.

The number of Atlantic HMS tournaments registered from 2016 through 2021 is summarized in Figure 4.5. Since 2016, an average of 252 Atlantic HMS tournaments have registered each year. The number of Atlantic HMS tournaments registered as of September 2021, is below that average at 209 tournaments.

Tournament landings of billfishes and swordfish are presented below in Table 4.23.

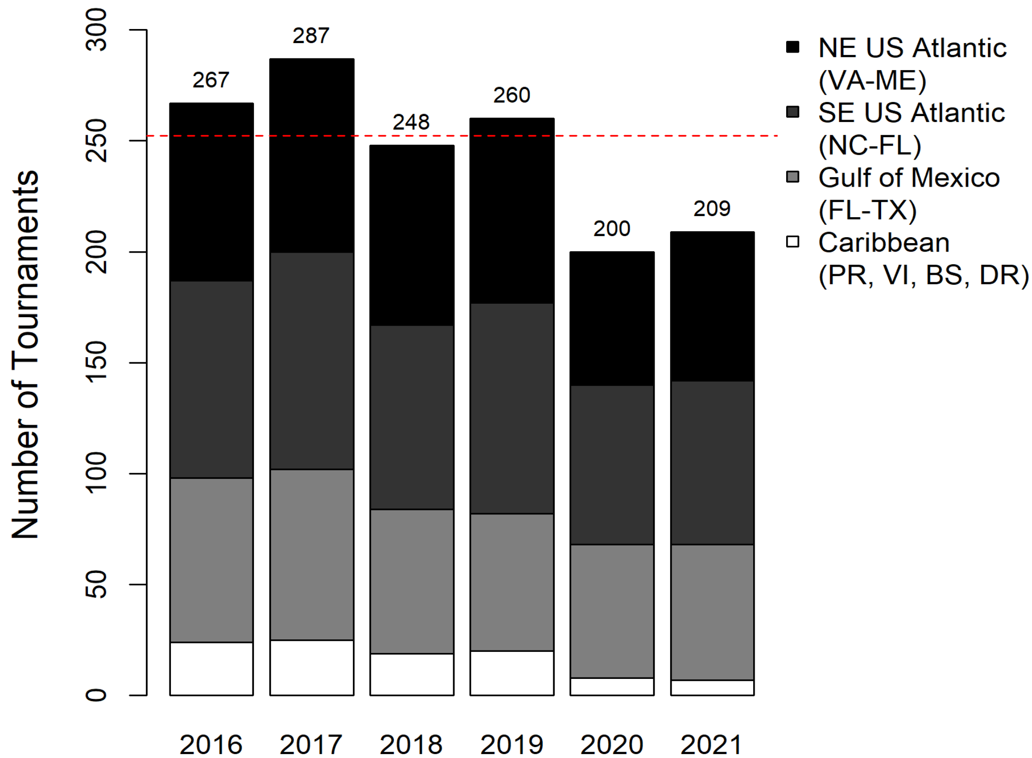

Figure 4.5. Annual number of registered Atlantic highly migratory species tournaments by region, 2016 – 2021 (as of September 2021). 2021 data are considered preliminary and do not represent a complete year. Source: Atlantic Tournament Registration and Reporting database.

Table 4.23. Tournaments and numbers of billfishes and swordfish kept by state/territory in 2020

State	Tournaments	White marlin	Blue marlin	Sailfish	Roundscale Spearfish	Swordfish
New York	35	0	0	0	0	0
New Jersey	21	37	4	0	0	3
Maryland	17	39	3	0	66	34
Massachusetts	8	0	0	0	0	2
Alabama	45	0	7	0	0	0
Virginia	4	0	1	0	0	6
North Carolina	15	0	16	0	0	0
South Carolina	7	0	0	0	0	0
Florida	60	0	14	10	0	12
Mississippi	5	0	0	0	0	0
Louisiana	20	0	5	0	0	8
Texas	18	0	2	10	0	0
Puerto Rico	3	0	0	0	0	0

Notes: Some states have been excluded to protect tournament reporting privacy. These states include Maine, Rhode Island, Delaware, and Georgia, as well as the U.S. Virgin Islands. Five registered tournaments were held outside the United States (data not shown). Source: Atlantic Tournament Registration and Reporting.

On January 1, 2019, NOAA Fisheries announced that all Atlantic HMS tournaments are required to report tournament catch and effort data to NOAA Fisheries within seven days of the tournament's conclusion. Prior to that announcement, only Atlantic billfish and swordfish tournaments were required to report due to limited resources for data collection. The data collected are used to estimate the total annual catch of Atlantic HMS and the impact of tournament operations in relation to other types of fishing activities. Selecting all Atlantic HMS tournaments for reporting provides NOAA Fisheries with additional information that improves domestic fishery management decision making and augments data reporting for species managed by ICCAT. Improved tournament data on recreational tuna fisheries is especially important when the United States negotiates catch limits and quota shares internationally. Several ICCAT shark recommendations, including Recommendation 19-06 on shortfin mako sharks, recognize the need for parties to strengthen their monitoring and data collection efforts, and while the United States has longstanding recreational data collection programs, the expanded tournament reporting requirement contributes to improved U.S. recreational shark data. Anglers fishing from an Atlantic HMS-permitted vessel in any tournament awarding points or prizes for Atlantic billfish are required to deploy only non-offset circle hooks when using natural bait or natural bait/artificial lure combinations. The use of non-offset circle hooks increases the likelihood of post-release survival for billfish.

Table 4.24 provides the total number of Atlantic HMS tournaments from 2016 through 2021 that registered to award points or prizes for the catch or landing of each Atlantic HMS. Marlin, sailfish, and yellowfin tuna continue to be the most sought-after species.

A significant number of blue marlin, white marlin, and sailfish tournaments are "catch-and-release fishing only," utilizing observers, angler affidavits, polygraph tests, photographs, or digital video camcorders to document the live release of billfish. All billfish tournaments must report all caught fish, including numbers of released fish, to the ATR system. This was previously reported to the Recreational Billfish Survey.

Table 4.24. Number of HMS tournaments by targeted species, 2016-2021*

Species	2016	2017	2018	2019	2020	2021
Blue marlin	157	174	148	145	130	131
White marlin	143	165	135	128	117	118
Longbill spearfish	55	65	37	38	25	40
Roundscale spearfish	45	102	72	59	54	33
Sailfish	153	175	143	146	123	121
Swordfish	71	81	73	78	75	68
Bluefin tuna	98	87	103	87	71	74
Bigeye tuna	78	96	95	96	82	83
Albacore tuna	41	57	50	47	30	35
Yellowfin tuna	171	183	159	158	139	150
Skipjack tuna	41	56	54	54	32	34

Species	2016	2017	2018	2019	2020	2021
Smoothhound sharks[1]	0	0	3	9	3	1
Small coastal sharks	12	17	9	9	7	2
Large coastal sharks	27	23	18	29	22	21
Pelagic sharks	72	75	57	55	28	34

Note: Tournaments may be represented more than once if registration included more than one highly migratory species. *As of September 2021. [1]Smoothhound sharks includes smooth dogfish, Florida smoothhound, and Gulf smoothhound. Smoothhound shark quota monitoring became effective March 15, 2016 (80 FR 73128; November 24, 2015). Source: Atlantic Tournament Registration and Reporting database.

4.9.3 Charter and Party Boat Operations

Operators of vessels taking passengers for hire to fish for HMS species must have an HMS Charter/Headboat permit. The HMS Charter/Headboat permit authorizes recreational fishing for all Atlantic HMS. It also allows for the sale of Atlantic tunas and swordfish when combined with a commercial sale endorsement. Swordfish can only be sold on non-for-hire trips. Those vessels with a commercial sale endorsement are required to abide by the U.S. Coast Guard (USCG) commercial fishing vessel safety requirements. Starting in 2018, vessel owners issued an HMS Charter/Headboat permit who intend to fish for sharks are also required to obtain a shark endorsement. Table 4.25 shows the number of HMS Charter/Headboat permits by state in 2021.

Table 4.25. Number of charter/headboat permits by state in 2020 and 2021*

State	Permits Issued	State	Permits Issued
Maine	119	Georgia	23
New Hampshire	95	Florida	782
Massachusetts	791	Alabama	60
Rhode Island	163	Mississippi	18
Connecticut	92	Louisiana	84
New York	367	Texas	97
Pennsylvania	4	Puerto Rico	17
New Jersey	407	U.S. Virgin Islands	13
Delaware	73	North Dakota	1
Maryland	132	California	1
Virginia	83	Montana	1
North Carolina	386	Minnesota	1
South Carolina	142	Michigan	3
2021 Total*			4,055

Note: Number of permits and permit holders in each category and state is subject to change as permits are renewed or expire. *As of October 2021. Source: 2021 HMS SAFE Report (NOAA Fisheries 2022).

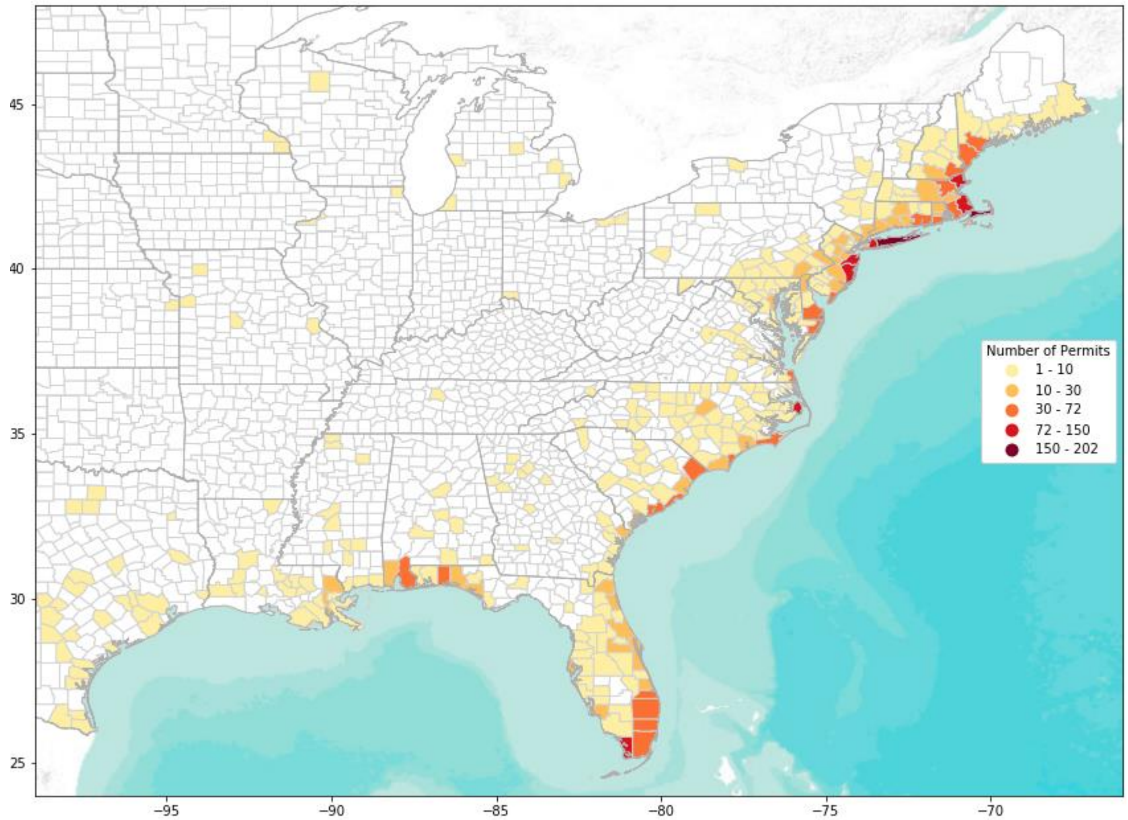

Figure 4.6. Distribution of Atlantic highly migratory species charter/headboat category permits as of October 2021

At the end of 2004 and 2012, NOAA Fisheries collected market information regarding advertised charter boat rates. The analysis of these data focused on advertised rates for full-day charters. Full-day charters vary in length from 6 to 14 hours, with a typical trip being 10 hours. The average price for a full-day boat charter was $1,053 in 2004 and $1,200 in 2012. Sutton et al. (1999) surveyed charter boats throughout Alabama, Mississippi, Louisiana, and Texas in 1998 and found the average charter boat base fee to be $762 for a full-day trip. Holland et al. (1999) conducted a similar study on charter boats in Florida, Georgia, South Carolina, and North Carolina and found the average fee for full-day trips to be $554, $562, $661, and $701, respectively. Comparing these two studies conducted in the late 1990s to the average advertised daily Atlantic HMS charter boat rate in 2004 and 2012, it is apparent that there has been a significant increase in charter boat rates.

In 2013, NOAA Fisheries executed a logbook study to collect cost and earnings data on charter boat and headboat trips targeting Atlantic HMS throughout Maine to Texas (Hutt and Silva 2015). The Atlantic HMS Cost and Earning Survey commenced in July 2013 and ended in November 2013. Data from the survey indicate that 47 percent of HMS Charter/Headboat permit holders who responded to the survey did not plan to take for-hire trips to target Atlantic HMS from July through November 2013.

The study revealed that the HMS most commonly targeted by charter boats included yellowfin tuna (45 percent), sailfish (37 percent), marlin (32 percent), and coastal sharks (32 percent). The reported percentages add to greater than 100 percent as most Atlantic HMS for-hire trips targeted multiple species. This was especially apparent for trips targeting tuna or billfish species as the majority of these trips reported targeting at least two other species. The exception was HMS trips targeting coastal sharks with only 5 percent or fewer of charter boats reporting targeting other species.

Of the 19 headboat trips that reported targeting coastal sharks, none reported targeting any other species. The Atlantic HMS most commonly targeted by headboats were bigeye tuna (45 percent), yellowfin tuna (37 percent), swordfish (34 percent), and coastal sharks (33 percent). In the North Atlantic region, the two Atlantic HMS most commonly targeted on both charter boat and headboat trips were yellowfin tuna (57 and 100 percent, respectively) and bigeye tuna (48 and 100 percent, respectively). The third most commonly targeted Atlantic HMS in the North Atlantic on charter boat trips were bluefin tuna (35 percent), which was not targeted on any reported headboat trips. Atlantic HMS charters in the South Atlantic were most likely to report targeting sailfish (56 percent), yellowfin tuna (44 percent), and marlins (40 percent). In the Gulf of Mexico, Atlantic HMS charter boats and headboats were most likely to report targeting coastal sharks (64 and 48 percent, respectively), yellowfin tuna (35 and 53 percent respectively), and marlins (23 and 30 percent, respectively).

In the Northeast, the average net return per Atlantic HMS charter boat trip was $969 (Table 4.26). Inflows from charter fees averaged $2,450 per trip. Northeast charter boat trips averaged $1,229 in material costs, with their greatest material expenditures being for fuel ($966) and bait ($129). In the Southeast, the average net return per Atlantic HMS charter boat trip was $534. Inflows from charter fees averaged $1,223 per trip.

Southeast charter boat trips averaged $496 in material costs, with their greatest material expenditures being for fuel ($376) and bait ($46). The lower costs and revenues reported for this region were likely due to the fact that only one overnight trip was reported in the Southeast for the survey. In the Gulf of Mexico, the average net return per Atlantic HMS charter boat trip was $1,028. Inflows from charter fees averaged $2,111 per trip. Gulf of Mexico charter boat trips averaged $858 in material costs, with their greatest material expenditures being for fuel ($631) and bait ($70).

Table 4.26. Average expenditures and revenues for charter boat trips by region in 2013

Type	**Expenditures per trip**	**Northeast Region**	**Southeast Region**	**Gulf of Mexico**
Outflow	Material costs	$1,228.62	$495.66	$857.56
	Fuel costs	$966.79	$376.32	$631.03
	Fuel price	$3.96	$3.74	$3.64
	Gallons used	244.14 gal	100.62 gal	173.36 gal
	Bait costs	$129.05	$45.76	$69.99
	Tackle costs	$61.01	$37.74	$58.22

Type	Expenditures per trip	Northeast Region	Southeast Region	Gulf of Mexico
	Ice costs	$56.28	$13.52	$42.95
	Other costs	$15.49	$22.32	$55.37
Payouts	Captain	$109.16	$101.56	$111.34
	Crew	$144.11	$97.42	$114.13
Inflow	Total fare	$2,450.40	$1,223.02	$2,111.44
	Daily fare	$1,791.67	$1,201.55	$1,422.19
Net return	Net return	$968.51	$528.38	$1,028.41

Note: The Northeast region, with 95 responses, includes states from Maine to Virginia. The Southeast region, with 297 responses, includes states from North Carolina to the east coast of Florida. The Gulf of Mexico, with 86 responses, includes states from the west coast of Florida to Texas. Source: Hutt and Silva 2015.

In the Northeast, LPS estimated there were 4,936 charter trips from July through November 2013 that targeted Atlantic HMS (Table 4.27). Extrapolating the average gross revenue per Atlantic HMS trip in the Northeast resulted in an estimate of $12.1 million in gross revenue for the same period. Of that gross revenue, $7.3 million went toward covering trip expenditures (e.g., fuel, bait, ice, crew), and $4.8 million went to owner net return and other annual operation costs. An input-output analysis in the economic impact assessment software IMPLAN (Minnesota IMPLAN 2010) estimated that these expenditures generated $31.9 million in total economic output, $8.0 million in labor income, and 460 full- and part-time jobs (Table 4.28).

In the Southeast, MRIP estimated that there were 3,008 charter trips from July through November 2013 that targeted Atlantic HMS (Table 4.27). Extrapolating the average gross revenue per Atlantic HMS trip in the Southeast resulted in an estimate of $3.7 million in gross revenue from July through November 2013. Of that gross revenue, $2.1 million went toward covering trip expenditures (e.g., fuel, bait, ice, and crew), and $1.6 million went to owner net return and other annual operation costs. Analysis in IMPLAN estimated that these expenditures generated $10.6 million in total economic output, $2.9 million in labor income, and 243 full- and part-time jobs (Table 4.28).

In the Gulf of Mexico, excluding Texas, MRIP estimated that there were 1,505 charter trips from July through November 2013 that targeted Atlantic HMS (Table 4.27). Extrapolating the average gross revenue per Atlantic HMS trip in the Gulf of Mexico resulted in an estimate of $3.2 million in gross revenue for the same period. Of that gross revenue, $1.6 million went toward covering trip expenditures (e.g., fuel, bait, ice, crew), and $1.5 million went to owner net return and other annual operation costs. Analysis in IMPLAN estimated that these expenditures generated $8.8 million in total economic output, $2.2 million in labor income, and 428 full- and part-time jobs (Table 4.28).

Table 4.27. Total costs and earnings for HMS charter boats by region in July through November, 2013

Type	Expenditure	Northeast	Southeast	Gulf of Mexico[2]
Total # HMS Charter Trips[1]	n/a	4,936	3,008	1,505
Inflow (gross revenue)	n/a	$12,095,174	$3,678,938	$3,176,799
Outflow (expenses)	Fuel	$4,772,097	$1,131,996	$949,426
	Bait	$636,991	$137,996	$105,305
	Tackle	$301,145	$113,525	$87,596
	ice	$277,798	$40,669	$64,621
	Other	$76,459	$67,140	$83,308
	Hired captain	$538,814	$305,500	$167,518
	Crew/mates	$711,327	293,047	$171,716
Owner net return plus fixed costs	n/a	$4,780,544	$1,589,411	$1,547,309

[1]Charter boat trips that indicated Atlantic HMS were their primary or secondary target species. Excludes head boat trips.[2]The estimate of Atlantic HMS for-hire trips in the Gulf of Mexico does not include trips originating from Texas, as the state does not participate in the Marine Recreational Information Program survey. Source: Hutt and Silva 2015.

This study estimated 1,131 jobs were generated as a result of Atlantic HMS charter vessel operations during the study period Table 4.28. This number is a conservative estimate and does not include jobs created by additional travel expenditures generated by the Atlantic HMS anglers that charter Atlantic HMS for-hire vessels. Furthermore, most Atlantic HMS for-hire vessels also take out trips targeting other species, and these trips were not included in this study's analysis and are not reflected in the estimated employment figures.

Table 4.28. Estimated total expenditures and economic impacts generated by charter boat trip operations by region in July through November 2013

Region	Total Expenditures (x $1,000)	Employment	Labor Income (x $1,000)	Total Output (x $1,000)
Northeast	$12,095	460	$8,011	$31,929
Southeast	$3,679	243	$2,848	$10,587
Gulf of Mexico	$3,177	428	$2,226	$8,847
Total	$18,951	1,131	$13,085	$51,363

Source: Hutt and Silva, 2015

4.10 Bycatch and Protected Species

4.10.1 Bycatch Overview

This section summarizes information on Atlantic HMS fisheries bycatch, including fish species managed under the Magnuson-Stevens Act and protected species interactions addressed more specifically by other statutes. The HMS SAFE Report provides additional information on species protected under the MMPA, ESA, and the Migratory Bird Treaty Act, including a description of the Pelagic Longline Take Reduction Team, Take Reduction Plan, and measures to address protected species concerns. The interaction of seabirds and longline fisheries are also considered under the United States "National Plan of Action for Reducing the Incidental Catch of Seabirds in Longline Fisheries" (NPOA-Seabirds). The pelagic observer program, the primary tool used to monitor bycatch, is discussed in further detail in the HMS SAFE Report (e.g., observer coverage).

Bycatch in commercial and recreational fisheries has become an important issue for the fishing industry, resource managers, scientists, and the public. These interactions can result in death or injury to the discarded fish, and it is essential that this component of total fishing-related mortality be incorporated into fish stock assessments and evaluation of management measures. Bycatch precludes other more productive uses of fishery resources and decreases the efficiency of fishing operations. Although not all discarded fish die, bycatch can in some fisheries become a large source of mortality, which can slow the rebuilding of overfished stocks. Bycatch imposes direct and indirect costs on fishing operations by increasing sorting time and decreasing the amount of gear available to catch target species. Incidental catch concerns also apply to populations of marine mammals, sea turtles, seabirds, and other components of ecosystems which may be protected under other applicable laws and for which there are no commercial or recreational uses but for which existence values may be high.

There are benefits associated with the reduction of bycatch, including the reduction of uncertainty concerning total fishing-related mortality, which improves the ability to assess the status of stocks, to determine the appropriate relevant controls, and to ensure that overfishing levels are not exceeded. NOAA Fisheries also has an obligation to ensure that conservation and management measures shall, to the extent practicable, minimize bycatch and, to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

It is also important to consider the bycatch of HMS in fisheries that target other species as a source of mortality for HMS and to work with fishery participants and resource manager partners on an effective bycatch strategy to maintain sustainable fisheries. This strategy may include a combination of management measures in the domestic fishery, and if appropriate, multi-lateral measures recommended by international bodies such as ICCAT or coordination with Regional Fishery Management Councils or States. The bycatch in each fishery and effectiveness of bycatch reduction measures are summarized annually in the HMS SAFE Report. In 2021, NOAA Fisheries conducted a review of the Standardized Bycatch Reporting Methodology (SBRM) for HMS fisheries (Amendment 12) to verify continued compliance with the Magnuson-Stevens Act and SBRM regulations (NOAA Fisheries 2021b).

Bycatch Interactions and the Magnuson-Stevens Act

Under the Magnuson-Stevens Act, "bycatch" has a very specific meaning: "Fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards. Such term does not include fish released alive under a recreational catch and release fishery management program" (16 U.S.C. §1802(2)). Fish is defined as finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds (§1802(12). Birds and marine mammals are therefore not considered bycatch under the Magnuson-Stevens Act.

National Standard 9 of the Magnuson-Stevens Act requires that fishery conservation and management measures shall, to the extent practicable, minimize bycatch and, to the extent bycatch cannot be avoided, minimize the mortality of such bycatch (16 U.S.C. § 1851(a)(9)). For Atlantic HMS, National Standard 9 requirements in this regard have been addressed through conservation and management measures when adopted, in the 2006 Consolidated HMS FMP, and in each subsequent amendment, as appropriate. As explained in those actions, in many fisheries, it is not practicable to eliminate all bycatch and bycatch mortality. There are probably no HMS fisheries in which there is zero bycatch because none of the currently authorized fishing gears are perfectly selective for the target of each fishery (although the swordfish/tuna harpoon fishery and speargun fishery likely come closest due to the capacity for selective harvest).

Some relevant examples of fish caught in Atlantic HMS fisheries as bycatch or incidental catch include sea turtles, Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), smalltooth sawfish (*Pristis pectinata*), some sharks, billfish, and undersized fish; species for which there is little or no market such as blue sharks; species caught and released in excess of a bag limit; and prohibited species including those in the prohibited shark complex. **Error! Reference source not found.**Below is a list of some of the methods that are employed to reduce bycatch in the Atlantic HMS fisheries.

<u>Commercial</u>

1. Gear modifications (including hook and bait types).
2. Corrodible (non-stainless steel) circle hooks.
3. Weak hooks.
4. Time/area closures.
5. Performance standards.
6. Education/outreach.
7. Prohibiting retention of certain fish.
8. Use of de-hooking devices (mortality reduction only).
9. Handling and release requirements (e.g., in the pelagic longline fishery, sharks that are not retained must have less than 3 ft. of trailing gear attached to the hook when released).
10. Fleet communication and relocation protocols (e.g., vessels must move 1 mile and inform other vessels that dusky sharks are in the area after a dusky shark interaction).

<u>Recreational</u>

1. Use of corrodible (non-stainless steel) circle hooks (mortality reduction only).
2. Use of de-hooking devices (mortality reduction only).
3. Prohibiting retention of fish.
4. Catch and release programs.

5. Education/outreach.

A summary of bycatch species, data collection methods, and management measures by Atlantic HMS fishery/gear type is found in Table 4.29.

Table 4.29. Bycatch reduction methods in the Atlantic highly migratory species fisheries

Bycatch Reduction Method	Commercial Fisheries	Recreational Fisheries
Prohibiting retention of certain fish and size restrictions	X	X
Education and outreach, including mandatory trainings	X	X
Use of de-hooking devices (mortality reduction only)	X	X
Corrodible (non-stainless) steel hooks	X	X
Catch-and-release programs	X	X
Handling and release requirements	X	X
Gear modifications, including hook and bait types	X	X
Time/area closures	X	
Catch share program and electronic monitoring (video cameras)	X	
Performance standards	X	
Weak hooks	X	
Fleet communication and relocation protocols (e.g., vessels must move 1 mile and inform other vessels that dusky sharks are in the area after a ducky shark interaction	X	

There are benefits associated with the reduction of bycatch, including the reduction of uncertainty concerning total fishing-related mortality, which improves the ability to assess the status of stocks and to determine the appropriate relevant controls. It is also important to consider the bycatch of HMS in fisheries that target other species as a source of mortality for HMS and to work with fishery constituents and resource manager partners on an effective bycatch strategy to maintain sustainable fisheries. This strategy may include a combination of management measures in the domestic fishery and coordination with Regional Fishery Management Councils or States, and if appropriate, consideration of multilateral measures at international bodies such as ICCAT.

Marine Mammal Protection Act (MMPA)

The MMPA as amended is one of the principal federal statutes guiding marine mammal species protection and conservation policy. In 1994 amendments, Section 118 established the goal that the incidental mortality or serious injury of marine mammals occurring during the course of commercial fishing operations be reduced to insignificant levels, approaching a zero mortality rate goal and zero serious injury rate goal within seven years of enactment. In addition, the amendments established a three-part strategy to govern interactions between marine mammals and commercial fishing operations. These include the preparation of marine mammal stock assessment reports, a registration and marine mammal mortality monitoring program for certain commercial fisheries, and the preparation and implementation of take reduction plans. NOAA Fisheries uses Take

Reduction Teams (TRTs) to develop recommendations for measures to be included in take reduction plans and to monitor the implementation of those plans until NOAA Fisheries has determined that the goals have been met. Team members include representatives of relevant fisheries, conservation groups, the academic community, fishery management organizations, and involved federal and state agencies.

NOAA Fisheries relies on both fishery-dependent and fishery-independent data to produce stock assessments for marine mammals in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea. Draft stock assessment reports are typically published in January, and final reports are typically published in the fall. Stock assessment reports are available on the NOAA Fisheries marine mammal stock assessment website.

Under MMPA requirements, NOAA Fisheries produces an annual list of fisheries that identifies species with which Atlantic HMS fisheries interact and classifies domestic commercial fisheries by gear type relative to their rates of incidental mortality or serious injury to marine mammals. The final MMPA list of fisheries for 2022 became effective May 19, 2022 (87 FR 23122; April 19, 2022). Additional information and references to the current list of fisheries can be found on the MMPA list of fisheries website. Three classifications exist in the list of fisheries:

- Category I fisheries are those with frequent serious injury or mortality to marine mammals.
- Category II fisheries are those with occasional serious injury or mortality.
- Category III fisheries are those with a remote likelihood of serious injury or mortality to marine mammals.

The Atlantic Ocean, Caribbean and Gulf of Mexico pelagic longline fisheries are classified as Category I fisheries. The Southeastern Mid-Atlantic and Gulf of Mexico bottom longline fisheries are classified as category III. Recreational vessels are not categorized because they are not considered commercial fishing vessels. Owners of vessels or gear engaging in a Category I or II fishery are required under MMPA to register with NOAA Fisheries and accommodate an observer aboard their vessels if requested. Vessel owners or operators or fishermen in Category I, II, and III fisheries must report all incidental mortalities and serious injuries of marine mammals during the course of commercial fishing operations to NOAA Fisheries' Office of Protected Resources on the Mortality/Injury Reporting Form.

There are currently no regulations requiring recreational fishermen to report marine mammal interactions; however, voluntary reporting of injured, entangled, or stranded marine mammals to (877) 942-5343 is encouraged. Incidental take of marine mammals by recreational fishermen is illegal. NOAA Fisheries continues to monitor observed interactions with marine mammals on a quarterly basis and reviews data for appropriate action, as necessary.

Under Section 118 of MMPA, the Pelagic Longline Take Reduction Team (PLTRT) is charged with developing recommendations to reduce bycatch of pilot whales in the Atlantic pelagic longline fishery. NOAA Fisheries considered these recommendations and developed a take reduction plan (74 FR 23349; May 19, 2009) that became effective June 18, 2009.

NOAA Fisheries reconvened the Team in 2015 and 2016 to develop additional take reduction recommendations and meet the MMPA goal. On December 15, 2020, NOAA Fisheries published a proposed rule to amend the regulations for the PLTRP under the Marine Mammal Protection Act based on consensus recommendations by the PLTRT, which is a multi-stakeholder group comprised of representatives from the fishing industry, academia, and non-governmental organizations (85 FR 81168). The purpose of the proposed rule is to reduce mortalities and serious injuries of short-finned pilot whales incidental to Atlantic portion of the Atlantic pelagic longline fishery. A final rule to implement those measures is expected in 2023. More information is available on the PLTRT website.

There is also an Atlantic Large Whale Take Reduction Team (ALWTRT) that develops plans to mitigate the risk to large marine mammals, particularly right whales, posed by fishing gear, which focuses on gillnet and pot/trap gear. Regulations implementing the Plan can be found at 50 CFR 229.32 and include a number of measures that affect HMS fisheries, specifically gillnet fisheries, including closed and restricted areas. Currently the ALWTRT is reviewing the need for additional measures in gillnet fisheries along the coast to further reduce the mortality of right whales (*Eubalaena glacialis*). In addition to these take reduction teams, there is a Harbor Porpoise Take Reduction Plan and a Bottlenose Dolphin Take Reduction Plan that aim to reduce interactions between harbor porpoises and bottlenose dolphins with commercial gillnet gear.

Endangered Species Act (ESA)

The ESA as amended (16 U.S.C. 1531 et seq.) provides for the conservation and recovery of endangered and threatened species of fish, wildlife, and plants. The listing of a species is based on the status of the species throughout its range, or in a specific portion of its range in some instances. Threatened species are those likely to become endangered in the foreseeable future if no action is taken to stop the decline of the species, whereas endangered species are those in danger of becoming extinct throughout all or a significant portion of their range (16 U.S.C. 1532(20)). Species can be listed as endangered without first being listed as threatened. The Secretary of Commerce, acting through NOAA Fisheries, is authorized to list marine and anadromous fish species, marine mammals (except for walruses and sea otters), marine reptiles, and marine plants. In total, NOAA Fisheries has jurisdiction over 165 threatened and endangered marine species (NOAA ESA Species Directory). The Secretary of the Interior, acting through the U.S. Fish and Wildlife Service, is authorized to list walruses and sea otters, seabirds, terrestrial plants and wildlife, and freshwater fish and plant species.

In addition to listing species under the ESA, NOAA Fisheries or the U.S. Fish and Wildlife Service generally must designate critical habitat for listed species concurrently with the listing decision to the "maximum extent prudent and determinable" (16 U.S.C. 1533(a)(3)).

The ESA defines critical habitat as those specific areas that are occupied by the species at the time it is listed that are essential to the conservation of a listed species and that may be in need of special consideration, as well as those specific areas that are not occupied by the species that are essential to their conservation. Federal agencies are prohibited from undertaking actions that are likely to destroy or adversely modify designated critical habitat.

NOAA Fisheries has taken numerous steps to reduce sea turtle and other endangered species bycatch and bycatch mortality in the Atlantic HMS fisheries over the years. The details of these efforts are described in past SAFE reports and are not repeated here. On May 15, 2020, NOAA Fisheries released the latest BiOps conducted under Section 7 of the ESA for HMS pelagic longline and non-pelagic longline fisheries. These BiOps analyzed the best available data, the status of the species, environmental baseline, effects of the proposed action, and cumulative effects. The BiOps concluded that the Atlantic HMS fisheries were not likely to jeopardize the continued existence of sperm whales, the Northwest Atlantic distinct population segment (DPS) of loggerhead, Kemp's ridley (*Lepidochelys kempii*), the North and South Atlantic DPSs of green (*Chelonia mydas*), leatherback, hawksbill (*Eretmochelys imbricata*), or olive ridley sea turtles *(Lepidochelys olivacea*), Atlantic sturgeon, smalltooth sawfish, giant manta ray, the Central and Southwest Atlantic DPS of scalloped hammerhead shark, and oceanic whitetip shark. It determined that because no critical habitat will be adversely affected, the action is not likely to destroy or adversely modify designated critical habitat.

The BiOps also determined that the following Reasonable and Prudent Measures (RPMs) were necessary and appropriate to minimize the impacts of future takes on sea turtles and other ESA-listed fish and to monitor levels of incidental take. The HMS Management Division shall ensure that fishermen in the HMS fisheries receive relevant outreach materials and provide such materials describing how captured ESA-listed sea turtles and fish should be handled and how gear should be removed from ESA-listed sea turtles, fish, and marine mammals to minimize adverse effects from incidental take and reduce mortality. The HMS Management Division shall provide such training using materials provided by the SERO Protected Resources Division to fishermen. The HMS Management Division must also ensure that any takes of ESA-listed species are monitored and reported, coordinating with the SEFSC as necessary and appropriate. Such reports should allow the Agency to: (1) detect any adverse effects resulting from the proposed action; (2) assess the actual level of incidental take in comparison with the anticipated incidental take documented in this Opinion; (3) assess (for sea turtles) the hooking location and gear remaining on every sea turtle released to allow for post-release mortality estimations; and (4) detect when the level of anticipated take (lethal and non-lethal) is exceeded.

To be exempt from the take prohibitions established by Section 9 of the ESA, the BiOp requires compliance with specified terms and conditions, which implement the RPMs described above. The terms and conditions specify the types of outreach materials that must be provided to pelagic longline fishermen, levels of observer coverage, quarterly reporting of the total take and total mortalities (dead-on-retrieval and post-release mortality) of ESA-listed species in the Atlantic HMS fisheries, and annual reports detailing interactions between ESA-listed species and the Atlantic HMS fisheries. The 2020 Atlantic HMS fishery BiOps can be found at: HMS Pelagic Longline BiOp and HMS Non-Pelagic Longline BiOp.

In July 2022, the Office of Sustainable Fisheries, NOAA Fisheries, requested reinitiation of consultation on the effects of the Atlantic HMS pelagic longline fishery. Reinitiation of consultation on the pelagic longline fishery was requested due to new information on mortality of giant manta ray that exceeded the mortality anticipated in the 2020 BiOp on that fishery. The anticipated consultation will consider the effects of the 2006 Consolidated HMS FMP and relevant amendments, including Amendment 13 (described below), and relevant implementing regulations. Pending completion of consultation, the fishery continues to operate consistent with the RPMs and Terms and Conditions specified in the May 2020 BiOp, and NOAA Fisheries will continue to monitor any take of giant manta rays in the fishery. Actions within the scope of the May 2020 BiOp and consistent with the RPMs and Terms and Conditions are not likely to jeopardize the species during consultation, consistent with section 7(a)(2) of the ESA. Giant manta ray interactions with the Atlantic HMS pelagic longline fishery are low, with total takes estimated to be well below the levels of takes authorized under the ITS in the 2020 BiOp. In addition, the species is not thought to be in peril in the Atlantic, the level of potential mortalities is considered to be low, and extrapolated mortalities may overstate the fishery's effects on the species.

In accordance with section 7(d) of the ESA, NOAA Fisheries has determined that, during consultation, pelagic longline fishery activity consistent with the existing 2020 BiOp will not result in an irretrievable or irreversible commitment of resources which would have the effect of foreclosing the formulation or implementation of any reasonable and prudent alternative measures and that continued compliance with the RPMs and Terms and Conditions in that BiOp will avoid jeopardy to ESA-listed species, consistent with section 7(a)(2) of the ESA.

The status of the species "listed" under the ESA that may be affected by the Atlantic HMS fisheries are in Table 4.30.

Table 4.30. Status of listed species that may be affected by the pelagic longline fishery

Species	**Status**
Blue whale (*Balaenoptera musculus*)	Endangered
Gulf of Mexico Rice's Whale (*Balaenoptera ricei*)	Endangered
Fin whale (*Balaenoptera physalus*)	Endangered
North Atlantic right whale (*Eubalaena glacialis*)	Endangered
Sei whale (*Balaenoptera borealis*)	Endangered
Sperm whale (*Physeter macrocephalus*)	Endangered
Green turtle (*Chelonia mydas*)	Threatened*
Hawksbill sea turtle (*Eretmochelys imbricata*)	Endangered
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered

Species	Status
Loggerhead sea turtle (*Caretta caretta*)	Threatened
Giant manta ray (*Manta birostris*)	Threatened
Olive ridley sea turtle (*Lepidochelys olivacea*)	Threatened
Gulf of Maine Atlantic salmon (*Salmo salar*)	Threatened
Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*)	Endangered/Threatened**
Gulf sturgeon (*Acipenser oxyrinchus desotoi*)	Threatened
Smalltooth sawfish (*Pristis pectinata*)	Endangered
Oceanic whitetip shark (*Carcharhinus longimanus*)	Threatened
Scalloped hammerhead shark (*Sphyrna lewini*)	Threatened***

*Green sea turtles in the Florida breeding population were changed from endangered to threatened on April 6, 2016 (81 FR 20057). Green sea turtles have two DPSs: North Atlantic and South Atlantic. **Atlantic sturgeon have five distinct population segments. The population in the Gulf of Maine is considered threatened. The other DPSs—New York Bight, Chesapeake Bay, Carolina, and South Atlantic—are all considered endangered. ***Scalloped hammerhead sharks have two DPSs. The populations in the Central and Southwest Atlantic are considered threatened. The other populations in the Northwest Atlantic and Gulf of Mexico DPSs are not considered threatened.

4.10.2 Bycatch Reduction in the Pelagic Longline Fishery

To minimize bycatch and bycatch mortality in the domestic pelagic longline fishery, NOAA Fisheries implemented regulations to close certain areas to this gear type (Figure 4.7) and has banned the use of live bait by pelagic longline vessels in the Gulf of Mexico.

In addition to the regulations mentioned above, to protect sea turtles, vessels using pelagic longline gear onboard must, at all times, in all areas open to pelagic longline fishing except the NED, possess onboard and/or use only 16/0 or larger non-offset circle hooks and/or 18/0 or larger circle hooks with an offset not to exceed 10 degrees. Only whole finfish and squid baits may be possessed and/or utilized with allowable hooks. Vessels fishing in the NED are required to use 18/0 or larger circle hooks with an offset not to exceed 10 degrees and whole mackerel or squid baits. All pelagic longline vessels must possess and use sea turtle handling and release gear in compliance with NOAA Fisheries careful release protocols. Additionally, all pelagic longline vessel owners and operators must be certified in the use of the protected species handling and release gear. Certification must be renewed every three years and can be obtained by attending a training workshop. Approximately 18 to 24 workshops are conducted annually, and they are held in areas with significant numbers of pelagic longline permit holders.

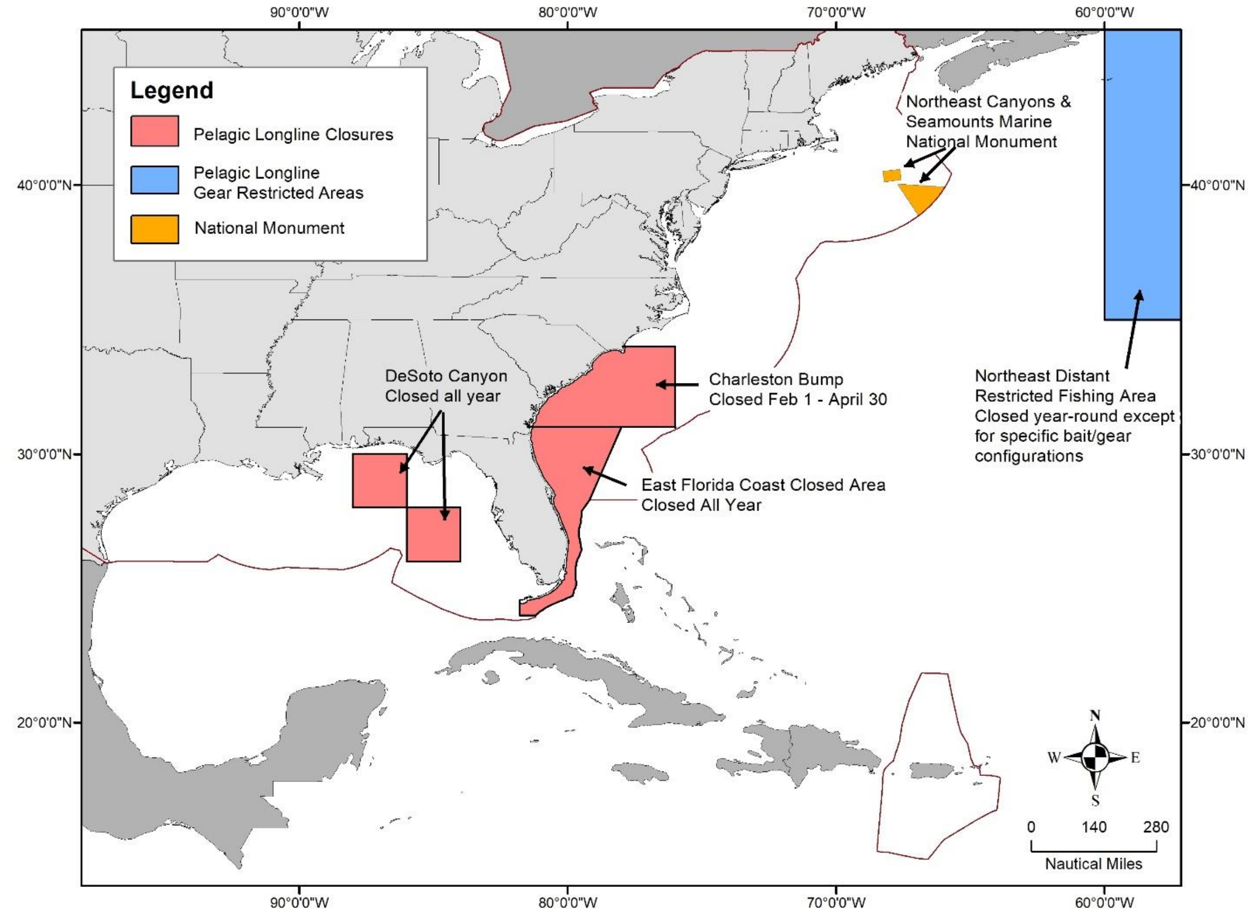

Figure 4.7. Principal spatially managed areas that prohibit or restrict pelagic longline fishing by U.S. flagged vessels

In 2009, to protect pilot whales and Risso's dolphins (*Grampus griseus*), the PLTRP (74 FR 23349; May 19, 2009) included a requirement that pelagic longline vessel operators fishing in the Cape Hatteras Special Research Area must contact NOAA Fisheries at least 48 hours prior to a trip, and carry observers if requested. The PLTRP also established a 20-nautical mile upper limit on mainline length for all pelagic longline sets in the Mid-Atlantic Bight, and required that an informational placard be displayed in the wheelhouse and on the working deck of all active pelagic longline vessels in the Atlantic fishery.

NOAA Fisheries scientists and managers continue to consult as necessary on reporting methodology design considerations, including changes in monitoring and reporting technology, to improve the quality of target and non-target catch estimates as needed while considering cost, technical, and operational feasibilities. NOAA Fisheries uses mandatory self-reported logbook data (HMS and Coastal Fisheries Logbook Programs, including a supplemental discard report), at-sea observer data (the Pelagic Longline, Southeast Gillnet, and Bottom Longline Observer Programs), mandatory recreational fish landings reports, online reporting of dead discards of bluefin tuna in the commercial harpoon and hook and line fisheries (Automated Landings Reporting System), and survey data (recreational fishery dockside intercept and telephone surveys including LPS) to produce bycatch estimates for HMS fisheries. The incidental catch of bluefin tuna in the pelagic longline fishery is monitored electronically via camera array, and catch reporting via VMS. Post-release mortality of HMS is considered in stock assessments to the extent that the data allow. Fishing mortality estimates from these sources of information, as incorporated in stock assessments, are critical to understanding the overall status and outlook of a stock as well as helping to understand the available options for conservation and management measures for the stock and potential implications for the ecosystem in which it lives.

An important element of the bycatch reduction strategy for the pelagic longline fishery is the IBQ Program. The IBQ Program is a catch share program implemented by Amendment 7 to the 2006 Consolidated HMS FMP that enhanced accountability for bluefin tuna at the individual vessel level and is supported by several reporting and monitoring requirements specifically for pelagic longline vessels. Pelagic longline vessels are required to account for all bluefin tuna landings and dead discards. IBQ allocations of bluefin tuna are distributed annually to permitted vessels with IBQ shares on January 1 of each year. A shareholder's share percentage is multiplied by the total pounds of Atlantic Tunas Longline category quota available to derive the amount of allocation in pounds. Permitted pelagic longline vessels may lease IBQ allocation among themselves.

On September 30, 2019, NOAA Fisheries released a formal Three-Year Review of the IBQ Program (NOAA Fisheries 2019) evaluating the IBQ Program's effectiveness in meeting its goals and objectives. Based on the number of bluefin tuna landings and dead discards during the IBQ period (2015-2017), the IBQ Program was successful in limiting bluefin tuna incidental catch in the pelagic longline fishery. Total bluefin tuna catch during the IBQ period was reduced compared to the baseline period (2012-2014). During the IBQ period, there was a 65-percent reduction in the average annual catch of bluefin tuna. The Longline category, since implementation of the IBQ Program has not overharvested its quota and therefore has not needed non-Longline quota (either under-harvests or quota carried-forward from a previous year) to account for dead discards. The markedly lower catch as of 2015 is the result of reduced dead discards, with the landings stable or increasing slightly as of 2015, as a result of a portion of the dead discards being converted into landings. It is likely that modified fishing strategies can explain the remaining reduction in dead discards. The regulatory incentives to avoid bluefin tuna interactions resulted from the combination of requirements associated with the IBQ Program, including individual shares and subsequent allocations of bluefin tuna, an IBQ allocation leasing program, requirements for minimum balances of IBQ allocation before trips each quarter, accountability for bluefin tuna catch, VMS reporting, and electronic monitoring.

Data and analyses subsequent to the Three-Year Review support the conclusion that the IBQ Program continued to reduce dead discards during 2018 and 2019. Table 4.31 shows data on bluefin tuna landings, dead discards, and total catch by pelagic longline vessels from 2012 through 2019.

Table 4.31. Landings, dead discards, and total catch of bluefin tuna, including the Northeast Distant gear restricted area, 2012-2019

Year	Landings (mt)	Dead Discards (mt)	Total Catch (mt)
2012	89.6	205.8	259.4
2013	62.9	156.4	219.3
2014	82.5	139.2	221.7
2015	71.4	17.1	88.5
2016	86.2	25.0	111.3
2017	104.1	10.3	114.4
2018	88.0	14.6	102.6
2019	86.3	7.1	93.4

Source: Landings: SAFIS federal dealer landings data; Dead discard estimates based on Observer and Logbook data.

The National Academy of Sciences, Engineering and Medicine conducted a study of catch share programs, including the IBQ Program, and concluded the IBQ Program successfully reduced dead discards (NASEM 2021).

NOAA Fisheries began an amendment to the fishery management plan (Amendment 13) focused on bluefin tuna on May 21, 2019, with the publication of a Notice of Intent to prepare an environmental impact analysis and Notice of Availability of an Issues and Options document (84 FR 23020). The notice announced the start of a public scoping process for determining the significant issues related to the management of bluefin tuna and addressing issues identified by considering modification of bluefin tuna regulations. NOAA Fisheries began the regulatory process, because, since 2015, the pelagic longline fishery had undergone substantial changes, including successful implementation of the IBQ Program for bluefin tuna, declining effort, continued underharvest of swordfish, and substantial reductions in bluefin tuna dead discards. In addition to the pelagic longline fishery that incidentally catches bluefin tuna, the directed bluefin tuna fisheries evolved over time. The purse seine fishery had been largely inactive for many years, with no landing of bluefin tuna since 2015. NOAA Fisheries did not issue a vessel permit to any of the five historical purse seine fishery participants since 2015. Handgear fisheries that target bluefin tuna were consistently very active, and the number of permit holders remained high. Increases in landings from the commercial and recreational handgear fisheries that began prior to 2015 continued. With such increases there was renewed public interest in the optimal and equitable allocation of bluefin tuna quota among fisheries, seasons, and geographic areas. The principal reasons for Amendment 13 were the findings of the Three-Year Review, recent changes in the bluefin tuna fisheries, and advice and input from the HMS Advisory Panel and the public.

On May 21, 2021, NOAA Fisheries released a DEIS, the Environmental Protection Agency published a Notice of Availability (86 FR 27593) for the DEIS, and NOAA Fisheries published a proposed rule to implement the preferred alternatives (86 FR 27686). The proposed rule notified the public of the opportunity to comment on the DEIS and proposed rule through July 20, 2021. NOAA Fisheries extended the public comment period for the proposed rule until September 20, 2021, based upon public requests, in order to provide additional time for the public to understand the proposed measures and supporting analyses and provide comment (86 FR 38262; July 20, 2021).

On May 13, 2022, NOAA Fisheries published a Final Environmental Impact statement, and on October 3, 2022, published a final rule implementing Amendment 13 (87 FR 59966). Final Amendment 13 measures: Established dynamic IBQ shares based upon fishing sets; modified regional Gulf of Mexico and Atlantic IBQ designations; capped bluefin tuna catch from the Gulf of Mexico; added a triggered measure whereby a low threshold percent of Gulf of Mexico IBQ (5 percent) causes a temporary relaxation in the regional accounting rules; clarified regulations for EM video camera installation and required vessel owners to pay for necessary camera booms; required installation of EM measuring grids and required vessels owners to pay relevant costs; reduced EM hard drive mailing frequency; implemented a cost recovery program for the IBQ Program; removed PIN and dead discard requirements for IBQ reports submitted by dealers; modified codified quota allocation percentages to reflect the annual 68-mt allocation to the Longline category; discontinued the Purse Seine category and reallocated the Purse Seine quota proportionally to all bluefin tuna quota categories; modified the Angling category trophy areas and allocations; set a Harpoon category default limit on the total number of bluefin a tuna t 10 fish (combined large medium and giant) and allowed in-season adjustment of the combined retention limit to between 5 and 10 fish; allowed Longline category permitted vessels to retain bluefin tuna caught on green-stick gear, regardless of whether pelagic longline gear is onboard; and allowed vessels with an open access Atlantic Tunas or HMS permit to change permit categories within a fishing year provided they have not landed a bluefin tuna in that year.

Measures to Reduce Bycatch of Sharks in the Pelagic Longline Fishery

Management measures for sharks caught in association with ICCAT fisheries using pelagic longline gear have been domestically implemented to comply with ICCAT recommendations. Consistent with ICCAT Recommendations 09-07, 10-07, 10-08, and 11-08, the United States has prohibited the retention of bigeye thresher sharks since 1999; prohibited retaining, transshipping, landing, storing, or selling oceanic whitetip sharks or hammerhead sharks caught in association with ICCAT fisheries since 2011; and prohibited retaining on board, transshipping, or landing silky sharks caught in association with ICCAT fisheries since 2012.

Consistent with ICCAT Recommendation 15-06, the United States in 2016 began requiring pelagic longline vessels to release unharmed, to the extent practicable, porbeagle sharks that are alive at the time of haulback if tunas, swordfish, or billfish are onboard vessels (81 FR 57803; September 23, 2016). Additionally, in 2022, the United States began prohibiting pelagic longline vessels from retaining any shortfin mako sharks consistent with ICCAT Recommendation 21-09 (87 FR 39373; July 1, 2022).

NOAA Fisheries has prohibited the retention of dusky sharks since 2000. Based upon the results of a 2016 stock assessment update indicating that the Atlantic dusky shark stock remained overfished and was experiencing overfishing, NOAA Fisheries implemented additional management measures to reduce fishing mortality on the stock and rebuild the dusky shark population as part of Amendment 5b (82 FR 16478; April 4, 2017). In the pelagic longline fishery, these included the adoption of shark release protocols, dusky shark identification and safe handling training and outreach, and fleet communication and relocation protocols. These measures were anticipated to also reduce the bycatch and mortality of other shark species caught in the fishery.

Pelagic Longline Bycatch Data

Amendment 12 to the 2006 Consolidated HMS FMP reviewed and summarized the SBRM regarding the pelagic longline fishery. NOAA Fisheries collects data on the disposition (released alive or dead) of bycatch species from logbooks submitted by fishermen in the pelagic longline fishery. Observer reports also include disposition of the catch as well as information on hook location, trailing gear, and injury status of protected species interactions. These data are used to estimate post-release mortality of sea turtles and marine mammals based on guidelines for each (Angliss and DeMaster 1998, Ryder et al. 2006). Bycatch information is summarized extensively in the HMS SAFE Report. Table 4.32 shows numbers of fish caught in the pelagic longline fishery from 2015 through 2018.

Table 4.32. Reported numbers of fish discarded in the U.S. Atlantic pelagic longline fishery, 2015–2019. Sources: NOAA Fisheries Logbooks and 2019 SAFE Report.

Species	2015	2016	2017	2018	2019
Swordfish discarded	5,382	4,437	7,116	8,004	4,307
Blue marlin discarded	990	1,050	1,562	854	984
White marlin discarded	2,885	2,153	2,221	1,586	1,467
Sailfish discarded	715	855	657	810	402
Bluefin tuna discarded	210	582	229	310	347
Pelagic sharks discarded	45,082	27,900	25,564	14,649	12,733
Large coastal sharks	8,839	9,549	11,533	7,988	4,466

Pelagic Longline Sea Turtle Interactions

NOAA Fisheries has taken several significant steps to reduce sea turtle bycatch and bycatch mortality in domestic longline fisheries, including: the required use of mitigation gear on pelagic longline vessels and handling/release guidelines and protocols (66 FR 17370); On March 30, 2001, NOAA Fisheries implemented via interim final rule requirements for U.S. flagged vessels using pelagic longline gear on board to have line clippers and dipnets to remove gear on incidentally captured sea turtles (66 FR 17370); and additional gear, bait and safe handling regulations for the Atlantic pelagic longline fishery to further reduce the mortality of incidentally caught sea turtles (69 FR 40734). NOAA Fisheries conducts workshops to educate longline and gillnet fishermen on all regulations and safe handling practices.

Internationally, the United States is pursuing sea turtle conservation through international, regional, and bilateral organizations such as ICCAT, the Asia Pacific Fishery Commission, and the United Nation's Food and Agriculture Organization (FAO) Committee on Fisheries (COFI).

Sea turtle bycatch in the U.S. Atlantic pelagic longline fishery has decreased significantly in the last decade. From 1999 through 2003 (NOAA Fisheries 2019), the pelagic longline fleet targeting HMS interacted with an average of 772 loggerhead and 1,013 leatherback sea turtles per year, based on observed takes and total reported effort. In 2005, the fleet was estimated to have interacted with 275 loggerhead and 351 leatherback sea turtles outside of experimental fishing operations (Walsh and Garrison 2006). In 2017, the U.S Atlantic pelagic longline fishery was estimated to have interacted with 78 loggerhead sea turtles and 292 leatherback sea turtles (Garrison 2018, unpublished data) (Table 4.33). In 2018, the U.S Atlantic pelagic longline fishery was estimated to have interacted with 61 loggerhead sea turtles and 119 leatherback sea turtles (Garrison 2019, unpublished data) (Table 4.33). The total interactions for the 2013–15 Incidental Take Statement, takes the most recent and complete 3-year period, which were below the level established by the statement in the 2004 BiOp for both loggerheads and leatherbacks (Table 4.33). NOAA Fisheries monitors observed interactions with sea turtles and marine mammals on a quarterly basis and reviews data for additional appropriate action, as necessary.

The 2022 HMS Pelagic Longline BiOp analyzed the best available data, the status of the species, environmental baseline, effects of the proposed action, and cumulative effects. The BiOp concluded that that proposed action (the operation of the pelagic longline fishery for Atlantic HMS, as managed under the 2006 Consolidated HMS FMP, as amended) was not likely to jeopardize the continued existence of the following ESA-listed species or distinct population segments (DPSs): sperm whales (*Physeter macrocephalus*); the Northwest Atlantic DPS of loggerhead, Kemp's ridley, the North and South Atlantic DPSs of green, leatherback, hawksbill, or olive ridley sea turtles; giant manta ray; the Central and Southwest Atlantic DPS of scalloped hammerhead shark; and oceanic whitetip shark. Since no critical habitat will be adversely affected, the BiOp also concluded the action is not likely to destroy or adversely modify designated critical habitat.

In July 2022, the Office of Sustainable Fisheries, NOAA Fisheries, requested reinitiation of consultation on the effects of the Atlantic HMS pelagic longline fishery. Reinitiation was not requested due to unexpected sea turtle impacts; it was requested due to new information on mortality of giant manta ray that exceeded the mortality anticipated in the 2020 BiOp on that fishery.

Under Section 7(b)(4) and Section 7(a)(2) of the ESA, "take" that would otherwise be considered prohibited under Section 9 or Section 4(d) of the ESA, but which is incidental to and not intended as part of the Agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the RPMs and the terms and conditions of the ITS of the Opinion. The BiOp determined that RPMs were necessary or appropriate to minimize the impacts of future takes on sea turtles and other ESA-listed species and to monitor levels of incidental take. There were two RPMs in the BiOp and multiple terms and conditions associated with each. The first RPM addressed sperm whale, sea turtle, giant manta ray, scalloped hammerhead, and oceanic whitetip handling requirements. It requires the HMS Management Division, with the advice of SERO Protected Resources Division, to ensure that fishermen in the HMS pelagic longline fishery receive relevant outreach materials and provide such materials describing how captured ESA-listed sea turtles and fish should be handled and how gear should be removed from ESA-listed sea turtles, fish, and marine mammals to minimize adverse effects from incidental take and reduce mortality. The HMS Management Division shall provide such training using materials provided by the SERO Protected Resources Division to fishermen. The second RPM requires the HMS Management Division to ensure that any takes of ESA-listed species are monitored and reported, coordinating with the SEFSC as necessary and appropriate. Such reports should allow the Agency to: (1) detect any adverse effects resulting from the proposed action; (2) assess the actual level of incidental take in comparison with the anticipated incidental take documented in this Opinion; (3) assess (for sea turtles) the hooking location and gear remaining on every sea turtle released to allow for post-release mortality estimations; and (4) detect when the level of anticipated take (lethal and non-lethal) is exceeded.

As a condition of the ITS, the BiOp requires that the HMS Management Division comply with eleven mandatory terms and conditions, which implement the RPMs described above. The terms and conditions specify the types of outreach materials that must be provided to pelagic longline fishermen, levels of observer coverage, quarterly reporting of the total take and total mortalities (dead-on-retrieval and post-release mortality) of ESA-listed species in the HMS pelagic longline fishery, and an annual report detailing interactions between ESA-listed species and the HMS pelagic longline fishery.

The 2020 HMS pelagic longline BiOp may be found at: HMS Pelagic Longline BiOp.

Table 4.33. Estimated sea turtle interactions and sea turtle incidental take levels in the U.S. Atlantic pelagic longline fishery by species, 2010–2018

Species	Total 2010 to 2012	Total 2013 to 2015	Total 2016 to 2018	*Total 3-Year ITS Level
Leatherback	1,006	944	750	1,764
Loggerhead	1,463	879	293	1,905
Other/unidentified sea turtles	22	24	32	105

*Applies to all subsequent three-year ITS periods (e.g., 2010–12, 2013–15, 2016–18); 2017 data are preliminary estimates. Sources: Garrison and Stokes 2016, 2017, 2019. Garrison 2018, 2019—unpublished data.

Pelagic Longline Seabird Interactions

The Migratory Bird Treaty Act provides protections for all seabirds, including gannets, gulls, greater shearwaters, and storm petrels. These species are occasionally hooked by Atlantic pelagic longline gear. The majority of longline interactions with seabirds occur as the gear is being set. The birds eat the bait and become hooked on the line. The line then sinks and the birds are subsequently drowned.

The NPOA-Seabirds was released in February 2001, and calls for detailed assessments of longline fisheries, and, if a problem is found to exist within a longline fishery, for measures to reduce seabird bycatch within two years. Because interactions appear to be relatively low in Atlantic HMS fisheries, such measures have not been necessary. The 2014 Report on the Implementation of the United States National Plan of Action for Reducing the Incidental Catch of Seabirds in Longline Fisheries was submitted to the FAO in June 2014.

Observer data indicate that seabird bycatch is low in the U.S. Atlantic pelagic longline fishery (NOAA Fisheries 2022). From 2017 through 2020, based on pelagic observer program data, there were a total of 24 seabirds released, of which 16 were dead (67 percent).

4.10.3 Bycatch Reduction in the Bottom Longline Fishery

Bottom longlines are classified as a Category III fishery under the MMPA. Bycatch reduction measures in the HMS bottom longline fishery are summarized in Section 6.3.6 of the 2021 SAFE Report, and the FEIS for Amendment 5b (NOAA Fisheries 2017b). Vessel owners and operators of vessels with a commercial shark limited access permit must attend a Safe Handling, Release, and Identification Workshop every three years and must carry NOAA

Fisheries-approved dehooking devices onboard and use them in the event of a protected species interaction. They must also store and post careful handling and release protocols and guidelines in the wheelhouse to minimize injury to protected species when interactions occur.

Any dusky shark, sea turtle, marine mammal, and smalltooth sawfish that becomes entangled or hooked must be immediately released, and the gear must be immediately retrieved. The vessel must move at least 1 nm from that location before fishing is resumed to avoid interacting with those species again. Marine mammal entanglements must be reported to NOAA Fisheries under the Marine Mammal Authorization Program. Time and area closures are implemented in this fishery to reduce bycatch, and these measures require the proper stowage of gear if the vessel is within a closed area.

To prevent long-term injury of bycatch that cannot be released safely if the hook is removed, bottom longline gear must include only corrodible hooks. On January 1, 2018, circle hook requirements by all Atlantic HMS Directed Shark permit holders using bottom longline gear became effective (82 FR 16478; April 4, 2017).

The bottom longline fishery also includes the shark research fishery, in which vessels are required to take an observer on all trips, and the limited access fishery, in which vessels are randomly selected for observer coverage and may be required to use a vessel monitoring system.

The shark bottom longline fishery has relatively low observed bycatch rates. Historically, finfish bycatch has averaged approximately 5 percent of the total observed catch in the bottom longline fishery. Observed protected species bycatch (e.g., sea turtles) has typically been much lower, less than 0.01 percent of the total observed catch.
No protected species interactions occurred on bottom longline trips covered by the Northeast Fisheries ObserverProgram.

Table 4.34 provides information on those observed interactions with protected resources for bottom longline vessels targeting sharks in the Gulf of Mexico and Atlantic regions. The observed data were combined for the Gulf of Mexico and southern Atlantic to protect confidentiality of vessels consistent with the requirements of theMagnuson-Stevens Act. In 2020, there were no protected resources interactions observed in the Gulf of Mexico and South Atlantic regions outside of the shark research fishery. On May 15, 2020, the Atlantic HMS non-pelagic longline BiOp was released. Bycatch of seabirds in the shark bottom longline fishery has been virtually non-existent. No expanded estimates of seabird bycatch or catch rates for the bottom longline fishery have been made due to therarity of seabird interactions.

Table 4.34. Protected species interactions observed on bottom longline trips targeting sharks in the Gulf of Mexico and Atlantic Ocean, 2016-2020

Year	Sea Turtles	Seabirds	Marine Mammals	Smalltooth Sawfish	Total
2016	9 (7A, 2D)	3 (U)	-	1 (A)	13
2017	3 (1A, 2D)	-	-	-	3
2018	5 (4A, 1D)	-	-	-	5
2019	2 (2A, 0D)	-	-	-	2
2020	-	-	-	-	0
Total					23

Note: Letters in parentheses indicate whether the animal was released (A) alive, (D) dead, or (U) unknown.
Source: Mathers et al.2021a, unpublished.

4.11 Spatial Management in Atlantic HMS

Since 2000, NOAA Fisheries has implemented a number of time/area closures and gear restrictions in the Atlantic Ocean and Gulf of Mexico to reduce discards and bycatch of a number of species (e.g., juvenile swordfish, bluefin tuna, billfish, sharks, and sea turtles) in the pelagic longline fishery. Time/area closures and gear restrictions have been part of the broader strategy to reduce bycatch in the Atlantic HMS pelagic longline fishery, as described above in Section 4.11. As explained fully in the overview of closed areas in Chapter 1, the need to assess the effectiveness of spatial management measures is critical due to the static nature of spatial management measures and the highly dynamic nature of HMS fisheries. When the areas were implemented there was the stated intent that they be evaluated in the future. This section below contains detailed background information on the closed areas under consideration in this DEIS.

4.11.1 East Florida Coast Closed Area

The East Florida Coast closed area is a spatial management area that was effective on September 1, 2000. (65 FR 47214; August 1, 2000). The East Florida Coast closed area was implemented at the same time and through the same final rule as the Charleston Bump and DeSoto Canyon closed areas. The relevant regulations prohibit vessels issued a limited access Atlantic Tunas longline category permit with pelagic longline gear on board from fishing or deploying any type of fishing gear in the East Florida Coast closed area at any time (50 CFR §635.21(c)(2)(ii)).

The East Florida Coast closed area extends along the full east coast of Florida between 31° 00’ N. lat., near Jekyll Island, Georgia, and Key West, Florida. The area is defined as: the Atlantic Ocean seaward of the inner boundary of the U.S. EEZ from a point intersecting the inner boundary of the U.S. EEZ at 31° 00' N. lat. near Jekyll Island, Georgia, and proceeding due east to connect by straight lines the following coordinates in the order stated: 31° 00' N. lat., 78° 00' W. long.; 28° 17' 10” N. lat., 79° 11' 24” W. long.; then proceeding along the outer boundary of the EEZ to the intersection of the EEZ with 24° 00' N. lat.; then proceeding due west to the following coordinates: 24° 00' N. lat., 81° 47' W. long.; then proceeding due north to intersect the inner boundary of the U.S. EEZ at 81° 47' W. long. near Key West, Florida..

The objectives of the closed area when implemented were to reduce bycatch, bycatch mortality, and incidental catch of undersized swordfish, billfish, and other overfished and protected species from the U.S. pelagic longline fishery. Specifically, the objectives stated in the proposed rule were "(1) to maximize the reduction in the incidental catch of billfish and of swordfish less than 33 lb (15 kg) dressed weight; (2) to minimize the reduction in the target catch of swordfish and other marketable species; and (3) to ensure that the incidental catch of other species (e.g., bluefin tuna, mammals, turtles) either remains unchanged or is reduced." It was recognized that all three objectives might not be met to the maximum extent and that conflicting outcomes would require some balancing of the objectives. The final rule stated "The areas closed by this rule are considered temporal and spatial "hot spots" for HMS bycatch from U.S. pelagic longline effort within the U.S. EEZ, as evaluated by the frequency of occurrence and the relationship between total catch and discard rates." and "NMFS will continue to monitor the pelagic longline fleet throughout its range and will take appropriate action if necessary through the proposed and final rule process to reconfigure closures."

At the time of the closure, Atlantic blue marlin, white marlin, sailfish, bluefin tuna, and swordfish were overfished, and bycatch reduction was a component of rebuilding efforts. In particular, the United States was implementing a 1999 swordfish rebuilding plan, and the closure helped reduce bycatch of juvenile swordfish.

There has been very little data collected from within the closed area since it was implemented, and efforts to collect data have been hampered by the small scope of research and consistent opposition by a portion of the public.

2006 Consolidated HMS FMP

An analysis prepared for the 2006 Consolidated HMS FMP indicated that the pelagic longline time/area closures alone resulted in large declines in fishing effort and bycatch from the 1997–1999 period to the 2001–2003 period. The analysis did not include data from within the closures. Overall effort, expressed as the number of hooks set, declined by 15 percent between the two time periods. The overall number of reported discards of swordfish, bluefin tuna, bigeye tuna, pelagic sharks, blue marlin, white marlin, sailfish and spearfish have all declined by more than 30 percent. Discards of blue and white marlin declined by more than 50 percent, and sailfish discards declined by almost 75 percent. Also, the reported number of sea turtles caught and released declined by almost 28 percent due to the time/area closures alone. In addition, the number of active fishing vessels declined by approximately 45 percent since 2000.

2007 Exempted Fishing Permit Request

In 2007 NOAA Fisheries received a request for an EFP to conduct research in the East Florida Coast closed area and Charleston Bump closed area. The impetus for this research was in part a previous modification to the gear regulations. Beginning in 2004, circle hooks and dehooking equipment were required on all pelagic longline vessels to reduce bycatch and bycatch mortality. Subsequently NOAA Fisheries was interested in analyzing information to determine the effectiveness of new circle hooks and bycatch mitigation gear. NOAA Fisheries analyzed data on bycatch rates of blue and white marlin, bluefin tuna, sea turtles, and other species in open areas. The applicant for the EFP sought to collect data on the performance of mandatory circle hooks with regard to target catch and bycatch rates, hooking location, and mortality of fish at haul back in these closed areas. With similar information from within the closed areas, NOAA Fisheries would be able to compare the data, and evaluate catch rates, discard rates and other variables, and analyze the impacts of the closed areas. NOAA Fisheries would be able to evaluate the benefits of the closed areas and determine if modification to the areas may be appropriate.

NOAA Fisheries announced receipt of the application and a public comment period, and subsequently extended and reopened the comment period (72 FR 11327; March 13, 2007, 72 FR 18208; April 11, 2007, 72 FR 25748; May 7, 2007). NOAA Fisheries prepared an Environmental Assessment that analyzed the impacts of the proposed research (NOAA Fisheries 2007). Public comments opposing and supporting issuance of the EFP were received, including a large number of form letters opposing issuance. Comments opposing issuance of the EFP were primarily received from the recreational fishing community, but were also received from the State of Florida, and the South Atlantic Fishery Management Council. These included, among others, objections to pelagic longline fishing in general, concerns over potential localized depletions and a reversal of swordfish rebuilding progress, concerns over economic impacts to south Florida recreational interests, concerns that the scientific aspects of the proposal were insufficient, and concerns that the proposed number of vessels (13) was too high. Comments supporting of issuing the EFP included reversing economic damage done to the pelagic longline fishery from the closures, the potential for increased catches from fishing in the closed areas to assist the U.S. in retaining swordfish quota share during 2008 ICCAT negotiations, and the need to collect data to assess the efficacy and continuing appropriateness of existing bycatch reduction measures. After considering public comment NOAA Fisheries decided not to issue the requested permit. NOAA Fisheries was concerned over the robustness of the study design, as submitted to the Agency in the February 2007 application, yet also noted the need to collect data on the efficacy of bycatch reduction measures currently in place.

2008 to 2010 Research

Limited research was conducted under an EFP from 2008 to 2010 to determine the effects on target and bycatch species' catch rates and mortality at haul back for the small-vessel coastal pelagic longline fishery, given the recovery of the overall North Atlantic swordfish stock and the mandatory use of large, non-offset circle hooks (Kerstetter 2011). The research was conducted within the East Florida Coast closed area and the Charleston Bump closed area. NOAA Fisheries' 2017 Environmental Assessment noted of the research that the results were inconclusive and suggested that more research was needed due to the small sample size and poor spatial distribution of pelagic longline sets (NOAA Fisheries 2017a).

2017 Exempted Fishing Permit

In 2016, a research institution in Florida submitted an application for an EFP to conduct research in the East Florida Coast closed area to evaluate the effectiveness of existing area closures at meeting current conservation and management goals under current conditions using standardized pelagic longline gear. In January 2017, in response to the EFP application, NOAA Fisheries published a Draft Environmental Assessment to analyze the impacts of issuing an EFP that would evaluate pelagic longline catches and catch rates of target and non-target species using standardized pelagic longline gear on a specified number of commercial vessels from within two different sub-areas in the northern portion of the East Florida Coast closed area (north and south of 29° 50' N. lat.) and compare those rates to rates obtained by authorized samplers from an area outside the East Florida Coast Closed area to evaluate the effectiveness of existing closures at meeting current conservation and management goals under current conditions. NOAA Fisheries made a preliminary determination that allowing limited access to the East Florida Coast closed area for research purposes via an EFP would provide important data from the closed area under the changed conditions since the area was closed, and current data to assess changes in species availability and distribution over time, and contribute to future stock assessments or other fishery management measures.

In conjunction with the Environmental Assessment, NOAA Fisheries solicited public comment on the Draft EA and terms and conditions of the proposed EFP during a 30-day comment period (82 FR 4856; January 17, 2017), which was later extended to March 29, 2017 (82 FR 10746; February 15, 2017). HMS Management Division staff presented the EFP application to the South Atlantic Fishery Management Council and conducted a webinar. NOAA Fisheries received over 500 public comments on the EFP application and the Environmental Assessment, including comments from recreational fishing constituents, environmental organizations, commercial fishing industry participants and organizations, and the State of Florida.

The majority of comments were submitted by recreational fishing constituents opposed to the research project. These commenters stated that the current East Florida Coast closed area has been effective at rebuilding several fish stocks and increasing recreational fishing opportunities. Several environmental organizations were opposed to the research project primarily because of concerns about excessive levels of bycatch (sharks, billfish, and undersized swordfish), although some groups recognized the need for the research.

Comments from HMS commercial fishing industry participants and organizations recognized the need for the research, but expressed reservations that one company would conduct and benefit from the project. If the EFP were issued, they suggested opening the project to other vessels and/or processors. The Florida Fish and Wildlife Conservation Commission indicated that they unanimously oppose the project. The South Atlantic Fishery Management Council was evenly split as to whether or not to support the EFP. The Council suggested that NOAA Fisheries consider potential interactions with Council-managed fisheries (including royal red shrimp, rock shrimp, golden crab, golden tilefish, dolphinfish, and wahoo); possible increased dolphinfish landings triggering a commercial closure; bycatch of protected species, sharks, and billfish; a recommendation to reduce the number of sets to the minimum necessary for statistical comparison; and, concern that the project is being conducted by only one company.

On August 11, 2017, NOAA Fisheries published a notice in the Federal Register (82 FR 37566) announcing a Final Environmental Assessment (NOAA Fisheries 2017a), and issued the EFP. The primary rationale for issuing the EFP was to gain much-needed scientific information from within the East Florida Coast closed area under current circumstances, which differed greatly from those that motivated designation of the closed area more than 15 years previously. The research would have allowed NOAA Fisheries to assess and compare current catch and bycatch rates during normal commercial fishing operations from areas inside and outside the East Florida Coast closed area, and to evaluate the effectiveness of the closed area in continuing to reduce bycatch of non-target species (e.g., billfish, undersized swordfish, prohibited species, and protected species). It would have also provided more current data about the socio-economic impact of reduced catches of target species (swordfish and tunas) as a result of the closure, assessed changes in species availability and distribution over time, and contributed to future stock assessments or other fishery management measures.

On December 14, 2017, NOAA Fisheries received a revised EFP application from the principal investigator to modify their affiliation. Subsequently NOAA Fisheries determined the original EFP, issued August 11, 2017, to be invalid, and that NOAA Fisheries would not proceed with a review of the new request. The public comments reflected that a more comprehensive and transparent approach was warranted for research of the proposed scale. NOAA Fisheries denied the revised application in order to instead evaluate other approaches to research and data collection from closed or restricted fishing areas.

4.11.2 Charleston Bump Closed Area

The Charleston Bump closed area is a spatial management area that was effective on September 1, 2000. (65 FR 47214; August 1, 2000). The Charleston Bump closed area was implemented at the same time and through the same final rule as the East Florida Coast and DeSoto Canyon closed areas. The relevant regulations prohibit vessels issued a limited access Atlantic Tunas Longline category permit with pelagic longline gear on board from fishing or deploying any type of fishing gear in the Charleston Bump closed area from February 1 through April 30 (50 CFR §635.21(c)(2)(ii).

The Charleston Bump closed area extends from its southern boundary near Jekyll Island, Georgia north to North Carolina, near Wilmington Beach. The area is defined as the Atlantic Ocean area seaward of the inner boundary of the U.S. EEZ from a point intersecting the inner boundary of the U.S. EEZ at 34° 00′ N. lat. near Wilmington Beach, North Carolina, and proceeding due east to connect by straight lines the following coordinates in the order stated: 34° 00′ N. lat., 76° 00′ W. long.; 31° 00′ N. lat., 76° 00′ W. long.; then proceeding due west to intersect the inner boundary of the U.S. EEZ at 31° 00′ N. lat. near Jekyll Island, Georgia.

The objectives of the closed area when implemented were to reduce bycatch, bycatch mortality, and incidental catch of undersized swordfish, billfish, and other overfished and protected species from the U.S. pelagic longline fishery.

The objectives of the closed area when implemented were to reduce bycatch, bycatch mortality, and incidental catch of undersized swordfish, billfish, and other overfished and protected species from the U.S. pelagic longline fishery. Specifically, the objectives stated in the proposed rule were "(1) to maximize the reduction in the incidental catch of billfish and of swordfish less than 33 lb (15 kg) dressed weight; (2) to minimize the reduction in the target catch of swordfish and other marketable species; and (3) to ensure that the incidental catch of other species (e.g., bluefin tuna, mammals, turtles) either remains unchanged or is reduced. " It was recognized that all three objectives might not be met to the maximum extent and that conflicting outcomes would require some balancing of the objectives. The final rule stated "The areas closed by this rule are considered temporal and spatial "hot spots" for HMS bycatch from U.S. pelagic longline effort within the U.S. EEZ, as evaluated by the frequency of occurrence and the relationship between total catch and discard rates." and "NMFS will continue to monitor the pelagic longline fleet throughout its range and will take appropriate action if necessary through the proposed and final rule process to reconfigure closures."

At the time of the closure, Atlantic blue marlin, white marlin, sailfish, bluefin tuna, and swordfish were overfished, and bycatch reduction was a component of rebuilding efforts. In particular, the United States was implementing a 1999 swordfish rebuilding plan, and the closure helped reduce bycatch of juvenile swordfish.

There has been very little data collected from within the closed area during the months of the closure since it was implemented, and efforts to collect data have been hampered by the small scope of research and consistent opposition by a portion of the public.

4.11.3 DeSoto Canyon closed area

The DeSoto Canyon closed area is in the eastern Gulf of Mexico, and is comprised of two adjacent square areas and was effective on November 1, 2000 (65 FR 47214; August 1, 2000). The DeSoto Canyon closed area was implemented at the same time and through the same final rule as the East Florida Coast and Charleston Bump closed areas. The relevant regulations prohibit vessels issued a limited access Atlantic Tunas longline permit with pelagic longline gear on board from fishing or deploying any type of fishing gear in the area year-round.

The area is defined as the area within the Gulf of Mexico bounded by straight lines connecting the following coordinates in the order stated: 30° 00′ N. lat., 88° 00′ W. long.; 30° 00′ N. lat., 86° 00′ W. long.; 28° 00′ N. lat., 86° 00′ W. long.; 28° 00′ N. lat., 84° 00′ W. long.; 26° 00′ N. lat., 84° 00′ W. long.; 26° 00′ N. lat., 86°00′ W. long.; 28° 00′ N. lat., 86° 00′ W. long.; 28° 00′ N. lat., 88° 00′ W. long.; 30° 00′ N. lat., 88° 00′ W. long.

The objectives of the closed area when implemented were to reduce bycatch, bycatch mortality, and incidental catch of undersized swordfish, billfish, and other overfished and protected species from the U.S. pelagic longline fishery. Specifically, the objectives stated in the proposed rule were "(1) to maximize the reduction in the incidental catch of billfish and of swordfish less than 33 lb (15 kg) dressed weight; (2) to minimize the reduction in the target catch of swordfish and other marketable species; and (3) to ensure that the incidental catch of other species (e.g., bluefin tuna, mammals, turtles) either remains unchanged or is reduced. " It was recognized that all three objectives might not be met to the maximum extent and that conflicting outcomes would require some balancing of the objectives. The final rule stated "The areas closed by this rule are considered temporal and spatial "hot spots" for HMS bycatch from U.S. pelagic longline effort within the U.S. EEZ, as evaluated by the frequency of occurrence and the relationship between total catch and discard rates." and "NMFS will continue to monitor the pelagic longline fleet throughout its range and will take appropriate action if necessary through the proposed and final rule process to reconfigure closures."

At the time of the closure, Atlantic blue marlin, white marlin, sailfish, bluefin tuna, and swordfish were overfished, and bycatch reduction was a component of rebuilding efforts. In particular, the United States was implementing a 1999 swordfish rebuilding plan, and the closure helped reduce bycatch of juvenile swordfish.

There has been very little data collected from within the closed area since it was implemented, and efforts to collect data in some areas, including the East Florida Coast closed area, have been hampered by the small scope of research and consistent opposition by a portion of the public.

4.11.4 Northeastern United States Pelagic Longline Monitoring Area

The Northeastern United States Pelagic Longline Monitoring Area was implemented on April 2, 2020 (85 FR 18812), replacing the Northeast United States closed area, which was implemented on January 1, 2015 (79 FR 71510; December 2, 2014). The current regulations authorize conditional access to the monitoring area for pelagic longline vessels. The rule established a three-year evaluation period during which fishing was allowed at times when the area was previously closed to pelagic longline fishing (June 1 through 31), provided the amount of IBQ allocation used to account for bluefin tuna catch from sets made within the area stays below a specified threshold. The rule indicated that if the threshold is exceeded, the monitoring area would be closed to pelagic longline fishing. It also indicated that if no closure of the area is triggered by attainment of the threshold amount from April 1, 2020 through December 31, 2022, the Monitoring Area would remain open, unless, and until, NOAA Fisheries decides to take additional action. During this time period, no closures were necessary.

The Northeastern United States Pelagic Longline Monitoring Area is defined as the area bounded by straight lines connecting the following coordinates in the order stated: 40° 00′ N. lat., 74° 00′ W. long.; 40° 00′ N. lat., 68° 00′ W. long.; 39° 00′ N. lat., 68° 00′ W. long.; and 39° 00′ N. lat., 74° 00′ W. long.

The objectives of the monitoring area included continuing to minimize, to the extent practicable, bycatch and bycatch mortality of bluefin tuna and other HMS by pelagic longline gear; and optimizing the ability for the pelagic longline fishery to harvest target species quotas. The monitoring area was established in light of the success of the IBQ Program in reducing discards of bluefin tuna.

The amount of bluefin tuna caught in the monitoring area has been low. In 2020, there were no landings or dead discards of bluefin tuna from the monitoring area during the relevant time period (June 1 through 31). In 2021, there were 16,606 lb of bluefin tuna landed and 1,045 lb discarded dead (whole weight). The total amount (17,651 lb), represents 12 percent of the threshold (150,519 lb). In 2022, there were 4,920 lb of bluefin tuna landed and 1,049 lb discarded dead (whole weight). The total amount (5,969 lb), represents 4 percent of the threshold (150,519 lb). Bluefin tuna landings and discard data are available on the Pelagic Longline Bluefin Tuna Area-Based and Weak Hook Management Measures webpage. NOAA Fisheries intends to evaluate the monitoring area and issue a report on the findings.

4.11.5 Spring Gulf of Mexico Pelagic Longline Monitoring Area

The Spring Gulf of Mexico Pelagic Longline Monitoring Area was implemented on April 2, 2020 (85 FR 18812), replacing the Spring Gulf of Mexico Pelagic Longline Gear Restricted Area, which was implemented on January 1, 2015 (79 FR 71510; December 2, 2014). The current regulations authorize conditional access to the monitoring area for pelagic longline vessels. The rule established a three-year evaluation period during which fishing was allowed at times when the areas were previously closed to pelagic longline fishing (April 1 through May 31), provided the amount of IBQ allocation used to account for bluefin tuna catch from sets made within these areas stays below a specified threshold. If the threshold is exceeded, the monitoring area is closed to pelagic longline fishing. If no closure of the area is triggered by attainment of the threshold amount from April 1, 2020 through December 31, 2022, the Monitoring Area will remain open, unless, and until, NOAA Fisheries decides to take additional action. During this time period, no closures were necessary.

The Spring Gulf of Mexico Pelagic Longline Monitoring Area is defined as two areas within the Gulf of Mexico described here. The first area is bounded by straight lines connecting the following coordinates in the order stated: 26° 30′ N. lat., 94° 40′ W. long.; 27° 30′ N. lat., 94° 40′ W. long.; 27° 30′ N. lat., 89° W. long.; 26° 30′ N. lat., 89° W. long.; 26° 30′ N. lat., 94° 40′ W. long. The second area is bounded by straight lines connecting the following coordinates in the order stated: 27° 40′ N. lat., 88° W. long.; 28° N. lat., 88° W. long.; 28° N. lat., 86° W. long.; 27° 40′ N. lat., 86° W. long.; 27° 40′ N. lat., 88° W. long.

The objectives of the monitoring area included continuing to minimize, to the extent practicable, bycatch and bycatch mortality of bluefin tuna and other HMS by pelagic longline gear; and optimizing the ability for the pelagic longline fishery to harvest target species quotas.

The amount of bluefin tuna caught in the monitoring area has been low. In 2020 and 2021, there were no landings or dead discards of bluefin tuna from the monitoring area during the relevant time period (April 1 through May 31). In 2022, there were 4,819 lb of bluefin tuna landed and no dead discards. The total amount (4,819 lb) represents 8 percent of the threshold (63,150 lb). Bluefin tuna landings and discard data are available on the Pelagic Longline Bluefin Tuna Area-Based and Weak Hook Management Measures webpage. NOAA Fisheries intends to evaluate the monitoring area and issue a report on the findings.

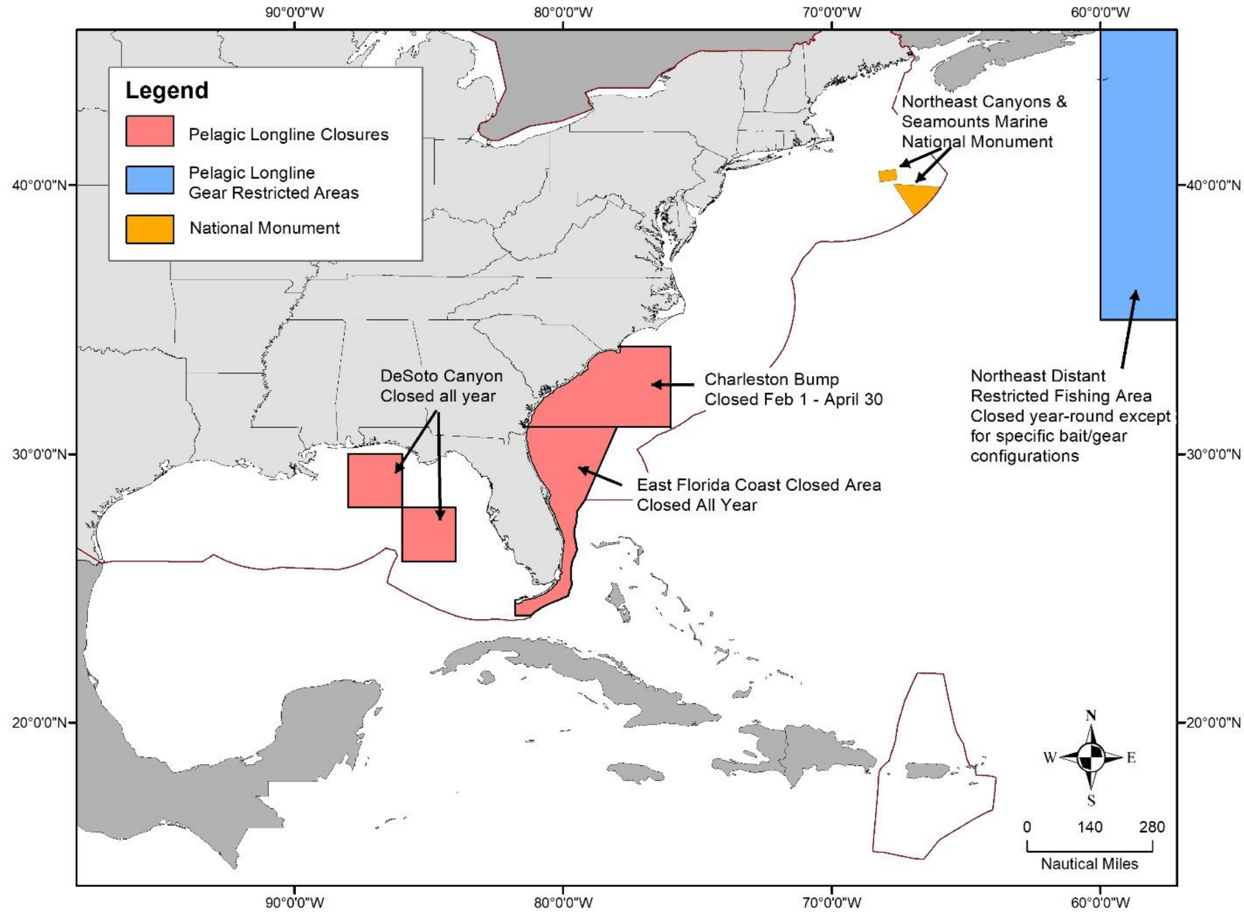

Figure 4.8. Areas closed/restricted to pelagic longline fishing

4.11.6 Mid-Atlantic Shark Closed Area

The Mid-Atlantic shark closed area was effective on January 1, 2005 (68 FR 74746; December 24, 2003). The relevant proposed rule had been published on August 1, 2003 (68 FR 45196). The intent of the closure was to reduce all interactions between commercial fishing operations and pupping and nursery grounds and hence reduce both the catch and mortality of dusky and juvenile sandbar sharks. The time/area closure was based on specific information from the shark bottom longline observer program that indicated a high proportion of prohibited dusky shark and juvenile sandbar sharks being caught off North Carolina from January through July. The time/area closure was based on information relating to all life stages of dusky sharks and sandbar sharks, including adults. The closure was expected to reduce the catch of all dusky and sandbar shark life stages.

The area is defined as the Atlantic Ocean area seaward of the inner boundary of the U.S. EEZ from a point intersecting the inner boundary of the U.S. EEZ at 35° 41′ N. lat. just south of Oregon Inlet, North Carolina, and connecting by straight lines the following coordinates in the order stated: 35° 41′ N. lat., 75° 25′ W. long. proceeding due east to 35° 41′ N. lat., 74° 51′ W. long.; then proceeding southeast to 35° 30′ N. lat., 74° 46′ W. long.; then proceeding southwest, roughly following the 55 fathom mark, to 33° 51′ N. lat., 76° 24′ W. long.; then proceeding due west to intersect the inner boundary of the U.S. EEZ at 33° 51′ N. lat., 77° 53′ W. long. near Cape Fear, North Carolina.

Draft Amendment 5 (77 FR 70551; November 26, 2012) proposed changing the timing of the Mid-Atlantic shark closed area to December 15 through July 15 each year, which would have be an approximately two week shift in the closure while maintaining the total number of days of the closure. The measure was preferred at the draft stage largely due to equitability and access issues for North Carolina shark fishermen. The ASMFC shark plan opened state waters to shark fishing on July 15, though North Carolina fishermen were unable to fish in large portions of the area offshore of the state until July 31 due to the closure. Amendment 5 was divided into two parts before final publication (see Section 1 of the 2013 FEIS for Amendment 5a for more information). Final Amendment 5b (82 FR 16478; April 4, 2017) did not include the change to the timing of the Mid-Atlantic shark closed area and the change was not implemented.

Due to decreased effort in the Atlantic shark fisheries, there is not a large amount of data recently collected from within the closed area. The data that has been collected was from a small number of vessels and cannot be publically shared due to confidentiality concerns.

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Chapter 5 Ecological, Social, and Economic Consequences of Alternatives

This chapter analyzes the impacts of the alternatives described in Chapter 3. Specifically, this chapter contains qualitative and quantitative analysis of the direct and indirect ecological, social, and economic impacts of the alternatives. The analyses of the ecological impacts of the alternatives focus on target species (direct impacts) and bycatch species (indirect impacts). Where relevant (i.e., facilitating the understanding of the nature of the impact), the impacts are also noted as short-term or long-term (as defined in Chapter 1). The social and economic impacts focus on fishermen (direct impacts), but also include impacts on seafood dealers and bait and tackle suppliers (indirect impacts). The relevant sources of data and methods used to analyze the alternatives are described under each alternative.

The spatial management alternatives are intended to be considered as potential components of a spatial management program that may be combined together to achieve the objectives. For example, a particular spatial management area ("A" Alternatives) (Section 5.1) would be coupled with a data collection and monitoring alternative ("B" Alternatives) (Section 5.2) and timeline for evaluation ("C" Alternatives) (Section 5.3). In Section 5.4, Preferred Alternative Packages, we estimate the impacts of our preferred set of A, B, and C Alternatives for each of the four spatial management areas (Figure 5.1). Given the number of possible combinations of alternatives, to simplify the analyses, this chapter provides impact analyses of each unique alternative and summarizes those impacts only for the preferred combination of A, B, and C Alternatives. While this DEIS provides NOAA Fisheries' preferred combination for each of the four spatial management areas, based on public comment and additional analyses, the preferred combinations may change in the FEIS.

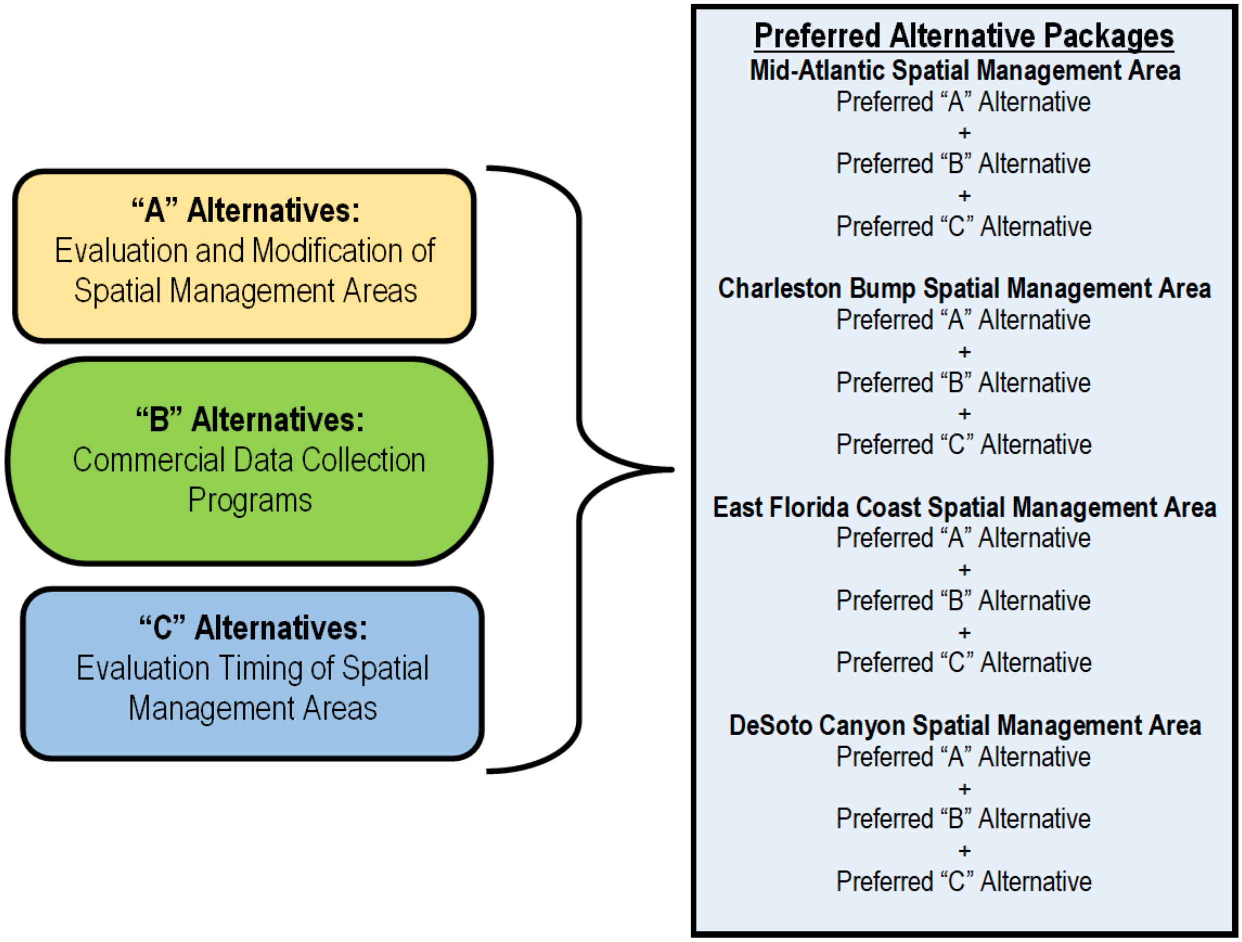

Figure 5.1. Combination of alternatives into preferred alternative packages

We adjusted all economic values to 2021 real dollars using the following GDP Deflator values (Table 5.1).

Table 5.1. Gross Domestic Product (GDP) deflator values (Source: Bureau of Economic Analysis)

Year	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
GDP Deflator	105.737	107.742	110.317	112.290	113.633	118.342

For each set of alternatives, the DEIS includes a "No Action" alternative with impact analyses. The No Action alternative analyzes expected impacts if none of the other alternatives in the group are implemented and provides a baseline from which to compare impacts resulting from the other alternatives. An overarching "No Action" option is also possible (i.e., no alternatives in Amendment 15 are implemented). Impacts from an overarching No Action option are not separately analyzed, however, if no alternatives in Amendment 15 are implemented, expected impacts would be the sum of the impacts from all No Action alternatives analyzed in the DEIS.

5.1 "A" ALTERNATIVES: EVALUATION AND MODIFICATION OF CLOSED AREAS

To analyze potential ecological impacts of the alternatives on target and bycatch species, NOAA Fisheries developed separate analyses for target species, bycatch species modeled in HMS PRiSM, and other bycatch and incidental species. Different methods were used to analyze the various metrics because the available relevant data varies.

Target Species Impacts

Bottom longline spatial management areas (including the current closed area)

NOAA Fisheries analyzed the impacts of the spatial management alternatives on bottom longline target species (generally large coastal sharks) because the alternatives would affect the time and location when/where vessel operators may fish with bottom longline gear. In the Mid-Atlantic shark closed area, sandbar shark was a targeted species and now a species caught as bycatch in need of protection.

Pelagic longline spatial management areas

NOAA Fisheries analyzed the impacts of the spatial management alternatives on target species (swordfish, yellowfin tuna, and bigeye tuna) because the alternatives would affect the time and location when/where vessel operators may fish with pelagic longline gear.

Reference Areas

Because there is no recent data from inside the current closed areas, NOAA Fisheries used an area outside the spatial management areas ("reference area") to approximate conditions in and/or around the spatial management areas. The reference areas selected were large geographic areas containing the spatial management areas analyzed. Although large, the reference areas selected were smaller than the total open areas of the EEZ, because pelagic longline trends vary widely by region. Therefore, using recent fishery-wide data or average data from the entire area in which the pelagic longline fishery operates would not accurately reflect the potential impacts of allowing fishing in a discrete geographic area. NOAA Fisheries determined an appropriate "reference area" for the pelagic longline closed areas in the Atlantic (Charleston Bump closed area and East Florida Coast closed area) and a separate reference area for the pelagic longline DeSoto Canyon closed area in the Gulf of Mexico. The reference area in the Atlantic occurred within the U.S. EEZ from 35° N. lat. to 22° N. lat. and east of 81° 47' 24" W. long. (see map and description in Chapter 2 Figure 7), whereas the reference area in the Gulf of Mexico occurred within the US EEZ west of 81° 47' 24" W. long. (see map and description in Chapter 2 Figure 8). Pelagic longline logbook data were the source of target species catch information because the dataset is comprehensive and includes data on the location of the retained fish. More specifically, pelagic longline logbook data within the reference areas where swordfish or tuna were targeted from multiple time periods (based on specific spatial management areas described below) were analyzed to estimate fishing effort and catch-per-unit-effort (CPUE) inside and outside the spatial management areas. This method was not used for the Mid-Atlantic spatial management area sub-alternatives, for reasons explained further below.

Modeled bycatch species impacts

Bottom and pelagic longlines spatial management areas

For the modeled bycatch species, a qualitative description of the nature of the impact (e.g., increase or decrease in catch) was based on the overall metric score and scope (total area protected by the closure multiplied by the number of closure months) of each alternative. Interactions with bycatch species that were modeled by HMS PRiSM were compared using the standardized scoring system and overall metric score ranking (described in Chapters 2 and 3) generated by HMS PRiSM, which is used in this context as a standardized measure of ecological impacts on the modeled bycatch species. The higher the score the greater protection from the area is inferred. The modeled bycatch species for the bottom longline are the sandbar shark, dusky shark, and scalloped hammerhead shark. The modeled bycatch species for the pelagic longline are leatherback sea turtle, shortfin mako shark, billfish, and loggerhead sea turtle (only in Atlantic).

Non-modeled bycatch species or incidental species

Bottom and pelagic longlines spatial management areas

For the non-modeled bycatch species or incidental species, qualitative impacts are described based on other information about the ecology and distribution of those species.

Social and Economic Impacts

The economic impacts on fishermen are quantitative, and based on estimated changes in target species catch unless otherwise noted. The social impacts on fishermen and the social and economic impacts on dealers and associate businesses are qualitative.

5.1.1 Alternative Suite A1: Mid-Atlantic Spatial Management Area

General Methods

Ecological Impacts

Target Species: Descriptions of the ecological impact analysis methodologies are in the impacts discussion for each sub-alternative. The Mid-Atlantic shark closed area was designed, in part, to protect sandbar sharks, however, participants in the shark research fishery target sandbar sharks.

Bycatch species modeled by HMS PRiSM: The ecological impacts of each sub-alternative on bycatch species that were modeled by HMS PRiSM were based on metric scores (described in Chapters 2 and 3; see also Appendix 5) generated by HMS PRiSM. The metric scores are various ways of measuring the likelihood of the fishery interacting with bycatch species and can be interpreted as a measure of conservation. Four metrics were used:

- Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
- Metric 2: Does the spatial management area protect the most at-risk areas?
- Metric 3: What percent of total high-bycatch-risk area across the whole fishery domain does the spatial management area protect?
- Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Other bycatch and incidental species: Descriptions of the ecological impact analysis methodologies are in the impacts discussion for each sub-alternative.

Social and Economic Impacts

Descriptions of the social and economic impact analysis methodologies are in the impacts discussion for each sub-alternative

5.1.1.1 Sub-Alternative A1a - No Action

This sub-alternative would maintain the spatial and temporal extent of the current Mid-Atlantic shark closed area, as shown in Chapter 3 Figure 1.

Ecological Impacts on Target Species

The ecological impacts of Sub-Alternative A1a on target species are expected to be neutral. Overall, the shark fishery in the Mid-Atlantic area comprises a small portion of the U.S. shark fishery. There is currently only one fisherman that participates in the shark research fishery in the Mid-Atlantic region, and the number of fishermen that fish within the Mid-Atlantic shark closed area during open periods is less than 3. No data on the catch associated with the research fishery in the closed area is included in this analysis due to the very low numbers of fishing vessels and Magnuson-Stevens Act confidentiality of information concerns. No increase in fishing effort by bottom longline fishermen is anticipated.

The shark bottom longline fishery impacted by the Mid-Atlantic closure largely targets large coastal sharks including blacktip, spinner, tiger and, notably, sandbar sharks within the shark research fishery. Because the Mid-Atlantic closure was implemented in part to protect sandbar sharks (which is a prohibited species outside the shark research fishery), impacts to sandbar sharks are discussed below in the *Ecological Impacts on Bycatch Species Modeled by HMS PRiSM* section. Blacktip, spinner, and tiger sharks are managed in the aggregated large coastal shark management group. The Atlantic shark management groups are quota managed through two linked quotas: one for the hammerhead sharks (great, smooth, and scalloped hammerhead sharks) and one for the aggregated large coastal shark species, including blacktip and spinner sharks. When either one of the two linked quotas is reached, NOAA Fisheries closes the shark management groups and retention is not authorized for the rest of the season. In recent years, both quotas have been under-harvested with only 61 percent of the Atlantic aggregated large coastal shark management group quota filled and 66 percent of the Atlantic hammerhead shark management group quota filled in 2020 (NOAA Fisheries 2021b). Landings for target species in the shark bottom longline fishery are well below the commercial quotas. Some vessel operators fish in the Mid-Atlantic shark closed area with gillnet gear and land mostly small coastal sharks and smooth dogfish. Because there would be no change to the spatial or temporal extent of the current Mid-Atlantic shark closed area, the fishing effort by bottom longline vessel operators and target catch is likely to be similar to, or less than that of recent years. The number of shark permits (incidental and directed) has been steadily decreasing in the Atlantic in recent years, with active directed permits down from 114 in 2014 to 73 in 2019 and active incidental permits down from 2014 in 2014 to 73 in 2019. Accompanying the reduction in active permits there was a decrease in landings of large coastal sharks from 2017 through 2019 (NOAA Fisheries 2021a). Atlantic blacktip sharks underwent a species-specific stock assessment in 2020 which found the stock was not overfished, not experiencing overfishing, and could sustainably handle additional fishing mortality. Great hammerhead sharks are currently (2022-2023) undergoing a stock assessment through SEDAR 77. Spinner sharks have not been individually assessed, but are scheduled to be assessed in 2024.

Ecological Impacts on Bycatch Species Modeled by HMS PRiSM

The individual metric scores for this sub-alternative for each bycatch species and each of the 4 metrics are listed in Table 5.2. For example, for sandbar shark and Metric 1, the metric score of 7 indicates that the probability of the fishery interacting with sandbar shark inside the area is higher than the probability of interacting outside of the closed area for each of the 7 months of the closure (January through July; i.e., one point for each month). In contrast, for dusky shark and Metric 1, the score of 4 indicates that the probability of the fishery interacting with dusky shark inside the area is higher than the probability of interacting outside of the closed area for 4 of the 7 months of the closure. The total metric scores by species indicate that the area would be most effective at protection of dusky shark, with a total metric score of 19, but when considering the total metric scores for each of the four species, none of the species' total metric scores are very high, given that the highest possible combined score for each species across all 4 metrics is 48 (see column called "Total"). Under this sub-alternative, recent interaction rate of these bycatch species would be maintained, resulting in neutral indirect ecological impacts.

Table 5.2. Sub-Alternative A1a metric scores* for modeled species

Species	Metric 1	Metric 2	Metric 3	Metric 4	Total
Dusky shark	4	7	4	4	19
Scalloped hammerhead shark	7	4	0	2	13
Sandbar shark	7	0	3	4	14
Overall Metric Score					46

*For all sub-alternatives, the highest score possible for a single metric and species is 12. The highest possible total metric score for a species is 48. The highest possible overall metric score is 144.
Underlying questions:
Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
Metric 2: Does the spatial management area protect the most at-risk areas?
Metric 3: What percent of total high-bycatch-risk area across the whole fishery domain does the spatial management area protect?
Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Ecological Impacts on Other Bycatch and Incidental Species

Under Sub-Alternative A1a, effort in the shark bottom longline fishery is unlikely to increase and, if recent trends continue, could decrease. Thus, fishing impacts to other bycatch and incidental species (such as loggerhead sea turtle and blacknose shark) that the bottom longline fishery may interact with are unlikely to change and short and long-term neutral indirect ecological impacts are expected.

Social and Economic Impacts

The social and economic impacts are expected to be neutral. This sub-alternative would likely maintain the recent catch levels and revenues, because the spatial and the temporal extents would remain unchanged. Table 4.11 in Chapter 4 shows non-prohibited shark species caught on bottom longline trips in the shark research fishery in the Gulf of Mexico and Southern Atlantic in 2020. Median earnings across the shark research fishery and non-shark research fishery per trip (taking into account operating costs) ranged between $609 and $1,192 from 2017 through 2020 in nominal dollars ($614 in 2020). Estimated total ex-vessel revenue from sharks in 2020 is $2,311,319 (2021 real dollars) (NOAA Fisheries 2021a). Based on permit and target species, some fishermen direct effort on sharks while others only retain incidentally caught sharks. In 2020, there were 13 active vessels (vessels that had trips where 75 percent of the landings by weight were sharks) targeting sharks in the Atlantic (NOAA Fisheries 2021a).

Since fishing effort is not expected to change, indirect impacts to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be neutral. From 2016 through 2020, 48 dealers purchased shark products in Virginia, North Carolina, and South

Carolina which are the states in the vicinity of the Mid-Atlantic shark closed area. This sub-alternative would not alter the footprint of the current closed area, so vessel transit times and distances are unlikely to change. Thus, no impacts to fuel costs or greenhouse gas emissions are expected. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

5.1.1.2 Sub-Alternative A1b

This sub-alternative would maintain the spatial extent of the current Mid-Atlantic shark closed area, and shift the temporal extent to November 1 through May 31 from January 1 through July 31 (i.e., same duration of 7 months, but shifted two months earlier), as shown in Chapter 3 Figure 2.

Ecological Impacts on Target Species

The ecological impacts of Sub-Alternative A1b on target species are expected to be neutral. The impacts would be similar to those described under the No Action Sub-Alternative (Sub-Alternative A1a), because the spatial extent of the area under Sub-Alternative A1b would not change, and the shift in months of the area compared to the No Action sub-alternative would not substantively impact fishing effort or catch.

Ecological Impacts on Bycatch Species Modeled by HMS PRiSM

The individual metric scores for this sub-alternative for each bycatch species and each of 4 metrics are listed in Table 5.3. The total metric scores by species indicate that the alternative would be most effective at protecting dusky sharks, and substantially more effective than the status quo sub-alternative (with a score of 25 compared to 19). In contrast, the total metric scores for scalloped hammerhead and sandbar sharks are relatively low out of a possible total of 48. While it is still low, the score for sandbar sharks is higher than the score for the status quo sub-alternative (16 compared to 14). The score for scalloped hammerhead sharks was slightly lower than the status quo sub-alternative (12 compared to 13). Due to the increased scores for dusky and sandbar sharks, this sub-alternative had a higher overall metric score than the No Action sub-alternative (53 compared to 46). As such, Sub-Alternative A1b would likely have minor beneficial indirect ecological impacts for the bycatch species.

Table 5.3. Sub-Alternative A1b metric scores* for modeled species

Species	Metric 1	Metric 2	Metric 3	Metric 4	Total
Dusky shark	6	7	6	6	25
Scalloped hammerhead shark	7	3	0	2	12
Sandbar shark	7	0	4	5	16
Overall Metric Score					53

*For all sub-alternatives, the highest score possible for a single metric and species is 12. The highest possible total metric score for a species is 48. The highest possible overall metric score is 144.
Underlying questions:
Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
Metric 2: Does the spatial management area protect the most at-risk areas?
Metric 3: What percent of total high-bycatch-risk area across the whole fishery domain does the spatial management area protect?
Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Ecological Impacts on Other Bycatch and Incidental Species

Under Sub-Alternative A1b, effort in the shark bottom longline fishery is unlikely to increase and, if recent trends continue, could decrease. The spatial extent of the area would not change, and the shift in months of the area compared to the No Action sub-alternative would not substantively impact fishing effort. Thus, fishing impacts to other bycatch and incidental species (such as loggerhead sea turtle and blacknose shark) that the bottom longline fishery may interact with are unlikely to change and short and long-term neutral indirect ecological impacts are expected.

Social and Economic Impacts

The social and economic impacts of Sub-Alternative A1b are expected to be neutral. There is relatively little bottom longline fishing effort in the Mid-Atlantic region during open time periods, including and adjacent to the area defined by this spatial management area. Effort is low enough that totals for the area, even during open time periods, that the data cannot be provided due to confidentiality concerns. This sub-alternative would maintain the recent catch levels and revenues, and there would likely be low levels of data collection from within the spatial management area. Overall revenues from shark research fishery trips are likely to continue in the range noted in Sub-Alternative A1a. Based on permit and target species, some fishermen direct effort on sharks while others only retain incidentally caught sharks. In 2020, there were 13 active vessels (vessels that had trips where 75 percent of the landings by weight were sharks) targeting sharks in the Atlantic (NOAA Fisheries 2021a).

Since fishing effort is not expected to change, indirect impacts to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be neutral. From 2016 through 2020, 48 dealers purchased shark products in Virginia, North Carolina, and South Carolina which are the states in the vicinity of the Mid-Atlantic shark closed area. This sub-alternative would not substantially alter the footprint of the current closed area, so vessel transit times and distances are unlikely to change. Thus, no impacts to fuel costs or greenhouse gas emissions are expected. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

5.1.1.3 Sub-Alternative A1c

This sub-alternative would modify both the spatial and temporal extent of the current closed area, as shown in Chapter 3 Figure 3. Specifically, this sub-alternative would extend the eastern boundary of the current Mid-Atlantic shark closed area eastward to the 350-m shelf break and shift the north boundary south to Cape Hatteras (35° 13’ 12” N. lat.). The temporal extent would shift to November 1 through May 31 from January 1 through July 31.

Ecological Impacts on Target Species

The ecological impacts of Sub-Alternative A1c on target species are expected to be neutral. The impacts would be similar to those described under Sub-Alternative A1a, because the spatial extent of the area under Sub-Alternative A1c would decrease, and the temporal extent would shift, but the overall extent would be similar to Sub-Alternative A1a.

Ecological Impacts on Bycatch Species Modeled by HMS PRiSM

Table 5.4 lists the individual metric scores for this sub-alternative for each bycatch species. The total metric scores by species indicate that the sub-alternative would be most effective at protection of dusky sharks and substantially more effective than the status quo sub-alternative (with a score of 24 compared to 19). In contrast, the total scores for scalloped hammerhead and sandbar sharks are relatively low out of a possible total of 48. While it is still low, the scores for sandbar sharks and scalloped hammerhead sharks are higher than the score for the status quo sub-alternative (15 and 15, respectively, compared to 14). In addition, the scope, which is the total area protected by the closure multiplied by the number of closure months, would decrease by 2.8 percent compared to the No Action sub-alternative. Due to the increased scores for all three shark species, this sub-alternative had a higher overall metric score than the No Action sub-alternative (54 compared to 46). As such, Sub-Alternative A1c would likely have moderate beneficial indirect ecological impacts.

Table 5.4. Sub-Alternative A1c metric scores* for modeled species

Species	Metric 1	Metric 2	Metric 3	Metric 4	Total
Dusky shark	6	7	5	5	24
Scalloped hammerhead	7	5	0	3	15
Sandbar shark	7	0	3	5	15
Overall Metric Score					54

*For all sub-alternatives, the highest score possible for a single metric and species is 12. The highest possible total metric score for a species is 48. The highest possible overall metric score is 144.
Underlying questions:
Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
Metric 2: Does the spatial management area protect the most at-risk areas?
Metric 3: What percent of total high-bycatch-risk area across the whole fishery domain does the spatial management area protect?
Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Ecological Impacts on Other Bycatch and Incidental Species

Under Sub-Alternative A1c, effort in the shark bottom longline fishery is unlikely to increase and, if recent trends continue, could decrease. The spatial extent of the area would increase slightly, and the temporal extent would be shifted, but remain seven months in duration. Thus, fishing impacts to other bycatch and incidental species (such as loggerhead sea turtle and blacknose shark) that the bottom longline fishery may interact with are unlikely to change and short and long-term neutral indirect ecological impacts are expected.

Social and Economic Impacts

The social and economic impacts of Sub-Alternative A1c are expected to be neutral. There is relatively little bottom longline fishing effort in the Mid-Atlantic region during open time periods, including and adjacent to the area defined by this spatial management area. Effort is low enough that totals for the area, even during open time periods, that the data cannot be provided due to confidentiality concerns. This sub-alternative would maintain the recent catch levels and revenues, and there would likely be low levels of data collection from within the spatial management area. Overall revenues from shark research fishery trips are likely to continue in the range noted in Sub-Alternative A1a. Based on permit and target species, some fishermen direct effort on sharks while others only retain incidentally caught sharks. In 2020, there were 13 active vessels (vessels that had trips where 75 percent of the landings by weight were sharks) targeting sharks in the Atlantic (NOAA Fisheries 2021a).

Since fishing effort is not expected to change, indirect impacts to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be neutral. From 2016 through 2020, 48 dealers purchased shark products in Virginia, North Carolina, and South Carolina which are the states in the vicinity of the Mid-Atlantic shark closed area. This sub-alternative would shift the northern boundary of the closed area south, possibly opening fishing ground closer to shore and important ports such as Wanchese, North Carolina, so vessel transit times and distances to open fishing grounds could slightly decrease. However, since the change is small, no impacts to fuel costs or greenhouse gas emissions are expected. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

5.1.1.4 Sub-Alternative A1d, Preferred Sub-Alternative

Preferred Sub-Alternative A1d would modify both the spatial and temporal extent of the current closed area, as shown in Chapter 3 Figure 4. Specifically, this sub-alternative would extend the eastern boundary of the current Mid-Atlantic shark closed area eastward to the 350-m shelf break. The temporal extent would shift to November 1 through May 31 from January 1 through July 31.

Ecological Impacts on Target Species

The ecological impacts of Sub-Alternative A1d on target species are expected to be neutral. The impacts would be similar to those described under Sub-Alternative A1a, because although the spatial extent of the area under Sub-Alternative A1d would increase, and the temporal extent would shift, the overall fishing effort would remain low, and similar to Sub-Alternative A1a.

Ecological Impacts on Bycatch Species Modeled by HMS PRiSM

Table 5.5 lists the individual metric scores for this sub-alternative for each bycatch species. For example, for dusky shark, scalloped hammerhead and sandbar shark, Metric 1 scores of 7 indicate that the probability of the fishery interacting with each of these shark species inside the area is higher than the probability of interacting outside of the closed area for each of the seven months the closure (November through May; i.e., one point for each month). The total metric scores by species indicate that the sub-alternative would be most effective at protection of dusky sharks and substantially more effective than the status quo sub-alternative (with a score of 26 compared to 19). Additionally, Sub-Alternative A1d had the highest dusky shark metric score of all the Suite A1 Alternatives. In contrast, the total scores for scalloped hammerhead and sandbar sharks are lower out of a possible total of 48. While it is still low, the scores for sandbar sharks and scalloped hammerhead sharks are higher than the score for the status quo sub-alternative (18 and 18, respectively, compared to 14). However, Sub-Alternative A1d had the highest sandbar shark and scalloped hammerhead shark metric score of all the Suite A1 Alternatives. In addition, the scope, which is the total area protected by the closure multiplied by the number of closure months, would decrease by 14.1 percent compared to the No Action sub-alternative. Due to the increased scores for all three shark species, this sub-alternative had a higher overall metric score than the No Action sub-alternative (62 compared to 46). Additionally, Sub-

Alternative A1d had the highest overall metric score of all the Suite A1 Alternatives. As such, Sub-Alternative A1d would likely have moderate beneficial indirect ecological impacts.

Table 5.5. Sub-Alternative A1d metric scores* for modeled species

Species	Metric 1	Metric 2	Metric 3	Metric 4	Total
Dusky shark	7	7	6	6	26
Scalloped hammerhead	7	5	3	3	18
Sandbar shark	7	0	6	5	18
Overall Metric Score					62

*For all sub-alternatives, the highest score possible for a single metric and species is 12. The highest possible total metric score for a species is 48. The highest possible overall metric score is 144.
Underlying questions:
Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
Metric 2: Does the spatial management area protect the most at-risk areas?
Metric 3: What percent of total high-bycatch-risk area across the whole fishery domain does the spatial management area protect?
Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Ecological Impacts on Other Bycatch and Incidental Species

Under Sub-Alternative A1d, effort in the shark bottom longline fishery is unlikely to increase and, if recent trends continue, could decrease. The spatial extent of the area would increase slightly, and the temporal extent would be shifted, but remain seven months in duration. The small increase in the spatial extent, particularly since it is further offshore, is unlikely to lead to an increase in effort. Thus, fishing impacts to other bycatch and incidental species (such as loggerhead sea turtle and blacknose shark) that the bottom longline fishery may interact with are unlikely to change and short and long-term neutral indirect ecological impacts are expected.

Social and Economic Impacts

The social and economic impacts of Sub-Alternative A1d are expected to be neutral. There is relatively little bottom longline fishing effort in the Mid-Atlantic region during open time periods, including and adjacent to the area defined by this spatial management area. Effort is low enough that totals for the area, even during open time periods, that the data cannot be provided due to confidentiality concerns. This sub-alternative would maintain the recent catch levels and revenues, and there would likely be low levels of data collection from within the spatial management area. Overall revenues from shark research fishery trips are likely to continue in the range noted in Sub-Alternative A1a. Based on permit and target species, some fishermen direct effort on sharks while others only retain incidentally caught sharks. In 2020, there were 13 active vessels (vessels that had trips where 75 percent of the landings by weight were sharks) targeting sharks in the Atlantic (NOAA Fisheries 2021a).

Since fishing effort is not expected to change, indirect impacts to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be neutral. From 2016 through 2020, 48 dealers purchased shark products in Virginia, North Carolina, and South Carolina which are the states in the vicinity of the Mid-Atlantic shark closed area. This sub-alternative would slightly extend the eastern boundary of the closed areas, so vessel transit times and distances to open fishing grounds could slightly increase. However, since the change is small, no impacts to fuel costs or greenhouse gas emissions are expected. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

5.1.1.5 Comparison of Alternative Suite A1 Sub-Alternatives

It is likely that the ecological impacts on target species of the Suite A1 Sub-Alternatives would be similar to one another, based on the scopes of the sub-alternatives shown in Table 5.6. Substantive changes in fishing effort would not occur as a result of the shifts in the temporal or spatial extent of the spatial management area, and therefore changes in target species catch are not expected.

Table 5.6, which compares the scopes and scored HMS PRiSM metrics, characterizes the impacts of the Suite A1 Sub-Alternatives on the modeled bycatch species.

The Sub-Alternative A1a (No Action) ranked the lowest for the overall metric scores, meaning the current spatial extent and temporal extent provide the least protection to areas where potential bycatch interaction with bottom longline gear is the highest. In other words, Sub-Alternatives A1b, A1c, and A1d would each be more effective than the No Action Sub-Alternative A1a at protecting the modeled bycatch species. For all of the sub-alternatives, dusky sharks had the highest combined metric scores. The Preferred Sub-Alternative A1d had the highest overall metric score (62), followed by A1b and A1c (53), and then A1a (46).

Sub-Alternative A1b had a higher overall metric score compared to the No Action sub-alternative and an equal overall metric score to Sub-Alternative A1c. Under Sub-Alternative A1b conservation of sandbar and dusky sharks are expected to be higher compared to the No Action sub-alternative when the timing of the closure is shifted earlier by two months. Scalloped hammerhead sharks would be somewhat less protected under Sub-Alternative A1b than under the No Action sub-alternative. Note that the conservation value of Sub-Alternative A1b compared to the No Action sub-alternative (A1a) comes solely from the temporal shift in the closure as the spatial extent would remain unchanged.

Sub-Alternative A1c had a higher overall metric score compared to the No Action sub-alternative. This means that the spatial and temporal extent of this sub-alternative improved bycatch protection relative to the status quo. Under Sub-Alternative A1c, conservation of sandbar, dusky, and scalloped hammerhead sharks are expected to be higher compared to the No Action sub-alternative due to the two-month temporal shift and the two spatial boundary changes. Sub-Alternative A1c had a lower scope (*see* *Scope explanation under Table 5.6) than the other sub-alternatives, however, the overall metric score is still higher than A1a and equal to that of A1b. Sub-Alternative A1c had a lower overall metric score than that of the Preferred Sub-Alternative A1d. Whereas Sub-Alternative A1b improved the conservation of dusky shark and sandbar shark, Sub-Alternative A1c improved the conservation of all three species.

Preferred Alternative A1d had the highest overall metric score, and had the highest total metric scores for each of the three species. Recall that the overall metric scores add the total metric scores of each species. The spatial and temporal extent of this sub-alternative as indicated by the scope, improved bycatch protection for the modeled species more than the other sub-alternatives.

Table 5.6. Comparison of scope and metrics of Suite A1 Sub-Alternatives

	A1a - No Action	**A1b**	**A1c**	**A1d - Preferred**
Summary description	*Spatial*: Status quo *Temporal*: Status quo (January-July)	*Spatial*: Status quo *Temporal*: November-May	*Spatial*: Extend eastern, reduce northern boundaries *Temporal*: November-May	***Spatial*: Extend eastern boundary** ***Temporal*: November-May**
Scope* compared to No Action sub-alternative	0 (no change)	0 (no change)	-1,056	**5,330**
Total metric score for dusky shark	19	25	23	**26**
Total metric score for scalloped hammerhead	13	12	15	**18**
Total metric score for sandbar shark	14	16	15	**18**
Overall metric score	46	53	53	**62**

*Scope: For the purpose of this DEIS, a measure of the spatial and temporal extent of a particular management area used to compare options and alternatives: square nautical miles of area x the number of closure months.

None of the A1 suite of sub-alternatives would have social or economic impacts on the commercial bottom longline fishery. The amount of target species landings and associated revenue would be similar for these sub-alternatives. The Mid-Atlantic region does not comprise a substantial portion of the commercial bottom longline fishery. Effort is low enough that totals for the area, even during open time periods, that the data cannot be provided due to confidentiality concerns. However, 149 trips targeting sharks occurred in 2020 in the Atlantic EEZ and only a small portion occurred in the Mid-Atlantic region. It is likely that the social and economic impacts on fishermen would be similar across the Suite A1 Sub-Alternatives, largely due to the small changes in timing and orientation of the closure.

5.1.1.6 Conclusions - Alternative Suite A1

Preferred Sub-Alternative A1d would have moderate beneficial ecological impacts. This sub-alternative would increase the protection of sandbar, dusky, and scalloped hammerhead sharks compared to the No Action sub-alternative. Shifting the timing of the spatial management by two months would make the temporal extent of the area coincide with times of the year when those three species are most likely to interact with bottom longline gear. Furthermore, the eastern boundary of the area would be extended east to the 350-m shelf break, providing additional protections for all three species. The scope (total area protected by the closure multiplied by the number of closure months) of the preferred sub-alternative is notably larger than the other sub-alternatives. The ecological impacts of the sub-alternative on bycatch species that were modeled by HMS PRiSM were based on metric scores (described in Chapters 2 and 3) generated by HMS PRiSM. The metric scores are various ways of measuring the likelihood of the fishery interacting with bycatch species and can be interpreted as a measure of conservation. The preferred sub-alternative would have minimal impacts on the commercial bottom longline fishery, mostly because the spatiotemporal changes are small relative to the larger Atlantic shark fishing areas. The temporal shift in Sub-Alternative A1d compared to the No Action sub-alternative may allow fishermen to more easily avoid bycatch species while pursuing target species. Although under the Preferred Sub-Alternative A1d the spatial extent of the area would be increased, which would reduce access to target species, the shift in months may facilitate access to target species because the months of June and July would no longer be included. Substantive changes to fishing effort are not anticipated. The Mid-Atlantic region does not comprise a substantial portion of the commercial bottom longline fishery. Preferred Sub-Alternative A1d is consistent with the objectives of Amendment 15 including Objectives 1 and 4: “Using spatial management tools, minimize bycatch and bycatch mortality, to the extent practicable, while also optimizing fishing opportunities for U.S. fishing vessels;” and “Evaluate the effectiveness of existing HMS spatial management areas, and if warranted, modify them to achieve an optimal balance of ecological, social, and economic benefits and costs.”

5.1.2 Alternative Suite A2: Charleston Bump Spatial Management Area

General Methods

Ecological Impacts

Target Species: Descriptions of the ecological impact analysis methodologies are in the impacts discussion for each sub-alternative.

Bycatch species modeled by HMS PRiSM: The ecological impacts of each sub-alternative on bycatch species that were modeled by HMS PRiSM were based on metric scores (described in Chapters 2 and 3; see also Appendix 5) generated by HMS PRiSM. The metric scores are various ways of measuring the likelihood of the fishery interacting with bycatch species and can be interpreted as a measure of conservation. Four metrics were used:

- Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
- Metric 2: Does the spatial management area protect the most at-risk areas?
- Metric 3: What percent of total high-bycatch-risk area across the whole fishery domain does the spatial management area protect?
- Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Other bycatch and incidental species: Descriptions of the ecological impact analysis methodologies are in the impacts discussion for each sub-alternative.

Social and Economic Impacts

Although there are no recent catch data from within the current Charleston Bump closed area from February through April, we estimated potential target species catch under the Suite A2 Alternatives using the reference area method described in the introduction to Section 5.1. Each sub-alternative considers spatial and temporal changes to the current Charleston Bump closed area and we estimated target catch by multiplying effort (number of hooks) by CPUE (catch per 1,000 hooks) for each species.

Effort estimates: In areas and times when the Charleston Bump is open to normal pelagic longline fishing, we used reported hook data from logbooks. In areas and months when Charleston Bump is currently closed, we estimated the number of hooks that would be deployed using the method described in the social and economic impacts section of each sub-alternative. The number of hooks is based on a percent, so we assumed that the total number of hooks in the entire reference area across the Charleston Bump closed area in each sub-alternatives would remain the same, and the percentages inside versus outside would change for each sub-alternative. Because of the ongoing decline in effort documented in the pelagic longline fishery, NOAA Fisheries selected a relatively recent time period (2016 through 2020) to represent fishing effort.

CPUE estimates: In areas and times when the Charleston Bump is open to normal pelagic longline fishing, we used reported hook and catch data from logbooks to calculate CPUE (catch / 1,000 hooks). In areas and times when Charleston Bump is currently closed, we estimated CPUE using the method described in the social and economic impacts section of each sub-alternative. Unlike effort, CPUE varied across target species and did not show similar trends for all species. To address this variation, we decided to incorporate more years for the CPUE calculation (2011-2020).

Catch estimates: NOAA Fisheries estimated the monthly catch (expressed as numbers of fish) within each sub-alternative for each target species by multiplying the estimated monthly effort by the monthly CPUE. The estimated monthly catch within the reference area outside the current Charleston Bump closed area was also calculated using the same approach. The sum of species-specific catch inside and outside the current Charleston Bump closed area across the entire reference area is the total estimated species-specific catch.

5.1.2.1 Sub-Alternative A2a - No Action

This sub-alternative would maintain the current Charleston Bump closed area in effect with respect to its spatial and temporal extent, as shown in Chapter 3 Figure 5.

Ecological Impacts on Target Species

The ecological impacts of Sub-Alternative A2a on target species catch is expected to be neutral. The target species are quota-managed species, and this sub-alternative would not affect the overall U.S. quotas for swordfish, yellowfin tuna, or bigeye tuna, which prevent overfishing, are based on the best scientific information available, and are consistent with the ICCAT-recommended total allowable catches.

Ecological Impacts on Bycatch Species Modeled by HMS PRiSM

Table 5.7 lists the individual metric scores for each bycatch species. For example, for shortfin mako shark the score of 3 for Metric 1 indicates that the probability of the fishery interacting with shortfin mako shark inside the area is higher than the probability of interacting outside of the closed area for each of the 3 months the closure (February through April; i.e., one point for each month). The total metric scores by species indicate that this sub-alternative would be most effective for the protection of the shortfin mako shark, followed by leatherback sea turtle, and provide little protection for billfish species (with a score of zero) or the loggerhead sea turtle (with a score of one). The overall metric score for Sub-Alternative A2a is relatively low with a score of 21. Under this sub-alternative (No Action), recent interaction rates of these bycatch species would be maintained, resulting in neutral indirect ecological impacts.

Table 5.7. Sub-Alternative A2a metric scores* for modeled species

Species	Metric 1	Metric 2	Metric 3	Metric 4	Total
Leatherback Sea Turtle	2	2	3	2	9
Shortfin Mako Shark	3	3	2	3	11
Billfish Species	0	0	0	0	0
Loggerhead Sea Turtle	0	1	0	0	1
Overall Metric Score					21

*For all sub-alternatives, the highest score possible for a single metric and species is 12. The highest possible total metric score for a species is 48. The highest possible overall metric score is 192.
Underlying questions:
Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
Metric 2: Does the spatial management area protect the most at-risk areas?
Metric 3: What percent of total high-bycatch-risk area across the whole fishery domain does the spatial management area protect?
Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Ecological Impacts on Other Bycatch and Incidental Species

Under Sub-Alternative A2a (No Action), effort in pelagic longline fishery is unlikely to increase and, if recent trends continue, could decrease. Thus, fishing impacts to other bycatch and incidental species of concern such as bluefin tuna, longfin mako shark, oceanic whitetip shark, scalloped hammerhead shark, dusky shark, or sandbar shark are unlikely to change and neutral indirect ecological impacts are expected. Further, the IBQ Program has been successful in reducing the incidental catch of bluefin tuna (NOAA Fisheries 2019, National Academies 2021).

Social and Economic Impacts

Methods

Sub-alternative-specific effort estimate: For each month, January through December, the percent of the total number of hooks deployed each month for each year in the reference area that occurred in the area inside Sub-Alternative A2a (the current Charleston Bump closed area) was calculated (i.e., Sub-Alternative A2a area hooks/reference area hooks x 100). The analysis used hook data from logbooks during months when the geographic area was open to fishing. When the area was closed to pelagic longline gear (February through April), we assumed that zero percent of the hooks occurred in the Sub-Alternative A2a. The monthly hook percentages were then averaged across the years 2016 through 2020. We subtracted those percentages from 100 to estimate a monthly percent of hooks that occurred in the reference area outside the current Charleston Bump closed area (in the reference area). The monthly percentages were multiplied by the average total number of hooks each month across years that occurred in the reference area to calculate the estimated number of hooks each month that occurred in Sub-Alternative A2a and inside the reference area outside the current Charleston Bump closed area.

Sub-alternative-specific CPUE estimate: We calculated species-specific CPUEs for each month in each year and then averaged across years within Sub-Alternative A2a and within the reference area outside the current Charleston Bump closed area. We assumed CPUEs in Sub-Alternative A2a were zero for months where fishing is not allowed. Next, we averaged the species-specific CPUEs across years within Sub-Alternative A2b and for all months within the reference area outside the current Charleston Bump closed area. This methodology provided a separate monthly CPUE for each species inside and outside the closed area.

Estimated Impacts

Table 5.8 shows the average number of monthly hooks and percentage of total hooks inside the current Charleston Bump closed area and outside the area within the reference area, on a monthly basis, from 2016 through 2020. NOAA Fisheries estimated that within the current Charleston Bump closed area for a given year a total of 460,569 hooks would be deployed, while 446,573 hooks were estimated in the reference area outside the current Charleston Bump closed area, which brings the total number of hooks to 907,142 within the entire reference area. Table 5.9, Table 5.10, and Table 5.11 show CPUEs for swordfish, yellowfin tuna and bigeye tuna, respectively, inside and outside the current Charleston Bump closed area for 2011 through 2020. Table 5.12 below shows the estimated numbers of swordfish, yellowfin tuna, and bigeye tuna target catch inside the reference area within the current Charleston Bump closed area compared to outside (within the reference area) for this sub-alternative. The estimated swordfish catch was higher inside the closed area compared to outside, whereas estimated yellowfin and bigeye tuna catch was higher outside. As noted above we compared the estimated catch for the target species inside the reference area, using the method described above, to the actual average catch from 2016 through 2020 inside the reference area, based on logbook data. The average annual (2016-2020) number of fish caught from the reference area was 11,772 swordfish, 2,109 yellowfin tuna, and 1,595 bigeye tuna.

Table 5.8. Average number of monthly hooks and percentage of hooks inside or outside (but in the reference area) the current Charleston Bump closed area (2016-2020); Sub-Alternative A2a

Month	Inside	Outside
January	41,864 (55%)	34,627 (45%)
February	0 (0%)	42,177 (100%)
March	0 (0%)	66,890 (100%)
April	0 (0%)	89,816 (100%)

May	201,617 (90%)	22,970 (10%)
June	64,285 (64%)	36,763 (36%)
July	31,764 (55%)	25,549 (45%)
August	24,930 (44%)	32,308 (56%)
September	11,789 (32%)	25,050 (68%)
October	11,808 (38%)	19,650 (62%)
November	31,309 (56%)	24,557 (44%)
December	41,202 (61%)	26,217 (39%)

Table 5.9. Average monthly swordfish CPUE (per 1,000 hooks) inside or outside (but in the reference area) the current Charleston Bump closed area (2011-2020); Sub-Alternative A2a

Month	Inside	Outside
January	21.36	4.83
February	0.00	5.61
March	0.00	6.01
April	0.00	6.12
May	14.15	4.34
June	15.15	2.56
July	20.71	2.78
August	27.76	3.99
September	44.20	5.12
October	44.17	6.12
November	36.80	5.22
December	24.40	4.85

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.10. Average monthly yellowfin tuna CPUE (per 1,000 hooks) inside or outside (but in the reference area) the current Charleston Bump closed area (2011-2020); Sub-Alternative A2a.

Month	Inside	Outside
January	1.72	6.27
February	0.00	5.55
March	0.00	3.21
April	0.00	1.61
May	0.12	1.82
June	0.80	4.24
July	0.98	5.14
August	0.50	4.95
September	0.37	4.91
October	0.42	4.50
November	1.01	4.50
December	1.20	5.61

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.11. Average monthly bigeye tuna CPUE (per 1,000 hooks) inside or outside the current Charleston Bump closed area (2011-2020); Sub-Alternative A2a

Month	Inside	Outside
January	0.15	4.97
February	0.00	2.25
March	0.00	1.69
April	0.00	1.39
May	0.01	2.67
June	0.18	3.19
July	1.05	4.93

August	0.59	6.25
September	0.45	6.48
October	0.05	8.14
November	0.06	4.56
December	0.04	5.74

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.12. Estimated annual numbers of target species caught inside or outside (but in the reference area) the current Charleston Bump closed area; Sub-Alternative A2a

	Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
Inside	9,271	281	78	9,630
Outside	2,254	1,768	1,597	5,619
Total	11,525	2,049	1,675	15,249

NOAA Fisheries used the target species catch estimates for swordfish, yellowfin tuna, and bigeye tuna presented in Table 5.12 to estimate the effect of the sub-alternative on commercial pelagic longline revenue. We first calculated the average ex-vessel price per fish in pounds dressed weight (lb dw) for the Atlantic using average price per lb dw from 2016 through 2020. We then multiplied the average price per lb dw (in 2021 real dollars - swordfish: $4.62; yellowfin tuna: $4.51; bigeye tuna: $5.89) by the average lb dw of one fish for the Atlantic to estimate the average price per fish. Lastly, we multiplied the average price per fish by the total species catch estimates in the reference area.

Table 5.13 shows the estimated annual revenue for each target species. The combined target species revenue is $4,419,261 (2021 real dollars). This sub-alternative would maintain the recent fishing effort, catch levels, and revenues, resulting in direct neutral social and economic impacts on pelagic longline fishermen. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Table 5.13. Estimated annual revenue of target species caught in the reference area (2021 real dollars); Sub-Alternative A2a

Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
$3,453,351	$537,596	$428,314	$4,419,261

Since fishing effort is not expected to change under this sub-alternative, changes to landings are not expected either. Thus, indirect impacts to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be neutral. From 2016 through 2020, 96 dealers purchased swordfish, yellowfin tuna, or bigeye tuna products in North Carolina, South Carolina, Georgia, and the east coast of Florida, which are the states in the vicinity of the Charleston Bump closed area. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

This sub-alternative would not alter the footprint of the current closed area, so vessel transit times and distances are unlikely to change. Thus, no impacts to fuel costs or greenhouse gas emissions are expected.

5.1.2.2 Sub-Alternative A2b

This sub-alternative would maintain the current spatial extent of the current Charleston Bump closed area, and would shift the temporal scope to December 1 through March 31 from February 1 through April 30, as shown in Chapter 3 Figure 6.

Ecological Impacts on Target Species

The ecological impacts of Sub-Alternative A2b on target species catch is expected to be neutral. The target species are quota-managed species, and this sub-alternative would not affect the overall U.S. quotas for swordfish, yellowfin tuna, or bigeye tuna, which prevent overfishing, are based on the best scientific information available, and are consistent with the ICCAT-recommended TACs and quotas.

Ecological Impacts on Bycatch Species Modeled by HMS PRiSM

Table 5.14 lists the individual metric scores for this sub-alternative for each bycatch species. Under this sub-alternative, when December and January are added to the closure and April is removed, the metric scores indicate that the sub-alternative would be most effective at protecting leatherback sea turtles and shortfin mako sharks, and more effective than the status quo sub-alternative (leatherback sea turtle score of 16 compared to 9; shortfin mako shark score of 14 compared to 11). In contrast, the total metric scores for billfish species and loggerhead sea turtles are relatively low out of a possible total of 48 (zero for both species). However, both scores are similar to the status quo sub-alternative (billfish species score of zero compared to zero; loggerhead sea turtle score of zero compared to 1). Due to the increased scores for leatherback sea turtles and shortfin mako sharks, this sub-alternative had a higher overall metric scores than the No Action sub-alternative (30 compared to 21). In addition, the scope, which is the total area protected by the closure multiplied by the number of closure months, increased by 33 percent compared to the No Action sub-alternative. As such, Sub-Alternative A2b would likely have short and long-term direct minor beneficial indirect ecological impacts for the bycatch species.

Table 5.14. Sub-Alternative A2b metric scores* for modeled species

Species	Metric 1	Metric 2	Metric 3	Metric 4	Total
Leatherback Sea Turtle	4	4	4	4	16
Shortfin Mako Shark	3	4	4	3	14
Billfish Species	0	0	0	0	0
Loggerhead Sea Turtle	0	0	0	0	0
Overall Metric Score					30

*For all sub-alternatives, the highest score possible for a single metric and species is 12. The highest possible total metric score for a species is 48. The highest possible overall metric score is 192.
Underlying questions:
Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
Metric 2: Does the spatial management area protect the most at-risk areas?
Metric 3: What percent of total high-bycatch-risk area across the whole fishery domain does the spatial management area protect?
Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Ecological Impacts on Other Bycatch and Incidental Species

Under Sub-Alternative A2b, effort in pelagic longline fishery is unlikely to increase and, if recent trends continue, could decrease. Thus, fishing impacts to other bycatch and incidental species of concern such as bluefin tuna, longfin mako shark, oceanic whitetip shark, scalloped hammerhead shark, dusky shark, or sandbar shark are unlikely to change and indirect neutral ecological impacts are expected. Further, the IBQ Program has been successful in reducing the incidental catch of bluefin tuna (NOAA Fisheries 2019, National Academies 2021).

Social and Economic Impacts

Methods

Sub-alternative-specific effort estimate: Under Sub-Alternative A2b, the spatial management area does not include the month of April. Because the pelagic longline fishing effort during the month of April has been zero since the inception of the current closed area, we used historical data from the months just before and immediately after the time period of the closure as an estimate for April fishing effort under this sub-alternative (in which April would not be closed). NOAA Fisheries assumed the effort in April inside Sub-Alternative A2b would equal the historical average effort (percent of hooks) in January and May inside the current Charleston Bump closed area. We also assumed the effort inside Sub-Alternative A2b for the newly affected months of December and January to be zero percent. We subtracted the monthly percentages from 100 percent to estimate a monthly percent of hooks that occurred in the reference area outside the current Charleston Bump closed area. We then multiplied the percentages by the average total number of hooks in the Atlantic reference area each month across years to estimate the number of hooks each month that occurred in Sub-Alternative A2b and inside the reference area outside the Charleston Bump spatial management area.

Sub-alternative-specific CPUE estimate: For months where fishing would be allowed, we averaged the species-specific CPUEs across years within Sub-Alternative A2b and for all months within the reference area outside the current Charleston Bump closed area. The method used to estimate CPUE inside Sub-Alternative A2b in April was similar to that used to estimate effort during April (due to the lack of recent historical data during April). That is, we assumed the CPUE during April was equal to the average CPUE inside Sub-Alternative A2b in January and May, the months abutting the period of the current closed area and that are open for pelagic longline fishing. To estimate the CPUE outside the current Charleston Bump closed area in April, we used the average CPUE of January and May (from the reference area outside the current Charleston Bump closed area), the months abutting the historical period of the closure. In an analogous manner, we estimated the CPUE outside the current Charleston Bump closed area in January and December using the average CPUE outside the current Charleston Bump closed area from February through April. We made these assumptions because CPUE may differ outside the current Charleston Bump closed area if that area is open or closed.

Estimated Impacts

Table 5.15 shows the average number of monthly hooks and percentage of total hooks inside the current Charleston Bump closed area and outside the area within the reference area, on a monthly basis, from 2016 through 2020. Of the estimated average annual total number of hooks in the reference area (907,142), NOAA Fisheries estimated that 442,396 hooks would be deployed within the current Charleston Bump closed area annually (49 percent of total hooks), while 464,746 hooks (would be deployed in the reference area outside the current Charleston Bump closed area (51 percent of the total hooks). Table 5.16, Table 5.17, and Table 5.18 show CPUEs for swordfish, yellowfin tuna and bigeye tuna, respectively, inside and outside the current Charleston Bump closed area for 2011 through 2020. Table 5.19 below shows the estimated numbers of swordfish, yellowfin tuna, and bigeye tuna target catch inside the reference area within the current Charleston Bump closed area compared to outside (within the reference area) for this sub-alternative. The estimated swordfish catch (numbers of fish) inside the current closed area and in the entire reference area were less than under the No Action sub-alternative due to the temporal shift for this sub-alternative. The total estimated yellowfin and bigeye tuna catch is expected to slightly increase and slightly decrease, respectively (Table 5.19).

Table 5.15. average number of monthly hooks and percentage of hooks inside or outside (but in the reference area) the current Charleston Bump closed area (2016-2020); Sub-Alternative A2b

Month	Inside	Outside
January	0 (0%)	76,491 (100%)
February	0 (0%)	42,177 (100%)
March	0 (0%)	66,890 (100%)
April	64,894 (72%)	24,922 (28%)
May	201,617 (90%)	22,970 (10%)
June	64,285 (64%)	36,763 (36%)
July	31,764 (55%)	25,549 (45%)
August	24,930 (44%)	32,308 (56%)
September	11,789 (32%)	25,050 (68%)
October	11,808 (38%)	19,650 (62%)
November	31,309 (56%)	24,557 (44%)
December	0 (0%)	67,419 (100%)

Table 5.16. Average monthly swordfish CPUE (per 1,000 hooks) inside or outside (but in the reference area) the current Charleston Bump closed area (2011-2020); Sub-Alternative A2b

Month	Inside	Outside
January	0.00	5.92
February	0.00	5.61
March	0.00	6.01
April	17.76	4.59
May	14.15	4.34
June	15.15	2.56
July	20.71	2.78
August	27.76	3.99

Month	Inside	Outside
January	0.00	5.92
September	44.20	5.12
October	44.17	6.12
November	36.8	5.22
December	0.00	5.92

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.17. Average monthly yellowfin tuna CPUE (per 1,000 hooks) inside or outside (but in the reference area) the current Charleston Bump closed area (2011-2020); Sub-Alternative A2b

Month	Inside	Outside
January	0.00	3.46
February	0.00	5.55
March	0.00	3.21
April	0.92	4.04
May	0.12	1.82
June	0.80	4.24
July	0.98	5.14
August	0.50	4.95
September	0.37	4.91
October	0.42	4.50
November	1.01	4.50
December	0.00	3.46

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.18. Average monthly bigeye tuna CPUE (per 1,000 hooks) inside or outside (but in the reference area) the current Charleston Bump closed area (2011-2020); Sub-Alternative A2b

Month	Inside	Outside
January	0.00	1.78
February	0.00	2.25
March	0.00	1.69
April	0.08	3.82
May	0.01	2.67
June	0.18	3.19
July	1.05	4.93
August	0.59	6.25
September	0.45	6.48
October	0.05	8.14
November	0.06	4.56
December	0.00	1.78

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.19. Estimated annual numbers of target species caught inside or outside (but in the reference area) the current Charleston Bump closed area; Sub-Alternative A2b

	Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
Inside	8,524	220	75	8,819
Outside	2,326	1,858	1,500	5,684
Total	10,900	2,078	1,575	14,553

Following the social and economic calculations described in the Sub-Alternative A2a, we estimated revenue for Sub-Alternative A2b. Table 5.20 shows the estimated annual revenue for each target species and the combined target species revenue is $3,911,864 (2021 real dollars). This sub-alternative would generate less revenue from swordfish and bigeye tuna, but more from yellowfin tuna than the No Action sub-alternative. When combined, the total revenue difference between this sub-alternative and the No Action sub-alternative is -$205,237. However, fishermen are unlikely to fish in areas with lower catch rates, so reductions in revenue may not be realized. Sub-Alternative A2b would likely result in minor adverse social and economic impacts. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Since fishing effort is not expected to change, changes to landings are not expected either. Thus, indirect impacts to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be neutral. From 2016 through 2020, 96 dealers purchased swordfish, yellowfin tuna, or bigeye tuna products in North Carolina, South Carolina, Georgia, and the east coast of Florida, which are the states in the vicinity of the Charleston Bump closed area. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

This sub-alternative would not substantially alter the footprint of the current closed area, so vessel transit times and distances are unlikely to change. Thus, no impacts to fuel costs or greenhouse gas emissions are expected.

Table 5.20. Estimated annual revenue of target species caught in the reference area (2021 real dollars); Sub-Alternative A2b

Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
$3,266,076	$545,205	$402,743	$4,214,024

5.1.2.3 Sub-Alternative A2c - Preferred Sub-Alternative

Preferred Sub-Alternative A2c would modify both the current spatial and temporal extent of the Charleston Bump closed area, as shown in Chapter 3 Figure 7. The spatial extent would be west of the line connecting the current northeast corner of the Charleston Bump closed area to a point on the current southern border of the closed area (31° 00' N. lat., -79° 32' 46" W. long.) and the current western boundary would remain the same. The temporal extent would increase from February 1 through April 30 to include the entire year. The remainder of the current closed area footprint would be designated a low-bycatch-risk area from February 1 through April 30. Outside those months, that area would be open to normal pelagic longline fishing.

Ecological Impacts on Target Species

The ecological impacts of Sub-Alternative A2c on target species catch is expected to be neutral. The target species are quota-managed species, and this sub-alternative would not affect the overall U.S. quotas for swordfish, yellowfin tuna, or bigeye tuna, which prevent overfishing, are based on the best scientific information available, and are consistent with the ICCAT-recommended TACs and quotas.

Ecological Impacts on Bycatch Species Modeled by HMS PRiSM

Table 5.21 lists the individual metric scores for this sub-alternative for each bycatch species. Based on the overall metric score ranking for the modeled bycatch species, this sub-alternative substantially improved the overall metric score compared to the No Action sub-alternative and was the highest among the sub-alternatives. The metric scores indicate that the sub-alternative would be most effective at protecting leatherback sea turtles and shortfin mako sharks, and more effective than the status quo sub-alternative (leatherback sea turtle score of 26 compared to 9; shortfin mako shark score of 20 compared to 11). In contrast, the total metric scores for billfish species and loggerhead sea turtles are relatively low out of a possible total of 48. The billfish species metric score of 5 is higher than the status quo sub-alternative score of zero, but the loggerhead sea turtle score of zero is lower than the status quo sub-alternative score of one. Due to the increased scores for leatherback sea turtles and shortfin mako sharks, this sub-alternative had a higher overall metric scores than the No Action sub-alternative (51 compared to 21). In addition, the scope for this sub-alternative was over double the scope of the No Action sub-alternative (121-percent increase) because sections of the Charleston Bump closed area would be closed year-round. As such, Sub-Alternative A2c would likely have moderate beneficial indirect ecological impacts for the bycatch species.

Table 5.21. Sub-Alternative A2c metric scores* for modeled species

Species	**Metric 1**	**Metric 2**	**Metric 3**	**Metric 4**	**Total**
Leatherback Sea Turtle	7	5	2	12	26
Shortfin Mako Shark	5	5	4	6	20
Billfish Species	5	0	0	0	5
Loggerhead Sea Turtle	0	0	0	0	0
Overall Metric Score					51

*For all sub-alternatives, the highest score possible for a single metric and species is 12. The highest possible total metric score for a species is 48. The highest possible overall metric score is 192.
Underlying questions:
Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
Metric 2: Does the spatial management area protect the most at-risk areas?
Metric 3: What percent of total high-bycatch-risk area across the whole fishery domain does the spatial management area protect?
Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Ecological Impacts on Other Bycatch and Incidental Species

Under Sub-Alternative A2c, effort in pelagic longline fishery is unlikely to increase and, if recent trends continue, could decrease. Thus, fishing impacts to other bycatch and incidental species of concern such as bluefin tuna, longfin mako shark, oceanic whitetip shark, scalloped hammerhead shark, dusky shark, or sandbar shark are unlikely to change and indirect neutral ecological impacts are expected. Further, the IBQ Program has been successful in reducing the incidental catch of bluefin tuna (NOAA Fisheries 2019, National Academies 2021).

Social and Economic Impacts

Methods

Analysis of this sub-alternative included analyzing the geographic area defined by Sub-Alternative A2c, as well as other geographic areas that are relevant. Specifically, we divided the reference area into three areas to characterize the different geographic areas formed by the overlap of the current Charleston Bump closed area and Sub-Alternative A2c: 1) the area inside Sub-Alternative A2c (which is inside the current Charleston Bump closed area), 2) the area that is outside Sub-Alternative A2c, but inside the current Charleston Bump closed area (herein referred to as "Sub-Alternative A2c*"), and 3) the reference area outside the current Charleston Bump closed area (Figure 5.2). We considered each of these areas separately to enable comparison of sub-alternatives, consider the impacts on different areas, and to facilitate consideration of the data collection alternatives ("B" Alternatives).

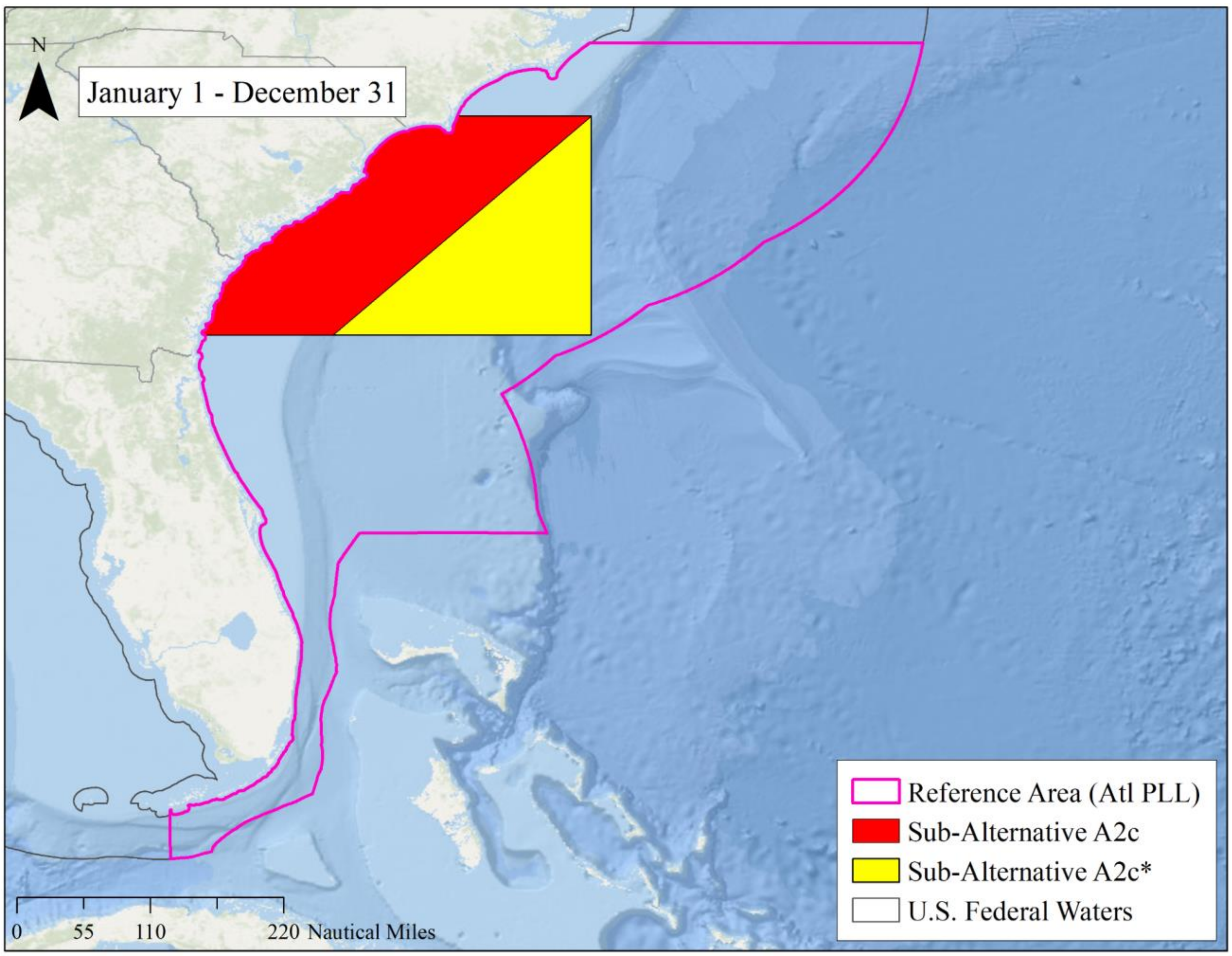

Figure 5.2. Areas defined by Sub-Alternative A2c and Sub-Alternative A2c* within the Atlantic reference area.

Sub-alternative-specific effort estimate: We averaged the percent of the total number of hooks within the reference area deployed each month for each year (2016-2020) across years for the areas defined by Sub-Alternative A2c and Sub-Alternative A2c*. To estimate the condition where no pelagic longline fishing would be allowed within the area defined by Sub-Alternative A2c, we assumed that all effort inside Sub-Alternative A2c would shift into Sub-Alternative A2c*, making the percent of hooks inside Sub-Alternative A2c to zero each month. Because Sub-Alternative A2c* has been closed to fishing during February, March, and April, we also assumed the monthly effort in February, March, and April would equal the average effort (percent of hooks) in January and May in that area, the two months close to the time of the closed months. We then subtracted the estimate of the percentage of hooks in Sub-Alternative A2c* from 100 percent to estimate a monthly percent of hooks that occurred in the reference area outside the current Charleston Bump closed area. We then multiplied the monthly percentages by the average total number of hooks each month across years that occurred in the reference area to estimate the number of hooks per month that occurred in the three areas analyzed (assume zero hooks in Sub-Alternative A2c each month). For example in February, the average percent of hooks inside Sub-Alternative A2c* (72 percent) equaled the average percent hooks inside Sub-Alternative A2c* for January (55 percent) and May (90 percent). Seventy-two percent was multiplied by the total number of hooks in February in the reference area (42,177) to calculate the total number of hooks in Sub-Alternative A2c* (30,367). Please note the total number of hooks in February in this example do not match the value in Table 5.22 due to rounding.

Sub-alternative-specific CPUE estimate: NOAA Fisheries calculated the monthly species-specific CPUEs averaged across years within Sub-Alternative A2c* and the reference area outside the current Charleston Bump closed area. Because effort was assumed to be zero for the Sub-Alternative A2c area, we also assumed the CPUEs for that area were zero. To estimate CPUE in Sub-Alternative A2c*, we used a similar method as the analysis for fishing effort. That is, because no fishing had occurred historically from February through April in Sub-Alternative A2c*, the CPUE for those months was based on the average CPUE during the months of January and May, adjacent months, in that area. To estimate the CPUE in the reference area outside the current Charleston Bump closed area in February through April, the analogous method was used: i.e., the average CPUE of January and May in the reference area outside the current Charleston Bump closed area was used to represent the CPUE from February through April. As an example, for February, average swordfish CPUE inside Sub-Alternative A2c* (17.02) equaled the average swordfish CPUE for January (21.59) and May (12.46) in Sub-Alternative A2c*. Please note the CPUE in February for this example does not match the value in Table 5.23 due to rounding.

NOAA Fisheries estimated the monthly catch within Sub-Alternative A2c* for each target species by multiplying the estimated monthly effort (hooks) by the monthly CPUE for that area. We calculated the estimated monthly catch within the reference area outside the current Charleston Bump closed area using the same approach. To provide an estimate of the social and economic impacts that represent the greatest economic impacts, we assumed that no fishing would take place in the area defined by Sub-Alternative A2c during any month of the year, and therefore the total target species catch would equal zero. We summed the total estimated species-specific catch inside Sub-Alternative A2c* and in the reference area outside the current Charleston Bump closed area.

Note that it is difficult to predict fishing effort and CPUE given the number of factors that may influence each. Therefore, the data on fishing effort, CPUE, target species catch and revenue should be considered estimates that are intended primarily to compare among sub-alternatives and not provide precise predictions. Alterations in the spatial or temporal aspects of spatial management areas may result in changes in fishing behavior such as increases in fishing effort and catch that are not reflected in the estimated social and economic impacts.

Estimated Impacts

Table 5.22 shows the average number of monthly hooks and percentage of total hooks inside Sub-Alternative A2c* and outside the current Charleston Bump closed area within the reference area, on a monthly basis, from 2016 through 2020. Of the estimated average annual total number of hooks in the reference area (907,142), NOAA Fisheries estimated that 604,265 hooks would be deployed within area Sub-Alternative A2c* annually (67 percent of total hooks), while 302,877 hooks (would be deployed in the reference area outside the current Charleston Bump closed area (33 percent of the total hooks). The number of hooks inside Sub-Alternative A2c* and outside the current closed area followed a similar pattern during all months, with the exception of May, which had a high number of hooks inside Sub-Alternative A2c*. CPUE estimates (Table 5.23, Table 5.24, and Table 5.25), for swordfish, yellowfin tuna, and bigeye tuna inside Sub-Alternative A2c* and outside the current closed area by month are variable. Most notable is the greater CPUEs for swordfish inside Sub-Alternative A2c* than any of the other CPUEs. For swordfish, the highest CPUEs occurred during September and October inside Sub-Alternative A2c*, and the lowest CPUEs during June and July outside the current closed area. Under this sub-alternative, 12,543 swordfish would be caught in the reference area analyzed (Table 5.26), which is over 1,000 more than the estimated swordfish catch under the No Action sub-alternative. The number of yellowfin tuna and bigeye tuna estimates under this sub-alternative is 1,876 and 1,582, respectively, which represent slight decreases relative to the No Action sub-alternative.

Table 5.22. Average number of monthly hooks and percentage of hooks Inside Sub-Alternative A2c ("Inside A2c"), Sub-Alternative A2c* ("Inside A2c*"), or outside (but in the reference area) the current Charleston Bump closed area (2016-2020); Sub-Alternative A2c

Month	Inside A2c	Inside A2c*	Outside
January	0 (0%)	41,864 (55%)	34,627 (45%)
February	0 (0%)	30,473 (72%)	11,703 (28%)
March	0 (0%)	48,329 (72%)	18,561 (28%)
April	0 (0%)	64,894 (72%)	24,922 (28%)

May	0 (0%)	201,617 (90%)	22,970 (10%)
June	0 (0%)	64,285 (64%)	36,763 (36%)
July	0 (0%)	31,764 (55%)	25,549 (45%)
August	0 (0%)	24,930 (44%)	32,308 (56%)
September	0 (0%)	11,789 (32%)	25,050 (68%)
October	0 (0%)	11,808 (38%)	19,650 (62%)
November	0 (0%)	31,309 (56%)	24,557 (44%)
December	0 (0%)	41,202 (61%)	26,217 (39%)

Table 5.23. Average monthly swordfish CPUE (per 1,000 hooks), inside Sub-Alternative A2c ("Inside A2c"), inside Sub-Alternative A2c* ("Inside A2c*"), or outside (but in the reference area) the current Charleston Bump closed area (2011-2020); Sub-Alternative A2c

Month	Inside A2c	Inside A2c*	Outside
January	0	21.59	4.83
February	0	17.02	4.59
March	0	17.02	4.59
April	0	17.02	4.59
May	0	12.46	4.34
June	0	13.61	2.56
July	0	20.29	2.78
August	0	27.92	3.99
September	0	44.57	5.12
October	0	43.30	6.12
November	0	35.92	5.22
December	0	23.92	4.85

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.24. Average monthly yellowfin tuna CPUE (per 1,000 hooks), inside Sub-Alternative A2c ("Inside A2c"), inside Sub-Alternative A2c* ("Inside A2c*"), or outside (but in the reference area) the current Charleston Bump closed area (2011-2020); Sub-Alternative A2c

Month	Inside A2c	Inside A2c*	Outside
January	0	2.13	6.27
February	0	1.13	4.04
March	0	1.13	4.04
April	0	1.13	4.04
May	0	0.12	1.82
June	0	1.11	4.24
July	0	0.99	5.14
August	0	0.53	4.95
September	0	0.40	4.91
October	0	0.44	4.50
November	0	1.07	4.50
December	0	1.06	5.61

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.25. Average monthly bigeye tuna CPUE (per 1,000 hooks), inside Sub-Alternative A2c ("Inside A2c"), inside Sub-Alternative A2c* ("Inside A2c*"), or outside (but in the reference area) the current Charleston Bump closed area (2011-2020); Sub-Alternative A2c

Month	Inside A2c	Inside A2c*	Outside
January	0	0.25	4.97
February	0	0.13	3.82
March	0	0.13	3.82
April	0	0.13	3.82
May	0	0.02	2.67
June	0	0.22	3.19

July	0	1.11	4.93
August	0	0.63	6.25
September	0	0.47	6.48
October	0	0.06	8.14
November	0	0.07	4.56
December	0	0.04	5.74

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.26. Estimated annual numbers of target species caught inside Sub-Alternative A2c* or outside (but in the reference area) the current Charleston Bump closed area; Sub-Alternative A2c

	Swordfish	**Yellowfin Tuna**	**Bigeye Tuna**	**Total**
Inside	11,224	478	107	11,809
Outside	1,319	1,398	1,475	4,192
Total	12,543	1,876	1,582	16,001

Following the social and economic calculations described in the Sub-Alternative A2a, we estimated revenue for Sub-Alternative A2c. Table 5.27 shows the estimated annual revenue for each target species and the combined target species revenue is $4,655,124 (2021 real dollars). This sub-alternative would generate more revenue from swordfish, but less from yellowfin and bigeye tuna relative to the No Action sub-alternative. When combined the total revenue difference between this sub-alternative and the No Action sub-alternative is $235,863 resulting in moderate positive direct social and economic impacts in the short- and long-term. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Since fishing effort is not expected to change, large changes to landings are not expected either. Thus, indirect impacts to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be neutral. From 2016 through 2020, 96 dealers purchased swordfish, yellowfin tuna, or bigeye tuna products in North Carolina, South Carolina, Georgia, and the east coast of Florida, which are the states in the vicinity of the Charleston Bump closed area. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

This sub-alternative would shift the eastern boundary of the closed area to the west, potentially opening fishing opportunities closer to shore, so vessel transit times and distances may decrease. Thus, reduced fuel costs for fishermen could provide minor beneficial social and economic impacts and reduce greenhouse gas emissions.

Table 5.27. Estimated annual revenue of target species caught in the reference area (2021 real dollars); Sub-Alternative A2c

Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
$3,758,385	$492,206	$404,533	$4,655,124

5.1.2.4 Sub-Alternative A2d

This sub-alternative would modify both the current spatial and temporal extent of the Charleston Bump closed area, as shown in Chapter 3 Figure 8. The spatial extent would shift the eastern boundary to 40 nm from the coastline, while maintaining the current western, northern, and southern boundaries of the Charleston Bump closed area. The temporal extent would be extended from February 1 through April 30 to October 1 through May 31. The remainder of the current closed area footprint would be designated a low-bycatch-risk area from February 1 through April 30. Outside those months, that area would be open to normal pelagic longline fishing.

Ecological Impacts on Target Species

The ecological impacts of Sub-Alternative A2d on target species catch is expected to be neutral. The target species are quota-managed species, and this sub-alternative would not affect the overall U.S. quotas for swordfish, yellowfin tuna, or bigeye tuna, which prevent overfishing, are based on the best scientific information available, and are consistent with the ICCAT-recommended TACs and quotas.

Ecological Impacts on Bycatch Species Modeled by HMS PRiSM

Table 5.28 lists the individual metric scores for this sub-alternative for each bycatch species. Based on the overall metric score ranking for the modeled bycatch species, this sub-alternative substantially improved the overall metric score compared to the No Action sub-alternative. The metric scores indicate that the sub-alternative would be most effective at protecting leatherback sea turtles and shortfin mako sharks, and more effective than the status quo sub-alternative (leatherback sea turtle score of 21 compared to 9; shortfin mako shark score of 21 compared to 11). In contrast, the total metric scores for billfish species and loggerhead sea turtles are relatively low out of a possible total of 48. The billfish species metric score of one is higher than the status quo sub-alternative score of zero, but the loggerhead sea turtle score of zero is lower than the status quo sub-alternative score of one. Due to the increased scores for leatherback sea turtles and shortfin mako sharks, this sub-alternative had a higher overall metric scores than the No Action sub-alternative (44 compared to 21). In addition, the scope for this sub-alternative was 24 percent smaller compared to that of the No Action sub-alternative because, relative to the No Action sub-alternative, a smaller area within the Charleston Bump closed area would be closed for 8 months. As such, Sub-Alternative A2d would likely have short and long-term direct moderate beneficial indirect ecological impacts for the bycatch species.

Table 5.28. Sub-Alternative A2d metric scores* for modeled species

Species	**Metric 1**	**Metric 2**	**Metric 3**	**Metric 4**	**Total**
Leatherback Sea Turtle	7	6	1	8	22
Shortfin Mako Shark	6	5	3	7	21
Billfish Species	1	0	0	0	1
Loggerhead Sea Turtle	0	0	0	0	0
Overall Metric Score					44

*For all sub-alternatives, the highest score possible for a single metric and species is 12. The highest possible total metric score for a species is 48. The highest possible overall metric score is 192.
Underlying questions:
Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
Metric 2: Does the spatial management area protect the most at-risk areas?
Metric 3: What percent of total high-bycatch-risk area across the whole fishery domain does the spatial management area protect?
Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Ecological Impacts on Other Bycatch and Incidental Species

Under Sub-Alternative A2d, effort in pelagic longline fishery is unlikely to increase and, if recent trends continue, could decrease. Thus, fishing impacts to other bycatch and incidental species of concern such as bluefin tuna, longfin mako shark, oceanic whitetip shark, scalloped hammerhead shark, dusky shark, or sandbar shark are unlikely to change and neutral indirect ecological impacts are expected. Further, the IBQ Program has been successful in reducing the incidental catch of bluefin tuna (NOAA Fisheries 2019, National Academies 2021).

Social and Economic Impacts

Methods

Analysis of this sub-alternative included analyzing the geographic area defined by Sub-Alternative A2d, as well as other geographic areas that are relevant. Specifically, the reference area was divided into three areas to characterize the different geographic areas formed by the overlap of the current Charleston Bump closed area and Sub-Alternative A2d: 1) the area inside Sub-Alternative A2d (which is inside the current Charleston Bump closed area), 2) the area that is outside Sub-Alternative A2d, but inside the current Charleston Bump closed area (herein referred to as “Sub-Alternative A2d*”), and 3) the reference area outside the current Charleston Bump closed area (Figure 5.3). We considered each of these areas separately to enable comparison of sub-alternatives, consider the impacts on different areas, and to facilitate consideration of the data collection alternatives ("B" Alternatives).

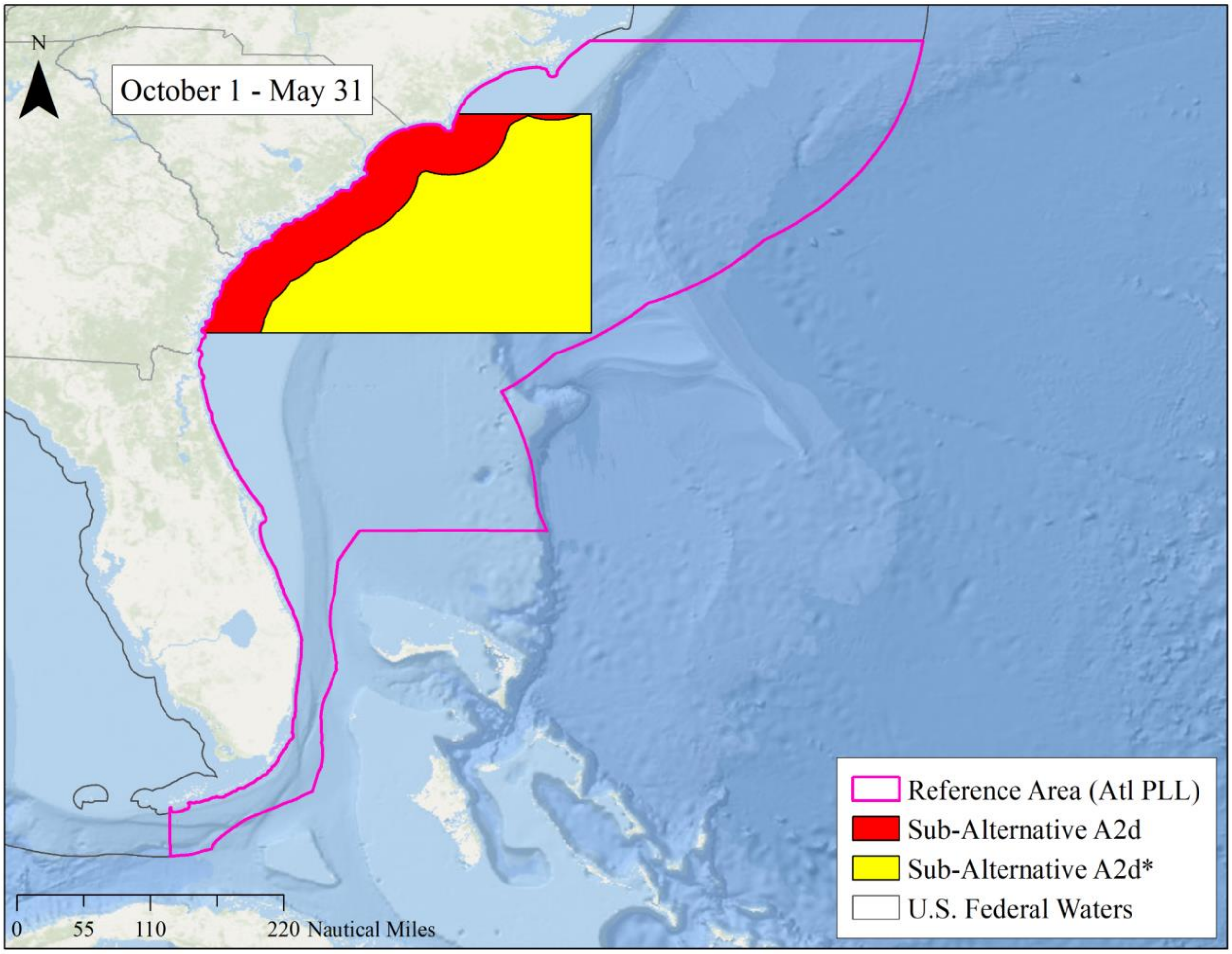

Figure 5.3. Areas defined by Sub-Alternative A2d and Sub-Alternative A2d* within the Atlantic reference area.

Sub-alternative-specific effort estimate: The percent of the total number of hooks within the reference area deployed each month for each year (2016-2020) were averaged across years for the areas defined by Sub-Alternative A2d and Sub-Alternative A2d*. To estimate the condition where no pelagic longline fishing would be allowed within the area defined by Sub-Alternative A2d, the analyses assumed that all effort inside Sub-Alternative A2d would shift into Sub-Alternative A2d* from October through May, making the percent of hooks inside Sub-Alternative A2d to zero for those months. Further, because Sub-Alternative A2d only incorporated areas close to the coastline, there was no effort inside Sub-Alternative A2d from June through September. This resulted in zero effort occurring inside Sub-Alternative A2d across all months. Because Sub-Alternative A2d* has been closed to fishing during February, March, and April, the analysis assumed the monthly effort in February, March, and April would equal the average monthly effort (percent of hooks) in January and May in that area, the two months close to the time of the closed months. The estimate of the percentage of hooks in Sub-Alternative A2d* was subtracted from 100 percent to estimate a monthly percent of hooks that occurred in the reference area outside the current Charleston Bump closed area. The monthly percentages were multiplied by the average total number of hooks each month across years that occurred in the reference area to calculate the estimated number of hooks each month that occurred in the three areas analyzed. Due to the effort shift from area Sub-Alternative A2d to Sub-Alternative A2d*, zero hooks were estimated for Sub-Alternative A2d for all months.

Sub-alternative-specific CPUE estimate: The monthly species-specific CPUEs averaged across years within Sub-Alternative A2d* and the reference area outside the current Charleston Bump closed area were calculated. Because effort was assumed to be zero for the Sub-Alternative A2d area, the CPUEs for that area were assumed to be zero as well. Similar to effort, because no fishing had occurred historically from February through April in Sub-Alternative A2d*, the CPUE for those months was based on the average CPUE during the months of January and May, adjacent months, in that area. To estimate the CPUE in the reference area outside the current Charleston Bump closed area in February through April, the analogous method was used: i.e., the average CPUE of January and May in the reference area outside the current Charleston Bump closed area was used to represent the CPUE from February through April.

NOAA Fisheries estimated the monthly catch within Sub-Alternative A2d* for each target species by multiplying the estimated monthly effort (hooks) by the monthly CPUE for those areas (zero effort in Sub-Alternative A2d so zero catch). The estimated monthly catch within the reference area outside the current Charleston Bump closed area was also calculated using the same approach. The total estimated species-specific catch was summed inside Sub-Alternative A2d* and in the reference area outside the current Charleston Bump closed area.

Estimated Impacts

Of the estimated average annual total number of hooks in the reference area (907,142), NOAA Fisheries estimated that 604,265 hooks would be deployed within area Sub-Alternative A2d* annually (67 percent of total hooks), while 302,877 hooks (would be deployed in the reference area outside the current Charleston Bump closed area (33 percent of the total hooks). CPUE estimates (Table 5.30, Table 5.31, and Table 5.32), for swordfish, yellowfin tuna, and bigeye tuna inside Sub-Alternative A2d* and outside the current closed area by month are variable. Most notable is the greater CPUEs for swordfish inside Sub-Alternative A2d* than any of the other CPUEs. For swordfish, the highest CPUEs occurred during September and October inside Sub-Alternative A2d*, and the lowest CPUEs during June and July outside the current closed area. Under this sub-alternative, 13,128 swordfish would be caught in the reference area analyzed (Table 5.33), which is over 1,500 more than the estimated swordfish catch under the No Action sub-alternative. These swordfish estimates were much higher relative to the No Action sub-alternative because this sub-alternative allowed fishing to the most area across months. The number of yellowfin tuna and bigeye tuna estimates under this sub-alternative is 1,813 and 1,566, respectively, which represent slight decreases relative to the No Action sub-alternative.

Table 5.29. Average number of monthly hooks and percentage of hooks inside Sub-Alternative A2d ("Inside A2d"), Sub-Alternative A2d* ("Inside A2d*"), or outside (but in the reference area) the current Charleston Bump closed area (2016-2020); Sub-Alternative A2d

Month	Inside A2d	Inside A2d*	Outside
January	0 (0%)	41,864 (55%)	34,627 (45%)
February	0 (0%)	30,473 (72%)	11,703 (28%)
March	0 (0%)	48,329 (72%)	18,561 (28%)
April	0 (0%)	64,894 (72%)	24,922 (28%)
May	0 (0%)	201,617 (90%)	22,970 (10%)
June	0 (0%)	64,285 (64%)	36,763 (36%)
July	0 (0%)	31,764 (55%)	25,549 (45%)
August	0 (0%)	24,930 (44%)	32,308 (55%)
September	0 (0%)	11,789 (32%)	25,050 (68%)
October	0 (0%)	11,808 (38%)	19,650 (62%)
November	0 (0%)	31,309 (56%)	24,557 (44%)
December	0 (0%)	41,202 (61%)	26,217 (39%)

Table 5.30. Average monthly swordfish CPUE (per 1,000 hooks), inside Sub-Alternative A2d ("Inside A2d"), inside Sub-Alternative A2d* ("Inside A2d*"), or outside (but in the reference area) the current Charleston Bump closed area (2011-2020); Sub-Alternative A2d

Month	Inside A2d	Inside A2d*	Outside
January	0	21.27	4.83
February	0	17.70	4.59
March	0	17.70	4.59
April	0	17.70	4.59
May	0	14.14	4.34
June	0	15.16	2.56
July	0	20.71	2.78

Month	Inside A2d	Inside A2d*	Outside
January	0	21.27	4.83
August	0	27.76	3.99
September	0	44.20	5.12
October	0	44.17	6.12
November	0	36.80	5.22
December	0	24.37	4.85

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.31. Average monthly yellowfin tuna CPUE (per 1,000 hooks), inside Sub-Alternative A2d ("Inside A2d"), inside Sub-Alternative A2d* ("Inside A2d*"), or outside (but in the reference area) the current Charleston Bump closed area (2011-2020); Sub-Alternative A2d

Month	Inside A2d	Inside A2d*	Outside
January	0	1.73	6.27
February	0	0.93	4.04
March	0	0.93	4.04
April	0	0.93	4.04
May	0	0.12	1.82
June	0	0.80	4.24
July	0	0.98	5.14
August	0	0.50	4.95
September	0	0.37	4.91
October	0	0.42	4.50
November	0	1.01	4.50
December	0	1.19	5.61

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.32. Average monthly bigeye tuna CPUE (per 1,000 hooks), inside Sub-Alternative A2d ("Inside A2d"), inside Sub-Alternative A2d* ("Inside A2d*"), or outside (but in the reference area) the current Charleston Bump closed area (2011-2020); Sub-Alternative A2d

Month	Inside A2d	Inside A2d*	Outside
January	0	0.16	4.97
February	0	0.08	3.82
March	0	0.08	3.82
April	0	0.08	3.82
May	0	0.01	2.67
June	0	0.18	3.19
July	0	1.05	4.93
August	0	0.59	6.25
September	0	0.45	6.48
October	0	0.05	8.14
November	0	0.06	4.56
December	0	0.04	5.74

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.33. Estimated annual numbers of target species caught inside Sub-Alternative A2d* or outside (but in the reference area) the current Charleston Bump closed area; Sub-Alternative A2d

	Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
Inside	11,809	415	91	12,315
Outside	1,319	1,398	1,475	4,192
Total	13,128	1,813	1,566	16,507

Following the social and economic calculations described in the Sub-Alternative A2a, we estimated revenue for Sub-Alternative A2d. Table 5.34 shows the estimated annual revenue for each target species and the combined target species revenue is $4,809,793 (2021 real dollars). This sub-alternative would generate more revenue from swordfish, but less from yellowfin and bigeye tuna relative to the No Action sub-alternative. When combined, the total revenue difference between this sub-alternative and the No Action sub-alternative is $390,532 resulting in moderate positive direct economic impacts in the short- and long-term which would also lead to positive direct social benefits. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Since fishing effort is not expected to change, large changes to landings are not expected either. Thus, indirect impacts to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be neutral. From 2016 through 2020, 96 dealers purchased swordfish, yellowfin tuna, or bigeye tuna products in North Carolina, South Carolina, Georgia, and the east coast of Florida, which are the states in the vicinity of the Charleston Bump closed area. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

This sub-alternative would shift the eastern boundary of the closed area to the west, potentially opening fishing opportunities closer to shore, so vessel transit times and distances may decrease. Thus, reduced fuel costs for fishermen could provide minor beneficial social and economic impacts and reduce greenhouse gas emissions.

Table 5.34. Estimated annual revenue of target species caught in the reference area (2021 real dollars); Sub-Alternative A2d

Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
$3,933,674	$475,677	$400,442	4,809,793

5.1.2.5 Sub-Alternative A2e

This sub-alternative would modify both the current spatial and temporal extent of the Charleston Bump closed area, as shown in Chapter 3 Figure 9. The spatial extent would shift the northern boundary southward to 33° 12’ 39” N. lat. and the eastern boundary westward to 78° 00’ W. long., while maintaining the current western and southern boundaries of the Charleston Bump closed area. The temporal extent would extend from October 1 through May 31. The remainder of the current closed area footprint would be designated a low-bycatch-risk area from February 1 through April 30. Outside those months, that area would be open to normal pelagic longline fishing.

Ecological Impacts on Target Species

The ecological impacts of Sub-Alternative A2e on target species catch is expected to be neutral. The target species are quota managed species, and this sub-alternative would not affect the overall U.S. quotas for swordfish, yellowfin tuna, or bigeye tuna, which prevent overfishing, are based on the best scientific information available, and are consistent with the ICCAT-recommended TACs and quotas.

Ecological Impacts on Bycatch Species Modeled by HMS PRiSM

Table 5.35 lists the individual metric scores for this sub-alternative for each bycatch species. Based on the overall metric score ranking for the modeled bycatch species, this sub-alternative improved the overall metric score compared to the No Action sub-alternative. The metric scores indicate that the sub-alternative would be most effective at protecting leatherback sea turtles and shortfin mako sharks, and more effective than the status quo sub-alternative (leatherback sea turtle score of 19 compared to 9; shortfin mako shark score of 18 compared to 11). In contrast, the total metric scores for billfish species and loggerhead sea turtles are relatively low out of a possible total of 48. The billfish species metric score of two is higher than the status quo sub-alternative score of zero, but the loggerhead sea turtle score of zero is lower than the status quo sub-alternative score of one. Due to the increased scores for leatherback sea turtles and shortfin mako sharks, this sub-alternative had a higher overall metric scores than the No Action sub-alternative (39 compared to 21). In addition, the scope for this sub-alternative was 22 percent larger compared to that of the No Action sub-alternative because although the area was smaller than the current spatial extent of the Charleston Bump closed area, it would be closed for eight months. As such, Sub-Alternative A2e would likely have short and long-term minor beneficial indirect ecological impacts for the bycatch species.

Table 5.35. Sub-Alternative A2e metric scores* for modeled species

Species	Metric 1	Metric 2	Metric 3	Metric 4	Total
Leatherback Sea Turtle	6	4	1	7	19
Shortfin Mako Shark	5	5	2	6	18
Billfish Species	2	0	0	0	2
Loggerhead Sea Turtle	0	0	0	0	0
Overall Metric Score					39

*For all sub-alternatives, the highest score possible for a single metric and species is 12. The highest possible total metric score for a species is 48. The highest possible overall metric score is 192.
Underlying questions:
Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
Metric 2: Does the spatial management area protect the most at-risk areas?
Metric 3: What percent of total high-bycatch-risk area across the whole fishery domain does the spatial management area protect?
Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Ecological Impacts on Other Bycatch and Incidental Species

Under Sub-Alternative A2e, effort in pelagic longline fishery is unlikely to increase and, if recent trends continue, could decrease. Thus, fishing impacts to other bycatch and incidental species of concern such as bluefin tuna, longfin mako shark, oceanic whitetip shark, scalloped hammerhead shark, dusky shark, or sandbar shark are unlikely to change and indirect neutral ecological impacts are expected. Further, the IBQ Program has been successful in reducing the incidental catch of bluefin tuna (NOAA Fisheries 2019, National Academies 2021).

Social and Economic Impacts

Methods

Analysis of this sub-alternative included analyzing the geographic area defined by Sub-Alternative A2e, as well as other geographic areas that are relevant. Specifically, we divided the reference area into three areas to characterize the different geographic areas formed by the overlap of the current Charleston Bump closed area and Sub-Alternative A2e: 1) the area inside Sub-Alternative A2e (which is inside the current Charleston Bump closed area), 2) the area that is outside Sub-Alternative A2e, but inside the current Charleston Bump closed area (herein referred to as "Sub-Alternative A2e*"), and 3) the reference area outside the current Charleston Bump closed area (Figure 5.4). We considered each of these areas separately to enable comparison of sub-alternatives, consider the impacts on different areas, and to facilitate consideration of the data collection alternatives ("B" Alternatives).

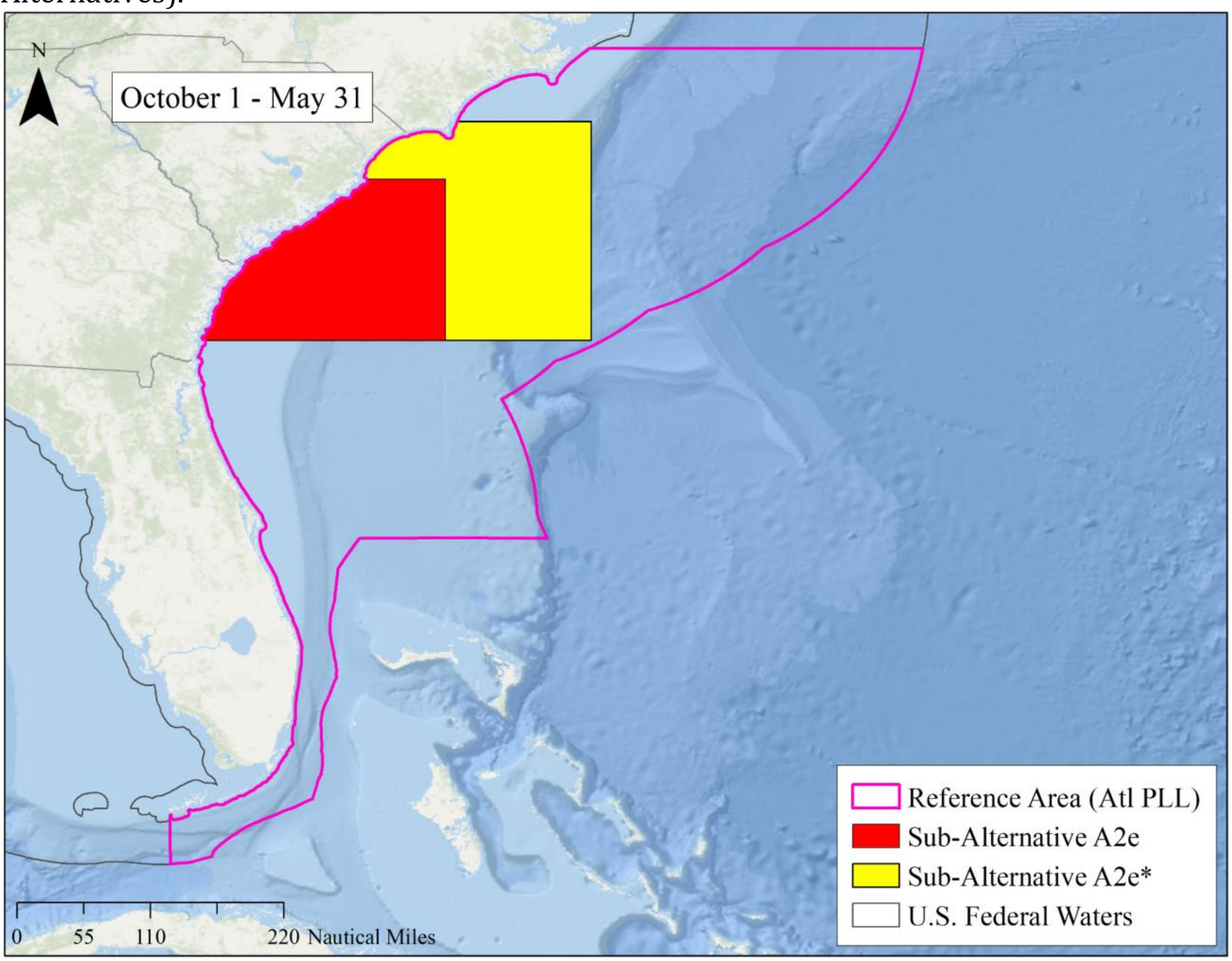

Figure 5.4. Areas defined by Sub-Alternative A2e and Sub-Alternative A2e* within the Atlantic reference area.

Sub-alternative-specific effort estimate: The percent of the total number of hooks within the reference area deployed each month for each year (2016-2020) were averaged across years for the areas defined by Sub-Alternative A2e and Sub-Alternative A2e*. To estimate the condition where no pelagic longline fishing would be allowed within the area defined by Sub-Alternative A2e, the analyses assumed that all effort inside Sub-Alternative A2e would shift into Sub-Alternative A2e* from October through May, making the percent of hooks inside Sub-Alternative A2e to zero for those months. Because Sub-Alternative A2e* has been closed to fishing during February, March, and April, the analysis assumed the monthly effort in February, March, and April would equal the average monthly effort (percent of hooks) in January and May in that area, the two months close to the time of the closed months. The estimate of the percentage of hooks in Sub-Alternative A2e* and Sub-Alternative A2e were subtracted from 100 percent to estimate a monthly percent of hooks that occurred in the reference area outside the current Charleston Bump closed area. The monthly percentages were multiplied by the average total number of hooks each month across years that occurred in the reference area to calculate the estimated number of hooks each month that occurred in the three areas analyzed.

Sub-alternative-specific CPUE estimate: The monthly species-specific CPUEs averaged across years within Sub-Alternative Ae*, Sub-Alternative A2e, and the reference area outside the current Charleston Bump closed area were calculated. Because effort was assumed to be zero for the Sub-Alternative A2e area from October through May, the CPUEs for that area were assumed to be zero as well for those months. Similar to effort, because no fishing had occurred historically from February through April in Sub-Alternative A2e*, the CPUE for those months was based on the average CPUE during the months of January and May, adjacent months, in that area. To estimate the CPUE in the reference area outside the current Charleston Bump closed area in February through April, the analogous method was used: i.e., the average CPUE of January and May in the reference area outside the current Charleston Bump closed area was used to represent the CPUE from February through April.

NOAA Fisheries estimated the monthly catch within Sub-Alternative A2e* and Sub-Alternative A2e for each target species by multiplying the estimated monthly effort (hooks) by the monthly CPUE for those areas. The estimated monthly catch within the reference area outside the current Charleston Bump closed area was also calculated using the same approach. The total estimated species-specific catch was summed inside the current Charleston Bump closed area (Sub-Alternative A2e + Sub-Alternative A2e*) and in the reference area outside the current Charleston Bump closed area.

Estimated Impacts

Of the estimated average annual total number of hooks in the reference area (907,142), NOAA Fisheries estimated that 604,265 hooks would be deployed within areas Sub-Alternative A2e and Sub-Alternative A2e* (consist of areas inside current Charleston Bump closed area) annually (67 percent of total hooks), while 302,877 hooks (would be deployed in the reference area outside the current Charleston Bump closed area (33 percent of the total hooks). CPUE estimates (Table 5.37, Table 5.38, and Table 5.39), for swordfish, yellowfin tuna, and bigeye tuna inside Sub-Alternative A2e, Sub-Alternative A2e*, and outside the current closed area by month are variable. Most notable is the greater CPUEs for swordfish occurred inside Sub-Alternative A2e when fishing would be allowed in that area from July through September. For swordfish, the highest CPUEs occurred January through May inside Sub-Alternative A2e* fishing was not allowed in Sub-Alternative A2e. Under this sub-alternative, 11,625 swordfish would be caught in the reference area analyzed (Table 5.40), which is approximately 100 more swordfish relative to the No Action sub-alternative. Estimated yellowfin catch (2,345) increased in the reference area by approximately 300 fish, while bigeye tuna catch (1,581) decreased slightly relative to the No Action sub-alternative.

Table 5.36. Average number of monthly hooks and percentage of hooks inside Sub-Alternative A2e ("Inside A2e"), Sub-Alternative A2e* ("Inside A2e*"), or outside (but in the reference area) the current Charleston Bump closed area (2016-2020); Sub-Alternative A2e

Month	Inside A2e	Inside A2e*	Outside
January	0 (0%)	41,864 (55%)	34,627 (45%)
February	0 (0%)	30,473 (72%)	11,703 (28%)
March	0 (0%)	48,329 (72%)	18,561 (28%)
April	0 (0%)	64,894 (72%)	24,922 (28%)
May	0 (0%)	201,617 (90%)	22,970 (10%)
June	48,901 (48%)	15,384 (15%)	36,763 (36%)
July	27,565 (48%)	4,200 (7%)	25,549 (45%)
August	23,209 (41%)	1,721 (3%)	32,308 (55%)
September	111,701 (32%)	88 (<1%)	25,050 (68%)
October	0 (0%)	11,808 (38%)	19,650 (62%)
November	0 (0%)	31,309 (56%)	24,557 (44%)
December	0 (0%)	41,202 (61%)	26,217 (39%)

Table 5.37. Average monthly swordfish CPUE (per 1,000 hooks), inside Sub-Alternative A2e ("Inside A2e"), inside Sub-Alternative A2e* ("Inside A2e*"), or outside (but in the reference area) the current Charleston Bump closed area (2011-2020); Sub-Alternative A2e

Month	Inside A2e	Inside A2e*	Outside
January	0.00	17.50	4.83
February	0.00	17.39	4.59
March	0.00	17.39	4.59
April	0.00	17.39	4.59
May	0.00	17.28	4.34
June	16.46	10.38	2.56
July	21.85	7.82	2.78
August	28.81	5.50	3.99
September	44.75	5.12	5.12
October	0.00	3.73	6.12
November	0.00	9.27	5.22
December	0.00	11.04	4.85

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.38. Average monthly yellowfin tuna CPUE (per 1,000 hooks), inside Sub-Alternative A2e ("Inside A2e"), inside Sub-Alternative A2e* ("Inside A2e*"), or outside (but in the reference area) the current Charleston Bump closed area (2011-2020); Sub-Alternative A2e

Month	Inside A2e	Inside A2e*	Outside
January	0.00	4.58	6.27
February	0.00	2.50	4.04
March	0.00	2.50	4.04
April	0.00	2.50	4.04
May	0.00	0.41	1.82

June	0.13	2.39	4.24
July	0.11	2.52	5.14
August	0.12	4.52	4.95
September	0.33	0.64	4.91
October	0.00	2.08	4.50
November	0.00	1.00	4.50
December	0.00	4.52	5.61

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.39. Average monthly bigeye tuna CPUE (per 1,000 hooks), inside Sub-Alternative A2e ("Inside A2e"), inside Sub-Alternative A2e* ("Inside A2e*"), or outside (but in the reference area) the current Charleston Bump closed area (2011-2020); Sub-Alternative A2e

Month	Inside A2e	Inside A2e*	Outside
January	0.00	0.37	4.97
February	0.00	0.20	3.82
March	0.00	0.20	3.82
April	0.00	0.20	3.82
May	0.00	0.03	2.67
June	0.03	0.52	3.19
July	0.10	2.19	4.93
August	0.21	2.26	6.25
September	0.40	1.32	6.48
October	0.00	1.31	8.14
November	0.00	0.09	4.56
December	0.00	0.06	5.74

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.40. Estimated annual numbers of target species caught inside the current Charleston Bump closed area (Sub-Alternative A2d + Sub-Alternative A2d*) or outside (but in the reference area) the current Charleston Bump closed area; Sub-Alternative A2e

	Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
Inside	10,306	947	106	11,359
Outside	1,319	1,398	1,475	4,192
Total	11,625	2,345	1,581	15,551

Following the social and economic calculations described in Sub-Alternative A2a, we estimated revenue for Sub-Alternative A2e. Table 5.41 shows the estimated annual revenue for each target species and the combined target species revenue is $4,502,851 (2021 real dollars). This sub-alternative would generate more revenue from swordfish and yellowfin tuna, but less from bigeye tuna relative to the No Action sub-alternative. When combined, the total revenue difference between this sub-alternative and the No Action sub-alternative is $83,590 resulting in minor positive direct economic impacts in the short- and long-term, which would also lead to positive direct social impacts. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Since fishing effort is not expected to change, large changes to landings are not expected either. Thus, indirect impacts to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be neutral. From 2016 through 2020, 96 dealers purchased swordfish, yellowfin tuna, or bigeye tuna products in North Carolina, South Carolina, Georgia, and the east coast of Florida, which are the states in the vicinity of the Charleston Bump closed area. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

This sub-alternative would shift the eastern boundary of the closed area to the west, potentially opening fishing opportunities closer to shore, so vessel transit times and distances may decrease. Thus, reduced fuel costs for fishermen could provide minor beneficial social and economic impacts and reduce greenhouse gas emissions.

Table 5.41. Estimated annual revenue of target species caught in the reference area (2021 real dollars); Sub-Alternative A2e

Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
$3,483,315	$615,258	$404,278	$4,502,851

5.1.2.6 Comparison of Alternative Suite A2 Sub-Alternatives

There were notable differences among the Suite A2 Sub-Alternatives, pertaining to spatial and temporal modifications to the current Charleston Bump closed area. The Sub-Alternative A2a (No Action) ranked the lowest for the amount of bycatch protection of modeled species, based on the overall metric scores. In other words, the spatial and temporal extent of the current closed area would provide the least protection to areas where potential bycatch interaction is the highest. Sub-Alternative A2c, the Preferred Sub-Alternative had the highest overall metric score, followed by Sub-Alternatives A2d, A2e, A2b, and A2a, descending score order (Table 5.42).

The Preferred Sub-Alternative A2c also had the highest scope, followed by A2b, A2e, A2a, and lastly A2d. Sub-Alternative A2d had the second highest overall metric score, despite having the scope lower than the No Action sub-alternative.

Under all of the A2 Sub-Alternatives the species with the highest metric total scores were leatherback sea turtle and shortfin mako shark (Table 5.42). In contrast, the metric total scores for billfish species and loggerhead sea turtle were relatively low. The Preferred Sub-Alternative A2c has the highest metric total score for billfish species.

Table 5.42. Total metric scores by species and scope for Suite A2 Sub-Alternative

Species	**A2a - No Action**	**A2b**	**A2c - Preferred**	**A2d**	**A2e**
Leatherback Sea Turtle	9	16	**26**	22	18
Shortfin Mako Shark	11	14	**20**	21	18
Billfish Species	0	0	**5**	1	2
Loggerhead Sea Turtle	1	0	**0**	0	0
Overall Metric Score	21	30	**51**	44	38
Scope* compared to No Action sub-alternative	0 (no change)	36,265	**131,576**	-26,084	23,934

*Scope: For the purpose of this DEIS, a measure of the spatial and temporal extent of a particular management area used to compare options and alternatives: square nautical miles of area x the number of closure months.

Table 5.43 and Table 5.44 provide high-level descriptions of the sub-alternatives, the estimated target species catch, and revenue from those species. The differences among the A2 Sub-Alternatives with respect to estimated target species catch and revenue were relatively small.

Sub-Alternative A2d had the highest estimated swordfish catch, followed by Sub-Alternative A2c (the Preferred Sub-Alternative), Sub-Alternative A2e, Sub-Alternative A2a (No Action), and Sub-Alternative A2b. Sub-Alternative A2e had the highest estimated yellowfin tuna catch, then Sub-Alternative A2b, the No Action, Sub-Alternative A2c, and Sub-Alternative A2d. The differences among sub-alternatives were small for estimated bigeye tuna catch.

Table 5.43. Comparison of Suite A2 Sub-Alternatives and total estimated target catch (numbers of fish) by species

	Summary Description	Swordfish	Yellowfin tuna	Bigeye tuna
A2a - No Action	*Spatial*: Status quo *Temporal*: Status quo (February-April)	11,525	2,049	1,675
A2b	*Spatial*: Status quo *Temporal*: December-March	10,900	2,078	1,575
A2c - Preferred	***Spatial*: Reduce diagonally to only include western areas** ***Temporal*: January-December**	**12,543**	**1,876**	**1,582**
A2d	*Spatial*: Reduce to west of 40 nm from coastline *Temporal*: October-May	13,128	1,813	1,566
A2e	*Spatial*: Reduce northern and eastern boundaries *Temporal*: October-May	11,625	2,345	1,581

Sub-Alternative A2d had the highest estimated revenue, whereas Sub-Alternative A2c, the Preferred Sub-Alternative, had the second highest revenue (Table 5.44). Sub-Alternative A2b had the lowest estimated revenue compared to all other A2 Sub-Alternatives.

Table 5.44. Comparison of total estimated revenue and net difference from the No Action of Suite A2 Sub-Alternatives (2021 real dollars)

A2a - No Action	A2b (net difference)	A2c - Preferred (net difference)	A2d (net difference)	A2e (net difference)
$4,419,261	$4,214,024 (-$205,237)	**$4,655,124 (+$235,863)**	4,809,793 (+$390,532)	$4,502,851 (+$83,590)

5.1.2.7 Conclusions - Alternative Suite A2

Sub-Alternative A2c was preferred because it would provide the most amount of bycatch protection of the sub-alternatives (based on the overall metric scores), while also providing the second highest estimated revenue. The preferred sub-alternative would provide notably increased protection for leatherback sea turtles and shortfin mako sharks. It would provide increased protection for billfish compared to the No Action sub-alternative, because the areas where bycatch interaction was expected to be the highest was protected year-round from the pelagic longline. The scope (total area protected by the closure multiplied by the number of closure months) for this sub-alternative was over double the scope of the No Action sub-alternative (121 percent increase), and sections of the current Charleston Bump closed area would be closed year-round. Although the Preferred Sub-Alternative A2c would have a larger estimated swordfish catch than the No Action sub-alternative, it would have less yellowfin or bigeye tuna catch. It should be noted that the actual target catch associated with the Preferred Sub-Alternative would depend upon many factors including the amount of commercial fishing allowed under the Data Collection Alternatives ("B" Alternatives) and whether the CPUE values used to estimate catch reflect future catch. The shape and location of the new area may provide commercial fishermen access to potentially productive areas that were previously closed. For example, the area defined by Sub-Alternative A2c assumed no fishing, but if combined with an alternative such as Alternative B4, there would be additional revenue for the fishery. Further, it is important to note that there is high variability in the catches of both the modeled bycatch species and the target species in the pelagic longline fishery due to the ecology of the species, and dynamic ocean conditions. The preferred sub-alternative provides the best balance between bycatch conservation and revenue for pelagic longline fishermen. Although Sub-Alternative A2d was associated with the highest estimated revenue, it had lower bycatch conservation and the lowest scope.

5.1.3 Alternative Suite A3: East Florida Coast Spatial Management Area

General Methods

Ecological Impacts

Target Species: Descriptions of the ecological impact analysis methodologies are in the impacts discussion for each sub-alternative.

Bycatch species modeled by HMS PRiSM: The ecological impacts of each sub-alternative on bycatch species that were modeled by HMS PRiSM were based on metric scores (described in Chapters 2 and 3; see also Appendix 5) generated by HMS PRiSM. The metric scores are various ways of measuring the likelihood of the fishery interacting with bycatch species and can be interpreted as a measure of conservation. Four metrics were used:

- Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
- Metric 2: Does the spatial management area protect the most at-risk areas?
- Metric 3: What percent of total high-bycatch-risk area across the whole fishery domain does the spatial management area protect?
- Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Other bycatch and incidental species: Descriptions of the ecological impact analysis methodologies are in the impacts discussion for each sub-alternative.

Social and Economic Impacts

Although there are no recent catch data from within the current East Florida Coast closed area, we estimated potential target species catch under the Suite A3 Alternatives using the reference area method described in the introduction to Section 5.1. Each sub-alternative considers spatial and temporal changes to the current East Florida Coast closed area and we estimated target catch by multiplying effort (number of hooks) by CPUE (catch per 1,000 hooks) for each species.

Effort estimates: We estimated the number of hooks that would be deployed using the method described in the social and economic impacts section of each sub-alternative. In areas within the current closure, we used logbook data prior to implementation of the closure (1995 through 2000) to estimate proportional distribution of effort among the areas analyzed in each sub-alternative. The analysis applied those proportions to more recent logbook data from 2016 through 2020 to estimate expected effort levels. Because the number of hooks inside versus outside is based on a percent, it was assumed that the total number of hooks in the entire reference area across the East Florida Coast closed area sub-alternatives would remain the same, and the percentages inside versus outside would change for each sub-alternative.

CPUE estimates: Using pelagic longline logbook data from 1995 through 2000, we calculated species-specific CPUEs and averaged across years within the areas considered in each sub-alternative. We then calculated a ratio of each species' averaged CPUE inside the analyzed area with that outside the current closure but within the reference area. Next, we multiplied the ratio(s) by the average monthly CPUE outside the current East Florida Coast closed area within the reference area from 2011 through 2020 to calculate an estimated current CPUE inside each analyzed area. As an example, the historical swordfish CPUE ratio (1.17) was calculated from the swordfish CPUE in Sub-Alternative A3d* (1995-2000) and swordfish CPUE outside the current East Florida Coast closed area (1995-2000). The ratio was multiplied by 12.13 which is the current swordfish CPUE in January outside the current East Florida Coast closed area (2011-2020), resulting in 14.19 which is the current swordfish CPUE in January inside Sub-Alternative A3d*.

Catch estimates: NOAA Fisheries estimated the monthly catch (expressed as numbers of fish) within each sub-alternative for each target species by multiplying the estimated monthly effort by the monthly CPUE in each analyzed area. The estimated monthly catch within the reference area outside the current East Florida Coast closed area was also calculated using the same approach. The sum of the estimated species-specific catch inside and outside the current East Florida Coast closed area across the entire reference area is the total estimated species-specific catch.

Note that it is difficult to predict fishing effort and CPUE given the number of factors that may influence each. Therefore, the data on fishing effort, CPUE, target species catch and revenue should be considered estimates that are intended primarily to compare among sub-alternatives and not provide precise predictions. Alterations in the spatial or temporal aspects of spatial management areas may result in changes in fishing behavior such as increases in fishing effort and catch that are not reflected in the estimated social and economic impacts.

5.1.3.1 Sub-Alternative A3a - No Action

This sub-alternative would maintain the current East Florida Coast closed area in effect with respect to its spatial and temporal extent, as shown in Chapter 3 Figure 10.

Ecological Impacts on Target Species

The ecological impacts of Sub-Alternative A3a on target species catch is expected to be neutral. The target species are quota-managed species, and this sub-alternative would not affect the overall U.S. quotas for swordfish, yellowfin tuna, or bigeye tuna, which prevent overfishing, are based on the best scientific information available, and are consistent with the ICCAT-recommended total allowable catches.

Ecological Impacts on Bycatch Species Modeled by HMS PRiSM

Table 5.45 lists the individual metric scores for Sub-Alternative A3a for each bycatch species. For example, for billfish species the metric score of 7 for Metric 1 indicates that the probability of the fishery interacting with billfish species inside the area is higher than the probability of interacting outside of the spatial management area for 7 months (i.e., one point for each month). The total metric scores by species indicate that this sub-alternative would be most effective for the protection of the shortfin mako shark, followed by leatherback sea turtle and billfish species, but provide little protection for loggerhead sea turtle (with a score of zero). The overall metric score for Sub-Alternative A2a is relatively high with a score of 43. Under this sub-alternative (No Action), recent interaction rates of these bycatch species would be maintained, resulting in neutral indirect ecological impacts.

Table 5.45. Sub-Alternative A3a metric scores* for modeled species

Species	Metric 1	Metric 2	Metric 3	Metric 4	Total
Leatherback Sea Turtle	2	3	7	9	21
Shortfin Mako Shark	0	3	4	5	12
Billfish Species	7	0	0	3	10
Loggerhead Sea Turtle	0	0	0	0	0
Overall Metric Score					43

*For all sub-alternatives, the highest score possible for a single metric and species is 12. The highest possible total metric score for a species is 48. The highest possible overall metric score is 192.
Underlying questions:
Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
Metric 2: Does the spatial management area protect the most at-risk areas?
Metric 3: What percent of total high-bycatch-risk area across the whole fishery domain does the spatial management area protect?
Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Ecological Impacts on Other Bycatch and Incidental Species

Under Sub-Alternative A3a, effort in pelagic longline fishery is unlikely to increase and, if recent trends continue, could decrease. Thus, fishing impacts to other bycatch and incidental species of concern such as bluefin tuna, longfin mako shark, oceanic whitetip shark, scalloped hammerhead shark, dusky shark, or sandbar shark are unlikely to change and indirect neutral ecological impacts are expected. Further, the IBQ Program has been successful in reducing the incidental catch of bluefin tuna (NOAA Fisheries 2019, National Academies 2021).

Social and Economic Impacts

Methods

Sub-alternative-specific effort estimate: For Sub-Alternative A3a (the current East Florida Coast closed area), we assumed that zero percent of the hooks occurred in the closed area, when the area was closed. Because the annual number of hooks in the reference area from 1995 through 2000 was greater than the annual number of hooks in recent years, NOAA Fisheries used the percentages from 1995 through 2000, but the actual number of hooks from 2016 through 2020 (similar to Charleston Bump closed area analysis). Specifically, the percentages inside (0 percent) and outside (100 percent) the closed area were multiplied by the average total number of hooks each month across years that occurred in the reference area to calculate the estimated number of hooks each month that occurred in Sub-Alternative A3a and inside the reference area outside the current East Florida Coast closed area.

Sub-alternative-specific CPUE estimate: We only calculated CPUE outside the current East Florida Coast closed area since the area inside would remain closed under Sub-Alternative A3a. Species-specific CPUEs inside the area were assumed to be zero.

Estimated Impacts

Table 5.46 shows the average number of monthly hooks and percentage of total hooks inside the current East Florida Coast closed area and outside the area within the reference area, on a monthly basis, from 2016 through 2020. Because fishing has not been allowed in the current East Florida Coast closed area, we expect the total number of hooks deployed in that area for a given year to be zero, while 907,142 hooks were estimated in the reference area outside the current East Florida Coast. Table 5.47, Table 5.48, and Table 5.49 show CPUEs for swordfish, yellowfin tuna and bigeye tuna, respectively, inside and outside the current East Florida Coast closed area for 2011 through 2020. Table 5.50 below shows the estimated numbers of swordfish, yellowfin tuna, and bigeye tuna target catch inside the reference area within the current East Florida Coast closed area compared to outside (within the reference area) for this sub-alternative. The estimated catch of all target species was zero inside the closed area, whereas estimated target species outside the closed area, but inside the reference area was just over 10,000 swordfish and approximately 2,000 yellowfin tuna, and 2,000 bigeye tuna. As noted above, we compared the estimated catch for the target species inside the reference area, using the method described above, to the actual average catch from 2016 through 2020 inside the reference area, based on logbook data. The average annual (2016-2020) number of fish caught from the reference area was 11,772 swordfish, 2,109 yellowfin tuna, and 1,595 bigeye tuna.

Table 5.46. Average number of monthly hooks and percentage of hooks inside or outside (but in the reference area) the current East Florida Coast closed area (2016-2020); Sub-Alternative A3a

Month	Inside	Outside
January	0 (0%)	76,491 (100%)
February	0 (0%)	42,177 (100%)
March	0 (0%)	66,890 (100%)
April	0 (0%)	89,816 (100%)
May	0 (0%)	224,589 (100%)
June	0 (0%)	101,048 (100%)
July	0 (0%)	57,313 (100%)
August	0 (0%)	57,238 (100%)
September	0 (0%)	36,839 (100%)
October	0 (0%)	31,458 (100%)
November	0 (0%)	55,867 (100%)
December	0 (0%)	67,419 (100%)

Table 5.47. Average monthly swordfish CPUE (per 1,000 hooks) inside or outside (but in the reference area) the current East Florida Coast closed area (2011-2020); Sub-Alternative A3a

Month	Inside	Outside
January	0.00	12.13
February	0.00	5.61
March	0.00	6.01
April	0.00	6.12
May	0.00	11.30

June	0.00	9.52
July	0.00	9.96
August	0.00	12.12
September	0.00	15.56
October	0.00	19.31
November	0.00	21.33
December	0.00	14.95

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.48. Average monthly yellowfin tuna CPUE (per 1,000 hooks) inside or outside (but in the reference area) the current East Florida Coast closed area (2011-2020); Sub-Alternative A3a

Month	Inside	Outside
January	0.00	4.34
February	0.00	5.55
March	0.00	3.21
April	0.00	1.61
May	0.00	0.54
June	0.00	2.20
July	0.00	3.56
August	0.00	3.34
September	0.00	3.79
October	0.00	3.09
November	0.00	2.82
December	0.00	3.10

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.49. Average monthly bigeye tuna CPUE (per 1,000 hooks) inside or outside (but in the reference area) the current East Florida Coast closed area (2011-2020); Sub-Alternative A3a

Month	Inside	Outside
January	0.00	3.18
February	0.00	2.25
March	0.00	1.69
April	0.00	1.39
May	0.00	0.87
June	0.00	1.57
July	0.00	3.54
August	0.00	4.43
September	0.00	4.91
October	0.00	5.25
November	0.00	2.45
December	0.00	2.80

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.50. Estimated annual numbers of target species caught inside or outside (but in the reference area) the current East Florida Coast closed area; Sub-Alternative A3a

	Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
Inside	0	0	0	0
Outside	10,261	2,269	2,059	14,589
Total	10,261	2,269	2,059	14,589

Table 5.50 presents the target species catch estimates used to estimate the effect of the sub-alternative on commercial pelagic longline revenue. We first calculated the average ex-vessel price per fish in pounds dressed weight (lb dw) for the Atlantic using average price per lb dw from 2016 through 2020. We then multiplied the average price per lb dw (in 2021 real dollars - swordfish: $4.62; yellowfin tuna: $4.51; bigeye tuna: $5.89) by the average lb dw of one fish for the Atlantic to estimate the average price per fish. Lastly, we multiplied the average price per fish by the total species catch estimates in the reference

area. These steps were conducted for three of the target species: swordfish, yellowfin tuna, and bigeye tuna.

Table 5.51 shows the estimated annual revenue for each target species and the combined target species revenue is $4,196,431 (2021 real dollars). This sub-alternative would maintain the recent fishing effort, catch levels, and revenues, resulting in direct neutral social and economic impacts on pelagic longline fishermen. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Since fishing effort is not expected to change, large changes to landings are not expected either. Thus, indirect impacts to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be neutral. From 2016 through 2020, 96 dealers purchased swordfish, yellowfin tuna, or bigeye tuna products in North Carolina, South Carolina, Georgia, and the east coast of Florida, which are the states in the vicinity of the East Florida Coast closed area. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

This sub-alternative would not alter the footprint of the current closed area, so vessel transit times and distances are unlikely to change. Thus, no impacts to fuel costs or greenhouse gas emissions are expected.

Table 5.51. Estimated annual revenue of target species caught in the reference area (2021 real dollars); Sub-Alternative A3a

Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
$3,074,606	$595,318	$526,507	$4,196,431

5.1.3.2 Sub-Alternative A3b

This sub-alternative can be split into two separate temporal periods, each with its own spatial extent, as shown in Chapter 3 Figure 11. This sub-alternative would maintain the current spatial extent of the East Florida Coast closed area from May 1 through November 30. From December 1 through April 30, the spatial extent would shift the eastern boundary to 40 nm from the coastline. The remainder of the current closed area footprint would be designated a low-bycatch-risk area from May 1 through November 30.

Ecological Impacts on Target Species

The ecological impacts of Sub-Alternative A3b on target species catch is expected to be neutral. The target species are quota-managed species, and this sub-alternative would not affect the overall U.S. quotas for swordfish, yellowfin tuna, or bigeye tuna, which prevent overfishing, are based on the best scientific information available, and are consistent with the ICCAT-recommended TACs and quotas.

Ecological Impacts on Bycatch Species Modeled by HMS PRiSM

Table 5.52 lists the individual metric scores for this sub-alternative for each bycatch species. Based on the overall metric score ranking for the modeled bycatch species, this sub-alternative improved the overall metric score compared to the No Action sub-alternative. The metric scores indicate that the sub-alternative would be most effective at protecting leatherback sea turtles, shortfin mako sharks, and billfish species. Protections of leatherback sea turtles and shortfin mako sharks are higher than the status quo sub-alternative (leatherback sea turtle score of 23 compared to 21; shortfin mako shark score of 16 compared to 11) and billfish protections are equal to the status quo sub-alternative (both scores are 10). In contrast, the total metric scores for loggerhead sea turtles are relatively low out of a possible total of 48 (total metric score of zero), but equal to the status quo sub-alternative. Due to the increased scores for leatherback sea turtles and shortfin mako sharks, this sub-alternative had a higher overall metric scores than the No Action sub-alternative (43 compared to 21). In addition, the scope was 21 percent smaller compared to that of the No Action sub-alternative because for five months, fishing would be allowed in parts of the closed area. Sub-Alternative A3b would likely have short and long-term direct moderate beneficial indirect ecological impacts for the bycatch species.

Table 5.52 Sub-Alternative A3b Metric Scores* for Modeled Species

Species	Metric 1	Metric 2	Metric 3	Metric 4	Total
Leatherback Sea Turtle	4	4	6	9	23
Shortfin Mako Shark	4	3	3	6	16
Billfish Species	7	0	0	3	10
Loggerhead Sea Turtle	0	0	0	0	0
Overall Metric Score					49

*For all sub-alternatives, the highest score possible for a single metric and species is 12. The highest possible total metric score for a species is 48. The highest possible overall metric score is 192.
Underlying questions:
Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
Metric 2: Does the spatial management area protect the most at-risk areas?
Metric 3: What percent of total high-bycatch-risk area across the whole fishery domain does the spatial management area protect?
Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Ecological Impacts on Other Bycatch and Incidental Species

Under Sub-Alternative A3b, effort in pelagic longline fishery is unlikely to increase and, if recent trends continue, could decrease. Thus, fishing impacts to other bycatch and incidental species of concern such as bluefin tuna, longfin mako shark, oceanic whitetip shark, scalloped hammerhead shark, dusky shark, or sandbar shark are unlikely to change and neutral indirect ecological impacts are expected. Further, the IBQ Program has been successful in reducing the incidental catch of bluefin tuna (NOAA Fisheries 2019, National Academies 2021).

Social and Economic Impacts

Methods

Sub-alternative-specific effort estimate: For this sub-alternative from December through April, the entire reference area can be divided into three areas: Sub-Alternative A3b Dec-Apr (which is inside the current Charleston Bump closed area), the area inside the current East Florida Coast closed area that is outside Sub-Alternative A3b Dec-Apr (herein referred to as "Sub-Alternative A3b Dec-Apr*"), and the reference area outside the current East Florida Coast closed area (Figure 5.5). Using pelagic longline logbook data from 1995 through 2000, the percent of the total number of hooks in the reference area deployed each year in Sub-Alternative A3b Dec-Apr and Sub-Alternative A3b Dec-Apr* was averaged across years. NOAA Fisheries then assumed that all effort inside Sub-Alternative A3b Dec-Apr would shift into Sub-Alternative A3b Dec-Apr* because under this Sub-Alternative fishing is not allowed inside Sub-Alternative A3b Dec-Apr (0 percent of hooks), but is allowed inside Sub-Alternative A3b Dec-Apr*. We subtracted that percent (28 percent) from 100 percent to estimate a percent of hooks that occurred in the reference area outside the current East Florida Coast closed area from December through April. Next, we multiplied the percentages by the average monthly number of hooks inside the reference area from 2016 through 2020 to calculate the estimated number of hooks each month that occurred in Sub-Alternative A3b Dec-Apr* and inside the reference area outside the current East Florida Coast closed area. For May through November (Figure 5.6), because no fishing was allowed inside the current East Florida Coast closed area, similar to Sub-Alternative A3a, 100 percent of the effort was assumed to occur outside the current East Florida Coast closed area. Meaning, the same estimated number of hooks outside the current East Florida Coast closed area inside the reference area from May through November was the same for this sub-alternative and Sub-Alternative A3a.

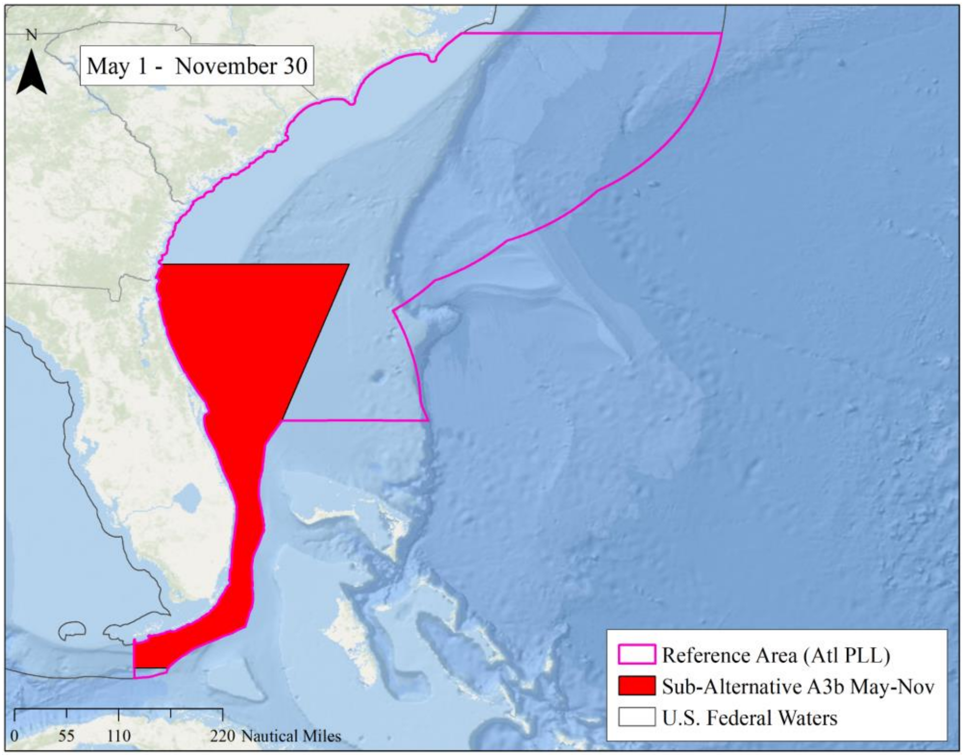

Figure 5.5. Areas defined by Sub-Alternative A3b May-Nov within the Atlantic reference area.

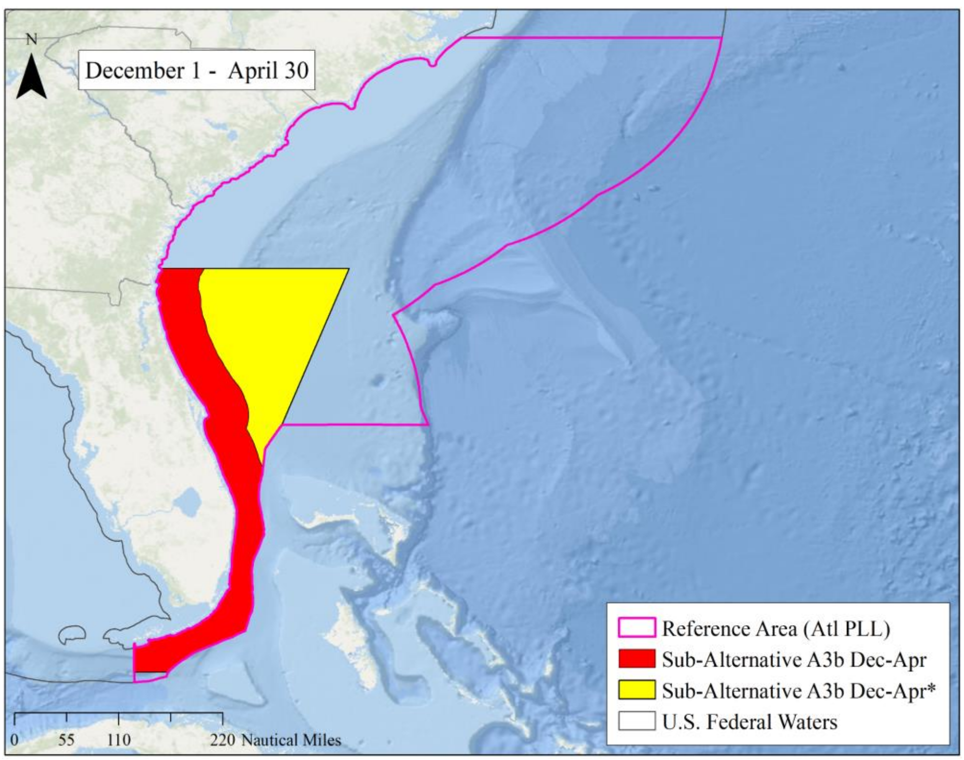

Figure 5.6. Areas defined by Sub-Alternative A3b Dec-Apr and Sub-Alternative A3b Dec-Apr* within the Atlantic reference area.

Sub-alternative-specific CPUE estimate: We averaged species-specific CPUEs across years within Sub-Alternative A3b Dec-Apr* and within the reference area outside the current East Florida Coast closed area from December through April. These two values generated the ratio for each species representing December through April. The ratio was then multiplied by the average monthly (from December through April) CPUE outside the current East Florida Coast closed area within the reference area from 2011 through 2020 to calculate an estimated current CPUE inside Sub-Alternative A3b Dec-Apr*. For May through November, a separate ratio was calculated inside Sub-Alternative A3b May-Nov and outside the current East Florida Coast closed area and then multiplied by the average monthly (from May through November) CPUE outside the current East Florida Coast closed area within the reference area from 2011 through 2020 to calculate an estimated current CPUE inside Sub-Alternative A3b May-Nov. However, similar to Sub-Alternative A3a, the effort in Sub-Alternative A3b May-Nov was zero percent, therefore, current species-specific CPUEs were assumed to be zero. These steps provided a separate monthly CPUE for each species inside and outside the different spatial management areas for a recent time period.

NOAA Fisheries estimated the monthly catch within Sub-Alternative A3b Dec-Apr* for each target species by multiplying the estimated monthly effort by the monthly CPUE inside Sub-Alternative A3b Dec-Apr*. The estimated monthly catch within the reference area outside the current East Florida Coast closed area for December through April and May through November was also calculated using the same approach. Total estimated species-specific catch was summed inside Sub-Alternative A3b Dec-Apr* and in the reference area outside the current East Florida Coast closed area.

Estimated Impacts

Of the estimated average annual total number of hooks in the reference area (907,142), NOAA Fisheries estimated that 94,315 hooks would be deployed within areas Sub-Alternative A3b Dec-Apr* (only area inside current East Florida Coast closed area where fishing would be allowed for part of the year) annually (10 percent of total hooks), while 812,827 hooks (would be deployed in the reference area outside the current East Florida Coast closed area (90 percent of the total hooks; Table 5.53)). CPUE estimates (Table 5.54, Table 5.55, and Table 5.56), for swordfish, yellowfin tuna, and bigeye tuna inside Sub-Alternative A3b Dec-Apr* and outside the current closed area by month are variable. Most notable was the greater CPUEs for swordfish occurred inside Sub-Alternative A3b Dec-Apr* in December and January, whereas, the greater CPUEs for swordfish outside the East Florida Coast closed area were in April and May. Under this sub-alternative, 10,294 swordfish would be caught in the reference area analyzed (Table 5.57), which is similar to the No Action sub-alternative. Estimated yellowfin tuna catch (2,087) decreased in the reference area by approximately 200 fish, while bigeye tuna catch (1,912) decreased slightly relative to the No Action sub-alternative.

Table 5.53. Average number of monthly hooks and percentage of hooks inside Sub-Alternative A3b Dec-Apr or Sub-Alternative A3b May-Nov ("Inside A3b"), Sub-Alternative A3b Dec-Apr* ("Inside A3b*"), or outside (but in the reference area) the current East Florida Coast closed area (2016-2020); Sub-Alternative A3b

Month	Inside A3b	Inside A3b*	Outside
January	0 (0%)	21,046 (28%)	55,445 (72%)
February	0 (0%)	11,604 (28%)	30,572 (72%)
March	0 (0%)	18,404 (28%)	48,486 (72%)
April	0 (0%)	24,712 (28%)	65,104 (72%)
May	0 (0%)	0 (0%)	224,587 (100%)
June	0 (0%)	0 (0%)	101,048 (100%)
July	0 (0%)	0 (0%)	57,313 (100%)
August	0 (0%)	0 (0%)	57,238 (100%)
September	0 (0%)	0 (0%)	36,839 (100%)
October	0 (0%)	0 (0%)	31,458 (100%)
November	0 (0%)	0 (0%)	55,867 (100%)
December	0 (0%)	18,549 (28%)	48,869 (72%)

Table 5.54. Average monthly swordfish CPUE (per 1,000 hooks), inside Sub-Alternative A3b Dec-Apr or Sub-Alternative A3b May-Nov ("Inside A3b"), inside Sub-Alternative A3b Dec-Apr* ("Inside A3b*"), or outside (but in the reference area) the current East Florida Coast closed area (2011-2020); Sub-Alternative A3b

Month	Inside A3b	Inside A3b*	Outside
January	0.00	12.60	12.13
February	0.00	5.83	5.61
March	0.00	6.25	6.01
April	0.00	6.36	6.12
May	0.00	0.00	11.30
June	0.00	0.00	9.52

Month	Inside A3b	Inside A3b*	Outside
January	0.00	12.60	12.13
July	0.00	0.00	9.96
August	0.00	0.00	12.12
September	0.00	0.00	15.56
October	0.00	0.00	19.31
November	0.00	0.00	21.33
December	0.00	15.54	14.95

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.55. Average monthly yellowfin tuna CPUE (per 1,000 hooks), inside Sub-Alternative A3b Dec-Apr or Sub-Alternative A3b May-Nov ("Inside A3b"), inside Sub-Alternative A3b Dec-Apr* ("Inside A3b*"), or outside (but in the reference area) the current East Florida Coast closed area (2011-2020); Sub-Alternative A3b

Month	Inside A3b	Inside A3b*	Outside
January	0.00	1.82	4.34
February	0.00	2.32	5.55
March	0.00	1.34	3.21
April	0.00	0.67	1.61
May	0.00	0.00	0.54
June	0.00	0.00	2.20
July	0.00	0.00	3.56
August	0.00	0.00	3.34
September	0.00	0.00	3.79
October	0.00	0.00	3.09
November	0.00	0.00	2.82

December	0.00	1.30	3.10

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.56. Average monthly bigeye tuna CPUE (per 1,000 hooks), inside Sub-Alternative A3b Dec-Apr or Sub-Alternative A3b May-Nov ("Inside A3b"), inside Sub-Alternative A3b Dec-Apr* ("Inside A3b*"), or outside (but in the reference area) the current East Florida Coast closed area (2011-2020); Sub-Alternative A3b

Month	Inside A3b	Inside A3b*	Outside
January	0.00	0.96	3.18
February	0.00	0.68	2.25
March	0.00	0.51	1.69
April	0.00	0.42	1.39
May	0.00	0.00	0.87
June	0.00	0.00	1.57
July	0.00	0.00	3.54
August	0.00	0.00	4.43
September	0.00	0.00	4.91
October	0.00	0.00	5.25
November	0.00	0.00	2.45
December	0.00	0.84	2.80

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.57. Estimated annual numbers of target species caught inside the current East Florida Coast closed area (Sub-Alternative A3b Dec-Apr + Sub-Alternative A3b Dec-Apr* + Sub-Alternative A3b May-Nov) or outside (but in the reference area) the current East Florida Coast closed area; Sub-Alternative A3b

	Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
Inside	893	131	63	1,087
Outside	9,401	1,956	1,849	13,206
Total	10,294	2,087	1,912	14,293

We estimated revenue for Sub-Alternative A3b by following the social and economic calculations described in the Sub-Alternative A3a. Table 5.58 shows the estimated annual revenue for each target species and the combined target species revenue is $4,120,978 (2021 real dollars). This sub-alternative would generate slightly more revenue from swordfish, but less from yellowfin tuna and bigeye tuna relative to the No Action sub-alternative. When combined the total revenue difference between this sub-alternative and the No Action sub-alternative is -$75,453 resulting in minor negative direct economic impacts in the short- and long-term and negative direct social impacts. However, fishermen are unlikely to fish in areas with lower catch rates, so reductions in revenue may not be realized. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Since fishing effort is not expected to change, large changes to landings are not expected either. Thus, indirect impacts to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be neutral. From 2016 through 2020, 96 dealers purchased swordfish, yellowfin tuna, or bigeye tuna products in North Carolina, South Carolina, Georgia, and the east coast of Florida, which are the states in the vicinity of the East Florida Coast closed area. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

This sub-alternative would shift the northeastern boundary of the closed area to the west during portions of the year, potentially opening fishing opportunities closer to shore, so vessel transit times and distances may decrease. Thus, reduced fuel costs for fishermen could provide minor beneficial social and economic impacts and reduce greenhouse gas emissions.

Table 5.58. Estimated annual revenue of target species caught in the reference area (2021 real dollars); Sub-Alternative A3b

Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
$3,084,494	$547,566	$488,918	$4,120,978

5.1.3.3 Sub-Alternative A3c

This sub-alternative would modify the spatial extent of the East Florida Coast closed area, and would maintain a year-round closure, as shown in Chapter 3 Figure 12. The spatial extent would be reduced by shifting the eastern boundary of the current closed area to 40 nm from the coastline in areas north of 28° 17’ 24” N. lat., while maintaining the closure for the areas south of that boundary. The remainder of the current closed area footprint would be designated a low-bycatch-risk area for the entire year.

Ecological Impacts on Target Species

The ecological impacts of Sub-Alternative A3c on target species catch is expected to be neutral. The target species are quota managed species, and this sub-alternative would not affect the overall U.S. quotas for swordfish, yellowfin tuna, or bigeye tuna, which prevent overfishing, are based on the best scientific information available, and are consistent with the ICCAT-recommended TACs and quotas.

Ecological Impacts on Bycatch Species Modeled by HMS PRiSM

Table 5.59 lists the individual metric scores for this sub-alternative for each bycatch species. Based on the overall metric score ranking for the modeled bycatch species, this sub-alternative slightly improved the overall metric score compared to the No Action sub-alternative. The metric scores indicate that the sub-alternative would be most effective at protecting leatherback sea turtles and shortfin mako sharks. Protections of leatherback sea turtles are equal to the status quo sub-alternative (both total metric scores are 21) and higher for shortfin mako sharks (total metric score of 17 compared to 12). In contrast, the total metric scores for billfish species (six) and loggerhead sea turtles (zero) are relatively low out of a possible total of 48. The billfish species total metric score is lower than the status quo sub-alternative (6 compared to 10) and the loggerhead sea turtle total metric score is equal to the status quo sub-alternative (both scores are zero). Due to the increased score for shortfin mako sharks, this sub-alternative had a slightly higher overall metric score than the No Action sub-alternative (44 compared to 43). In addition, the scope was 47 percent smaller compared to that of the No Action sub-alternative. Sub-Alternative A3c would likely have short and long-term minor beneficial indirect ecological impacts for the bycatch species.

Table 5.59. Sub-Alternative A3c metric scores* for modeled species

Species	Metric 1	Metric 2	Metric 3	Metric 4	Total
Leatherback Sea Turtle	4	4	3	10	21
Shortfin Mako Shark	5	3	3	6	17
Billfish Species	6	0	0	0	6
Loggerhead Sea Turtle	0	0	0	0	0
Overall Metric Score					44

*For all sub-alternatives, the highest score possible for a single metric and species is 12. The highest possible total metric score for a species is 48. The highest possible overall metric score is 192.
Underlying questions:
Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
Metric 2: Does the spatial management area protect the most at-risk areas?
Metric 3: What percent of total high-bycatch-risk area across the whole fishery domain does the spatial management area protect?
Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Ecological Impacts on Other Bycatch and Incidental Species

Under Sub-Alternative A3c, effort in pelagic longline fishery is unlikely to increase and, if recent trends continue, could decrease. Thus, fishing impacts to other bycatch and incidental species of concern such as bluefin tuna, longfin mako shark, oceanic whitetip shark, scalloped hammerhead shark, dusky shark, or sandbar shark are unlikely to change and neutral indirect ecological impacts are expected. Further, the IBQ Program has been successful in reducing the incidental catch of bluefin tuna (NOAA Fisheries 2019, National Academies 2021).

Social and Economic Impacts

Methods

Sub-alternative-specific effort estimate: For this sub-alternative, the entire reference area can be divided into three areas: Sub-Alternative A3c (which is inside the current East Florida Coast closed area), the area inside the current East Florida Coast closed area that is outside Sub-Alternative A3c (herein referred to as "Sub-Alternative A3c*"), and the reference area outside the current East Florida Coast closed area (Figure 5.7). The percent of the total number of hooks deployed each year from 1995 through 2000 in the reference area that occurred in Sub-Alternative A3c and Sub-Alternative A3c* was averaged across years. NOAA Fisheries then assumed that all effort inside Sub-Alternative A3c would shift into Sub-Alternative A3c* because under this Sub-Alternative fishing is not allowed inside Sub-Alternative A3c (0 percent of hooks), but is allowed inside Sub-Alternative A3c*. We subtracted that percent (31 percent) from 100 percent to estimate a percent of hooks that occurred in the reference area outside the current East Florida Coast closed area. Next, we multiplied the percentages by the average monthly number of hooks inside the reference area from 2016 through 2020 to calculate the estimated number of hooks each month that occurred in Sub-Alternative A3c* and inside the reference area outside the current East Florida Coast closed area.

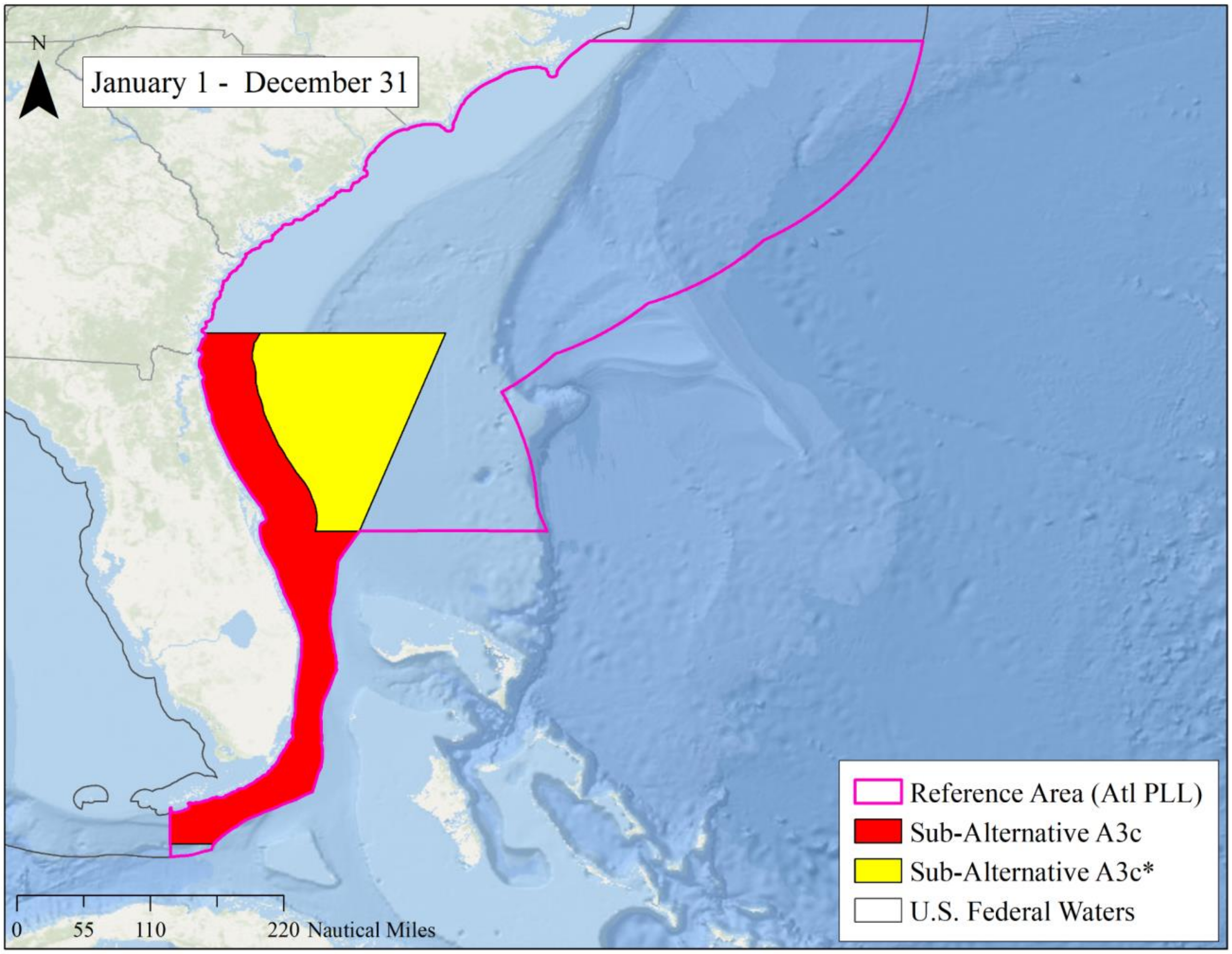

Figure 5.7. Areas defined by Sub-Alternative A3c and Sub-Alternative A3c* within the Atlantic reference area.

Sub-alternative-specific CPUE estimate: We followed the methodology outlined in the introduction of Section 5.1.3 to calculate CPUE inside and outside Sub-Alternative A3c*.

Estimated Impacts

Table 5.60 shows the average number of monthly hooks and percentage of total hooks inside Sub-Alternative A3c* and outside the current East Florida Coast closed area within the reference area, on a monthly basis, from 2016 through 2020. Of the estimated average annual total number of hooks in the reference area (907,142), NOAA Fisheries estimated that 283,401 hooks would be deployed within area Sub-Alternative A3c* annually (31 percent of total hooks), while 623,741 hooks (would be deployed in the reference area outside the current East Florida Coast closed area (69 percent of the total hooks). The number of hooks inside Sub-Alternative A3c* and outside the current closed area followed a similar pattern during all months, with the exception of May, which had a high number of hooks inside Sub-Alternative A3c*. CPUE estimates (Table 5.61, Table 5.62, and Table 5.63) for swordfish, yellowfin tuna, and bigeye tuna inside Sub-Alternative A3c* and outside the current closed area by month are variable. For swordfish, the highest CPUEs occurred during October and November inside Sub-Alternative A3c*, and the lowest CPUEs during February, March, and April outside the current closed area. Under this sub-alternative, 10,835 swordfish would be caught in the reference area analyzed (Table 5.64), which is over 500 more than the estimated swordfish catch under the No Action sub-alternative. The number of yellowfin tuna and bigeye tuna estimates under this sub-alternative is 2,024 and 1,697, which is over 200 and 300 less than the No Action sub-alternative, respectively.

Table 5.60. Average number of monthly hooks and percentage of hooks inside Sub-Alternative A3c ("Inside A3c"), Sub-Alternative A3c* ("Inside A3c*"), or outside (but in the reference area) the current East Florida Coast closed area (2016-2020); Sub-Alternative A3c

Month	Inside A3c	Inside A3c*	Outside
January	0 (0%)	23,897 (31%)	52,594 (69%)
February	0 (0%)	13,176 (31%)	29,000 (69%)
March	0 (0%)	20,897 (31%)	45,993 (69%)
April	0 (0%)	28,059 (31%)	61,757 (69%)
May	0 (0%)	70,163 (31%)	154,423 (69%)
June	0 (0%)	31,568 (31%)	69,480 (69%)
July	0 (0%)	17,905 (31%)	39,408 (69%)
August	0 (0%)	17,882 (31%)	39,356 (69%)
September	0 (0%)	11,509 (31%)	25,330 (69%)
October	0 (0%)	9,828 (31%)	21,630 (69%)
November	0 (0%)	17,453 (31%)	38,413 (69%)
December	0 (0%)	21,062 (31%)	46,356 (69%)

Table 5.61. Average monthly swordfish CPUE (per 1,000 hooks), inside Sub-Alternative A3c* ("Inside A3c"), inside Sub-Alternative A3c* ("Inside A3c*"), or outside (but in the reference area) the current East Florida Coast closed area (2011-2020); Sub-Alternative A3c

Month	Inside A3c	Inside A3c*	Outside
January	0.00	14.30	12.13
February	0.00	6.62	5.61
March	0.00	7.09	6.01

Month	Inside A3c	Inside A3c*	Outside
January	0.00	14.30	12.13
April	0.00	7.22	6.12
May	0.00	13.32	11.30
June	0.00	11.22	9.52
July	0.00	11.74	9.96
August	0.00	14.29	12.12
September	0.00	18.35	15.56
October	0.00	22.76	19.31
November	0.00	25.14	21.33
December	0.00	17.63	14.95

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.62. Average monthly yellowfin tuna CPUE (per 1,000 hooks), inside Sub-Alternative A3c* ("Inside A3c"), inside Sub-Alternative A3c* ("Inside A3c*"), or outside (but in the reference area) the current East Florida Coast closed area (2011-2020); Sub-Alternative A3c

Month	Inside A3c	Inside A3c*	Outside
January	0.00	2.85	4.34
February	0.00	3.64	5.55
March	0.00	2.10	3.21
April	0.00	1.05	1.61
May	0.00	0.36	0.54
June	0.00	1.44	2.20
July	0.00	2.33	3.56
August	0.00	2.19	3.34
September	0.00	2.49	3.79

October	0.00	2.02	3.09
November	0.00	1.85	2.82
December	0.00	2.03	3.10

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.63. Average monthly bigeye tuna CPUE (per 1,000 hooks), inside Sub-Alternative A3c ("Inside A3c"), inside Sub-Alternative A3c* ("Inside A3c*"), or outside (but in the reference area) the current East Florida Coast closed area (2011-2020); Sub-Alternative A3c

Month	Inside A3c	Inside A3c*	Outside
January	0.00	1.39	3.18
February	0.00	0.98	2.25
March	0.00	0.74	1.69
April	0.00	0.61	1.39
May	0.00	0.38	0.87
June	0.00	0.69	1.57
July	0.00	1.55	3.54
August	0.00	1.94	4.43
September	0.00	2.14	4.91
October	0.00	2.29	5.25
November	0.00	1.07	2.45
December	0.00	1.22	2.80

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.64. Estimated annual numbers of target species caught inside the current East Florida Coast closed area (Sub-Alternative A3c + Sub-Alternative A3c*) or outside (but in the reference area) the current East Florida Coast closed area; Sub-Alternative A3c

	Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
Inside	3,779	464	281	4,524
Outside	7,056	1,560	1,416	10,032

Total	10,835	2,024	1,697	14,556

We estimated revenue for Sub-Alternative A3c by following the social and economic calculations described in the Sub-Alternative A3a. Table 5.65 shows the estimated annual revenue for each target species and the combined target species revenue is $4,211,576 (2021 real dollars). This sub-alternative would generate more revenue from swordfish, but less from yellowfin and bigeye tuna relative to the No Action sub-alternative. When combined the total revenue difference between this sub-alternative and the No Action sub-alternative is $15,145 resulting in minor positive direct economic impacts in the short- and long-term, which would also lead to positive direct social impacts. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Since fishing effort is not expected to change, large changes to landings are not expected either. Thus, indirect impacts to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be neutral. From 2016 through 2020, 96 dealers purchased swordfish, yellowfin tuna, or bigeye tuna products in North Carolina, South Carolina, Georgia, and the east coast of Florida, which are the states in the vicinity of the East Florida Coast closed area. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

This sub-alternative would shift the northeastern boundary of the closed area to the west during portions of the year, potentially opening fishing opportunities closer to shore, so vessel transit times and distances may decrease. Thus, reduced fuel costs for fishermen could provide minor beneficial social and economic impacts and reduce greenhouse gas emissions.

Table 5.65. Estimated annual revenue of target species caught in the reference area (2021 real dollars); Sub-Alternative A3c

Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
$3,246,599	$531,037	$433,940	$4,211,576

5.1.3.4 Sub-Alternative A3d - Preferred Sub-Alternative

This sub-alternative would modify the spatial extent of the East Florida Coast closed area, and would maintain a year-round closure, as shown in Chapter 3 Figure 13. The spatial extent would be reduced by including all areas east of the line connecting two points at 31° 00’ N. lat., 79° 32’ 46” W. long. and 27° 52’ 55” N. lat., 79° 28’ 34” W. long. at the northern and southern boundaries, respectively, of the current closed area. All areas south of 27° 52’ 55” N. lat. within the current closed area would remain the same relative to No Action sub-alternative. The remainder of the current closed area footprint would be designated a low-bycatch-risk area for the entire year.

Ecological Impacts on Target Species

The ecological impacts of Sub-Alternative A3d on target species catch is expected to be neutral. The target species are quota managed species, and this sub-alternative would not affect the overall U.S. quotas for swordfish, yellowfin tuna, or bigeye tuna, which prevent overfishing, are based on the best scientific information available, and are consistent with the ICCAT-recommended TACs and quotas.

Ecological Impacts on Bycatch Species Modeled by HMS PRiSM

Table 5.66 lists the individual metric scores for this sub-alternative for each bycatch species. Based on the overall metric score ranking for the modeled bycatch species, this sub-alternative improved the overall metric score compared to the No Action sub-alternative. The metric scores indicate that the sub-alternative would be most effective at protecting leatherback sea turtles and shortfin mako sharks. Protections of leatherback sea turtles and shortfin mako sharks are higher than the status quo sub-alternative (leatherback sea turtle score of 23 compared to 21; shortfin mako shark score of 18 compared to 11). In contrast, the total metric scores for billfish species (eight) and loggerhead sea turtles (zero) are relatively low out of a possible total of 48. The billfish species total metric score is lower than the status quo sub-alternative (8 compared to 10) and the loggerhead sea turtle total metric score is equal to the status quo sub-alternative (both scores are zero). Due to the increased scores for leatherback sea turtles and shortfin mako sharks, this sub-alternative had a slightly higher overall metric score than the No Action sub-alternative (49 compared to 43). In addition, the scope was 26 percent smaller compared to that of the No Action sub-alternative because for all months, fishing would be allowed in parts of the closed area. Sub-Alternative A3d would likely have short and long-term moderate beneficial indirect ecological impacts for the bycatch species.

Table 5.66. Sub-Alternative A3d metric scores* for modeled species

Species	Metric 1	Metric 2	Metric 3	Metric 4	Total
Leatherback Sea Turtle	3	4	7	9	23
Shortfin Mako Shark	5	3	4	6	18
Billfish Species	7	0	0	1	8
Loggerhead Sea Turtle	0	0	0	0	0
Overall Metric Score					49

*For all sub-alternatives, the highest score possible for a single metric and species is 12. The highest possible total metric score for a species is 48. The highest possible overall metric score is 192.
Underlying questions:
Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
Metric 2: Does the spatial management area protect the most at-risk areas?

Metric 3: What percent of total high-bycatch-risk area across the whole fishery domain does the spatial management area protect?
Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Ecological Impacts on Other Bycatch and Incidental Species

Under Sub-Alternative A3d, effort in pelagic longline fishery is unlikely to increase and, if recent trends continue, could decrease. Thus, fishing impacts to other bycatch and incidental species of concern such as bluefin tuna, longfin mako shark, oceanic whitetip shark, scalloped hammerhead shark, dusky shark, or sandbar shark are unlikely to change and neutral indirect ecological impacts are expected. Further, the IBQ Program has been successful in reducing the incidental catch of bluefin tuna (NOAA Fisheries 2019, National Academies 2021).

Social and Economic Impacts

Methods

Sub-alternative-specific effort estimate: For this sub-alternative, the entire reference area can be divided into three areas: Sub-Alternative A3d (which is inside the current East Florida Coast closed area), the area inside the current East Florida Coast closed area that is outside Sub-Alternative A3d (herein referred to as "Sub-Alternative A3d*"), and the reference area outside the East Florida Coast closed area. The percent of the total number of hooks deployed each year from 1995 through 2000 in the reference area that occurred in Sub-Alternative A3d and Sub-Alternative A3d* was averaged across years. NOAA Fisheries then assumed that all effort inside Sub-Alternative A3d would shift into Sub-Alternative A3d* because under this Sub-Alternative fishing is not allowed inside Sub-Alternative A3d (0 percent of hooks), but is allowed inside Sub-Alternative A3d*. We subtracted that percent (31 percent) from 100 percent to estimate a percent of hooks that occurred in the reference area outside the current East Florida Coast closed area. Next, we multiplied the percentages by the average monthly number of hooks inside the reference area from 2016 through 2020 to calculate the estimated number of hooks each month that occurred in Sub-Alternative A3d* and inside the reference area outside the current East Florida Coast closed area. For example in January, on average 31 percent of historical hooks (1995-2000) occurred inside the area defined by the current East Florida Coast closed area and 76,491 hooks were fished on average in the reference area (2016-2020). Therefore, 23,712 hooks would be estimated to occur inside the current East Florida Coast closed area and shift in Sub-Alternative A3d*, as mentioned above. Please note the total hooks in January do not match exactly to the value in Table A due to rounding.

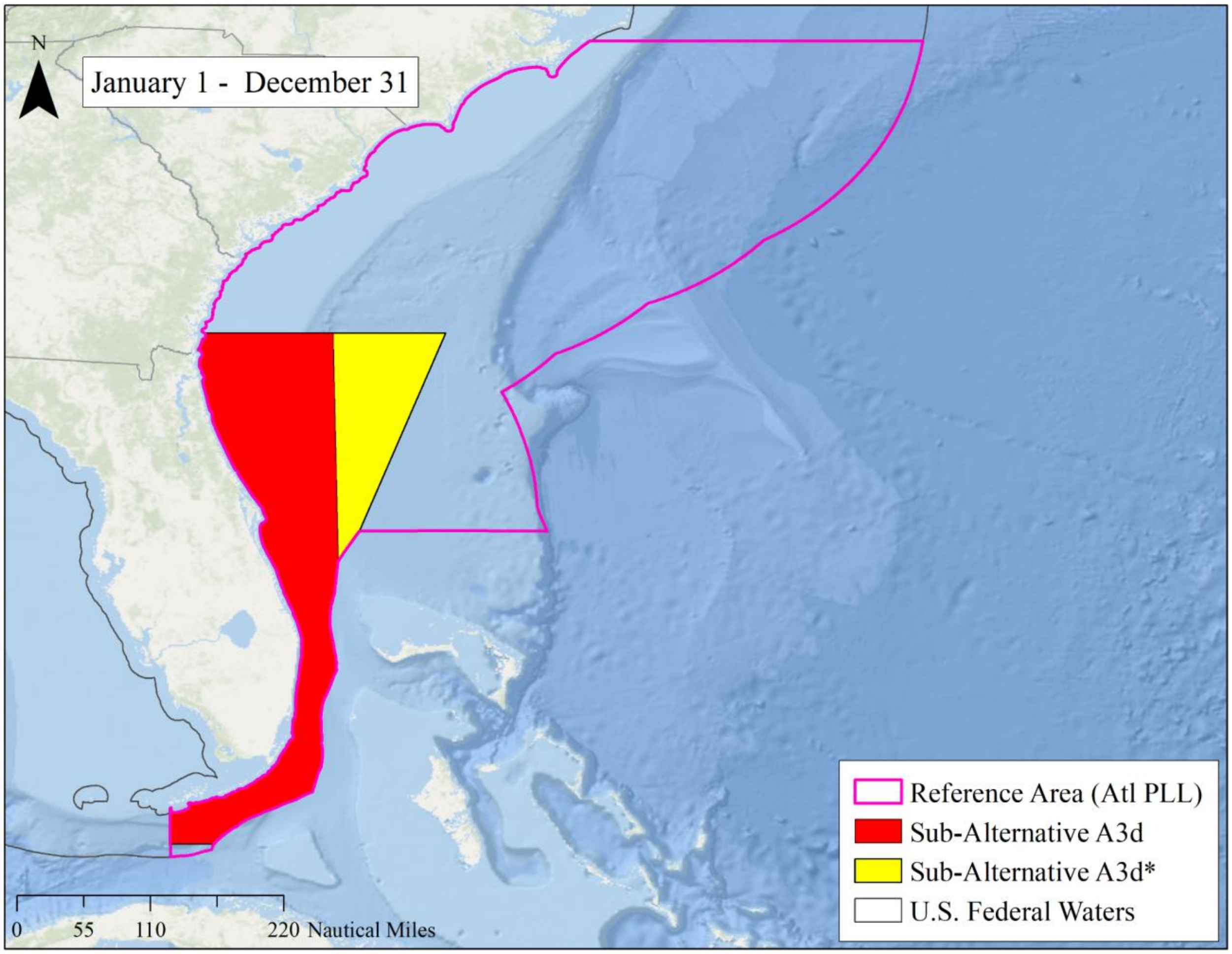

Figure 5.8. Areas defined by Sub-Alternative A3d and Sub-Alternative A3d* within the Atlantic reference area.

Sub-alternative-specific CPUE estimate: We followed the methodology outlined in the introduction of Section 5.1.3 to calculate CPUE inside and outside Sub-Alternative A3d*.

Estimated Impacts

Table 5.67 shows the average number of monthly hooks and percentage of total hooks inside Sub-Alternative A3d* and outside the current East Florida Coast closed area within the reference area, on a monthly basis, from 2016 through 2020. Of the estimated average annual total number of hooks in the reference area (907,142), NOAA Fisheries estimated that 283,401 hooks would be deployed within area Sub-Alternative A3d* annually (31 percent of total hooks), while 623,741 hooks would be deployed in the reference area outside the current East Florida Coast closed area (69 percent of the total hooks). The number of hooks inside Sub-Alternative A3d* and outside the current closed area followed a similar pattern during all months, with the exception of May, which had a high number of hooks inside Sub-Alternative A3d*. CPUE estimates (Table 5.68, Table 5.69, and Table 5.70) for swordfish, yellowfin tuna, and bigeye tuna inside Sub-Alternative A3d* and outside the current closed area by month are variable. For swordfish, the highest CPUEs occurred during October and November inside Sub-Alternative A3d*, and the lowest CPUEs during February, March, and April outside the current closed area. Under this sub-alternative, 10,822 swordfish would be caught in the reference area analyzed (Table 5.71), which is over 500 more than the estimated swordfish catch under the No Action sub-alternative. The number of yellowfin tuna and bigeye tuna estimates under this sub-alternative is 2,101 and 1,722, which is over 200 and 300 less than the No Action sub-alternative, respectively.

Table 5.67. Average number of monthly hooks and percentage of hooks inside Sub-Alternative A3d ("Inside A3d"), Sub-Alternative A3d* ("Inside A3d*"), or outside (but in the reference area) the current East Florida Coast closed area (2016-2020); Sub-Alternative A3d

Month	Inside A3d	Inside A3d*	Outside
January	0 (0%)	23,897 (31%)	52,594 (69%)
February	0 (0%)	13,176 (31%)	29,000 (69%)
March	0 (0%)	20,897 (31%)	45,993 (69%)
April	0 (0%)	28,059 (31%)	61,757 (69%)
May	0 (0%)	70,163 (31%)	154,423 (69%)
June	0 (0%)	31,568 (31%)	69,480 (69%)
July	0 (0%)	17,905 (31%)	39,408 (69%)
August	0 (0%)	17,882 (31%)	39,356 (69%)
September	0 (0%)	11,509 (31%)	25,330 (69%)
October	0 (0%)	9,828 (31%)	21,630 (69%)
November	0 (0%)	17,453 (31%)	38,413 (69%)
December	0 (0%)	21,062 (31%)	46,356 (69%)

Table 5.68. Average monthly swordfish CPUE (per 1,000 hooks), inside Sub-Alternative A3d ("Inside A3d"), inside Sub-Alternative A3d* ("Inside A3d*"), or outside (but in the reference area) the current East Florida Coast closed area (2011-2020); Sub-Alternative A3d

Month	Inside A3d	Inside A3d*	Outside
January	0.00	14.25	12.13
February	0.00	6.59	5.61
March	0.00	7.07	6.01

Month	Inside A3d	Inside A3d*	Outside
January	0.00	14.25	12.13
April	0.00	7.19	6.12
May	0.00	13.27	11.30
June	0.00	11.18	9.52
July	0.00	11.70	9.96
August	0.00	14.23	12.12
September	0.00	18.28	15.56
October	0.00	22.68	19.31
November	0.00	25.05	21.33
December	0.00	17.56	14.95

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.69. Average monthly yellowfin tuna CPUE (per 1,000 hooks), inside Sub-Alternative A3d ("Inside A3d"), inside Sub-Alternative A3d* ("Inside A3d*"), or outside (but in the reference area) the current East Florida Coast closed area (2011-2020); Sub-Alternative A3d

Month	Inside A3d	Inside A3d*	Outside
January	0.00	3.31	4.34
February	0.00	4.24	5.55
March	0.00	2.45	3.21
April	0.00	1.23	1.61
May	0.00	0.41	0.54
June	0.00	1.68	2.20
July	0.00	2.72	3.56
August	0.00	2.55	3.34
September	0.00	2.90	3.79

October	0.00	2.36	3.09
November	0.00	2.15	2.82
December	0.00	2.37	3.10

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.70. Average monthly bigeye tuna CPUE (per 1,000 hooks), inside Sub-Alternative A3d ("Inside A3d"), inside Sub-Alternative A3d* ("Inside A3d*"), or outside (but in the reference area) the current East Florida Coast closed area (2011-2020); Sub-Alternative A3d

Month	Inside A3d	Inside A3d*	Outside
January	0.00	1.51	3.18
February	0.00	1.07	2.25
March	0.00	0.80	1.69
April	0.00	0.66	1.39
May	0.00	0.41	0.87
June	0.00	0.75	1.57
July	0.00	1.68	3.54
August	0.00	2.11	4.43
September	0.00	2.33	4.91
October	0.00	2.50	5.25
November	0.00	1.17	2.45
December	0.00	1.33	2.80

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.71. Estimated annual numbers of target species caught inside the current East Florida Coast closed area (Sub-Alternative A3d + Sub-Alternative A3d*) or outside (but in the reference area) the current East Florida Coast closed area; Sub-Alternative A3d

	Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
Inside	3,766	541	306	4,613
Outside	7,056	1,560	1,416	10,032

Total	10,822	2,101	1,722	14,645

We estimated revenue for Sub-Alternative A3d by following the social and economic calculations described in the Sub-Alternative A3a. Table 5.72 shows the estimated annual revenue for each target species and the combined target species revenue is $4,234,276 (2021 real dollars). This sub-alternative would generate more revenue from swordfish, but less from yellowfin and bigeye tuna relative to the No Action sub-alternative. When combined the total revenue difference between this sub-alternative and the No Action sub-alternative is $37,845 resulting in minor positive direct economic impacts in the short- and long-term, which would also lead to positive direct social impacts. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Since fishing effort is not expected to change, large changes to landings are not expected either. Thus, indirect impacts to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be neutral. From 2016 through 2020, 96 dealers purchased swordfish, yellowfin tuna, or bigeye tuna products in North Carolina, South Carolina, Georgia, and the east coast of Florida, which are the states in the vicinity of the East Florida Coast closed area. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

This sub-alternative would shift the northeastern boundary of the closed area to the west, potentially opening fishing opportunities closer to shore, so vessel transit times and distances may decrease. Thus, reduced fuel costs for fishermen could provide minor beneficial social and economic impacts and reduce greenhouse gas emissions.

Table 5.72. Estimated annual revenue of target species caught in the reference area (2021 real dollars); Sub-Alternative A3d

Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
$3,242,704	$551,239	$440,333	$4,234,276

5.1.3.5 Sub-Alternative A3e

This sub-alternative would modify the current closed area into two separate temporal periods, each with its own spatial extent, as shown in Chapter 3 Figure 14. From June 1 through September 30, the spatial extent would consist of the area within 40 nm of the coastline. During this time period, the remainder of the current closed area footprint would be designated a low-bycatch-risk area. From October 1 through May 31, the spatial extent would be reduced by including all areas east of the line connecting two points at 31° 00’ N. lat., 79° 32’ 46” W. long and 27° 52’ 55” N. lat., 79° 28’ 34” W. long. at the northern and southern boundaries, respectively, of the current closed area. All areas south of 27° 52’ 55” N. lat. within the current closed area would remain the same relative to No Action sub-alternative. As with the June through September area, from October through May, the remainder of the current closed area footprint would be designated a low-bycatch-risk area.

Ecological Impacts on Target Species

The ecological impacts of Sub-Alternative A3e on target species catch is expected to be neutral. The target species are quota managed species, and this sub-alternative would not affect the overall U.S. quotas for swordfish, yellowfin tuna, or bigeye tuna, which prevent overfishing, are based on the best scientific information available, and are consistent with the ICCAT-recommended TACs and quotas.

Ecological Impacts on Bycatch Species Modeled by HMS PRiSM

Table 5.73 lists the individual metric scores for this sub-alternative for each bycatch species. Based on the overall metric score ranking for the modeled bycatch species, this sub-alternative improved the overall metric score compared to the No Action sub-alternative. The metric scores indicate that the sub-alternative would be most effective at protecting leatherback sea turtles and shortfin mako sharks. Protections of leatherback sea turtles and shortfin mako sharks are higher than the status quo sub-alternative (leatherback sea turtle score of 22 compared to 21; shortfin mako shark score of 18 compared to 11). In contrast, the total metric scores for billfish species (seven) and loggerhead sea turtles (zero) are relatively low out of a possible total of 48. The billfish species total metric score is lower than the status quo sub-alternative (7 compared to 10) and the loggerhead sea turtle total metric score is equal to the status quo sub-alternative (both scores are zero). Due to the increased scores for leatherback sea turtles and shortfin mako sharks, this sub-alternative had a slightly higher overall metric score than the No Action sub-alternative (47 compared to 43). In addition, the scope was 34 percent smaller compared to that of the No Action sub-alternative because for all months, fishing would be allowed in parts of the closed area. Sub-Alternative A3e would likely have short and long-term minor beneficial indirect ecological impacts for the bycatch species.

Table 5.73. Sub-Alternative A3e metric scores* for modeled species

Species	Metric 1	Metric 2	Metric 3	Metric 4	Total
Leatherback Sea Turtle	3	4	5	10	22
Shortfin Mako Shark	5	3	4	6	18
Billfish Species	7	0	0	0	7
Loggerhead Sea Turtle	0	0	0	0	0
Overall Metric Score					47

*For all sub-alternatives, the highest score possible for a single metric and species is 12. The highest possible total metric score for a species is 48. The highest possible overall metric score is 192.

Underlying questions:
Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
Metric 2: Does the spatial management area protect the most at-risk areas?
Metric 3: What percent of total high-bycatch-risk area across the whole fishery domain does the spatial management area protect?
Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Ecological Impacts on Other Bycatch and Incidental Species

Under Sub-Alternative A3e, effort in pelagic longline fishery is unlikely to increase and, if recent trends continue, could decrease. Thus, fishing impacts to other bycatch and incidental species of concern such as bluefin tuna, longfin mako shark, oceanic whitetip shark, scalloped hammerhead shark, dusky shark, or sandbar shark are unlikely to change and neutral indirect ecological impacts are expected. Further, the IBQ Program has been successful in reducing the incidental catch of bluefin tuna (NOAA Fisheries 2019, National Academies 2021).

Social and Economic Impacts

Methods

Sub-alternative-specific effort estimate: For this sub-alternative from June through September, the entire reference area can be divided into three areas: Sub-Alternative A3e Jun-Sep, the area inside the current East Florida Coast closed area that is outside Sub-Alternative A3e Jun-Sep (herein referred to as "Sub-Alternative A3e Jun-Sep*"), and the reference area outside the current East Florida Coast closed area (Figure 5.9). For October through May, the areas would be Sub-Alternative A3e Oct-May, the area inside the current East Florida Coast closed area that is outside Sub-Alternative A3e Oct-May (herein referred to as "Sub-Alternative A3e Oct-May*"), and the reference area outside the current East Florida Coast closed area (Figure 5.10). For June through September, the percent of the total number of hooks deployed each year from 1995 through 2000 in the reference area that occurred in Sub-Alternative A3e Jun-Sep and Sub-Alternative A3e Jun-Sep* was averaged across years. NOAA Fisheries then assumed that all effort inside Sub-Alternative A3e Jun-Sep would shift into Sub-Alternative A3e Jun-Sep* because under this sub-alternative fishing is not allowed inside Sub-Alternative A3e Jun-Sep (0 percent of hooks), but is allowed inside Sub-Alternative A3e Jun-Sep*. We subtracted that percent (36 percent) from 100 percent to estimate a percent of hooks that occurred in the reference area outside the current East Florida Coast closed area. The analysis for the temporal and spatial extent of Sub-Alternative A3e Oct-May followed the same method described for Sub-Alternative A3e Jun-Sep. The percent of hooks inside Sub-Alternative A3e Oct-May* was 29 percent. Next, we multiplied the percentages by the average monthly number of hooks inside the reference area from 2016 through 2020 to calculate the estimated number of hooks each month that occurred in the Sub-Alternative A3e Jun-Sep*, Sub-Alternative A3e Oct-May*, and inside the reference area outside the current East Florida Coast closed area.

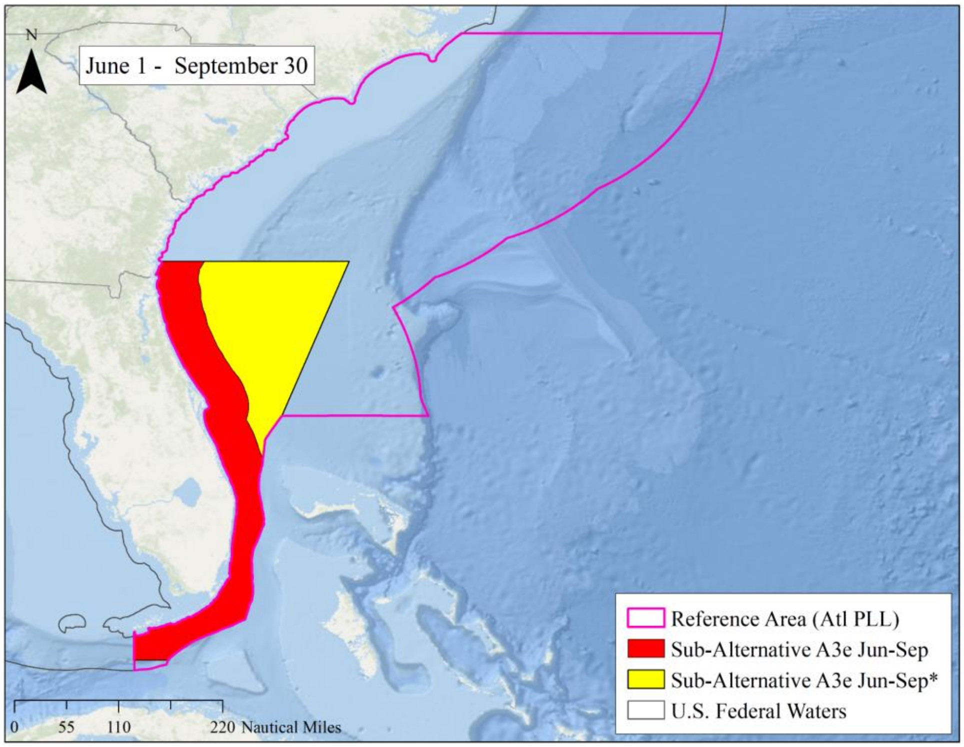

Figure 5.9. Areas defined by Sub-Alternative A3e Jun-Sep and Sub-Alternative A3e Jun-Sep* within the Atlantic reference area.

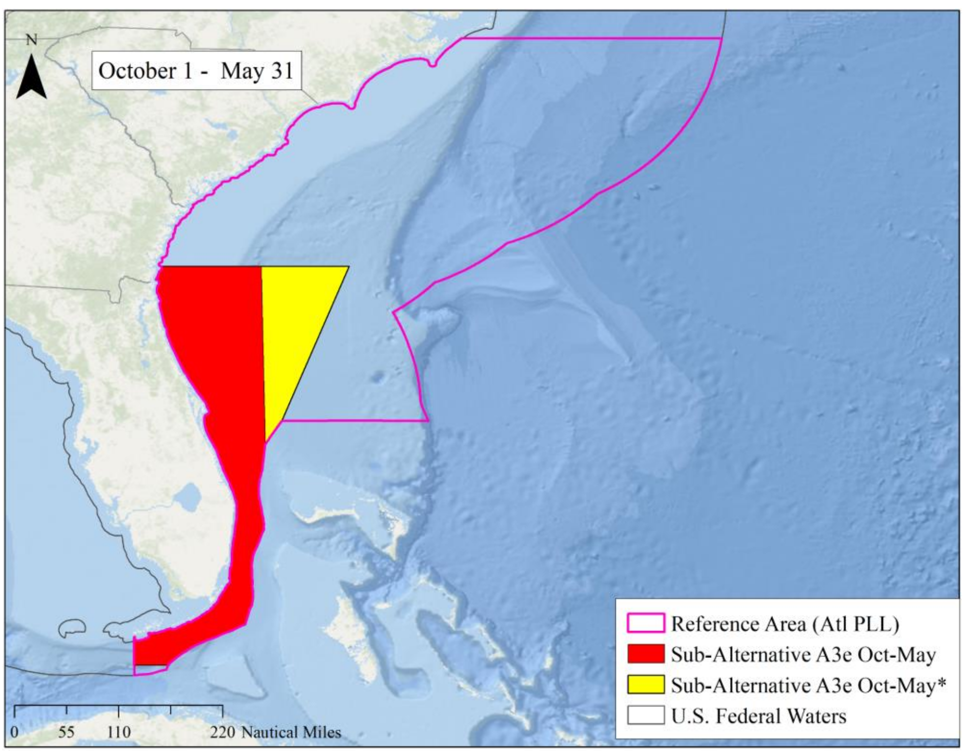

Figure 5.10. Areas defined by Sub-Alternative A3e Oct-May and Sub-Alternative A3e Oct-May* within the Atlantic reference area.

Sub-alternative-specific CPUE estimate: We averaged species-specific CPUEs across years within Sub-Alternative A3e Jun-Sep* and within the reference area outside the current East Florida Coast closed area. These two values generated the ratio for each species. The ratio was then multiplied by the average monthly (from June through September) CPUE outside the current East Florida Coast closed area within the reference area from 2011 through 2020 to calculate an estimated current CPUE inside Sub-Alternative A3e Jun-Sep*. Following the same methods described above, separate CPUE ratios and estimated current CPUEs inside Sub-Alternative A3e Oct-May* were calculated using logbook data from 1995 through 2000 and from 2011 through 2020 for the months of October through May. These steps provided a separate monthly CPUE for each species inside and outside the different spatial management areas for a recent time period.

Estimated Impacts

Of the estimated average annual total number of hooks in the reference area (907,142), NOAA Fisheries estimated that 282,614 hooks would be deployed within areas Sub-Alternative A3e Jun-Sep* and Sub-Alternative A3e Oct-May* (only areas inside the current East Florida Coast closed area where fishing would be allowed for part of the year) annually (31 percent of total hooks), while 624,528 hooks (would be deployed in the reference area outside the current East Florida Coast closed area (69 percent of the total hooks; Table 5.74). CPUE estimates (Table 5.75, Table 5.76, and Table 5.77), for swordfish, yellowfin tuna, and bigeye tuna inside Sub-Alternative A3e Jun-Sep*, inside Sub-Alternative A3e Oct-May*, and outside the current closed area by month are variable. Most notable was the greater CPUEs for swordfish occurred inside Sub-Alternative A3e Oct-May* in October and November, whereas, the greater CPUEs for swordfish inside Sub-Alternative A3e Jun-Sep* occurred in August and September. For swordfish CPUEs outside the current East Florida Coast closed area, the smallest values occurred in February, March, and April. Under this sub-alternative, 10,721 swordfish would be caught in the reference area analyzed (Table 5.78), which is almost 500 more fish compared to the No Action sub-alternative. Estimated yellowfin (2,066) and bigeye tuna (1,694) catch decreased in the reference area by approximately 200 and 300 fish, respectively, relative to the No Action sub-alternative.

Table 5.74. Average number of monthly hooks and percentage of hooks inside Sub-Alternative A3e Jun-Sep or Sub-Alternative A3e Oct-May ("Inside A3e"), Sub-Alternative A3e Jun-Sep* or Sub-Alternative A3e Oct-May* ("Inside A3e*"), or outside (but in the reference area) the current East Florida Coast closed area (2016-2020); Sub-Alternative A3e

Month	Inside A3e	Inside A3e*	Outside
January	0 (0%)	22,284 (29%)	54,207 (71%)
February	0 (0%)	12,287 (29%)	29,890 (71%)
March	0 (0%)	19,487 (29%)	47,403 (71%)

April	0 (0%)	26,166 (29%)	63,650 (71%)
May	0 (0%)	65,429 (29%)	159,158 (71%)
June	0 (0%)	36,778 (36%)	64,270 (64%)
July	0 (0%)	20,860 (36%)	36,453 (64%)
August	0 (0%)	20,833 (36%)	36,405 (64%)
September	0 (0%)	13,408 (36%)	23,431 (64%)
October	0 (0%)	9,165 (29%)	22,293 (71%)
November	0 (0%)	16,276 (29%)	39,591 (71%)
December	0 (0%)	19,641 (29%)	47,778 (71%)

Table 5.75. Average monthly swordfish CPUE (per 1,000 hooks), inside Sub-Alternative A3e Jun-Sep or Sub-Alternative A3e Oct-May ("Inside A3e"), inside Sub-Alternative A3e Jun-Sep* or Sub-Alternative A3e Oct-May* ("Inside A3e*"), or outside (but in the reference area) the current East Florida Coast closed area (2011-2020); Sub-Alternative A3e

Month	Inside A3e	Inside A3e*	Outside
January	0.00	14.73	12.13
February	0.00	6.82	5.61
March	0.00	7.30	6.01
April	0.00	7.43	6.12
May	0.00	13.72	11.30
June	0.00	9.47	9.52
July	0.00	9.91	9.96
August	0.00	12.05	12.12
September	0.00	15.48	15.56
October	0.00	23.45	19.31
November	0.00	25.90	21.33
December	0.00	18.16	14.95

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.76. Average monthly yellowfin tuna CPUE (per 1,000 hooks), inside Sub-Alternative A3e Jun-Sep or Sub-Alternative A3e Oct-May ("Inside A3e"), inside Sub-Alternative A3e Jun-Sep* or Sub-Alternative A3e Oct-May* ("Inside A3e*"), or outside (but in the reference area) the current East Florida Coast closed area (2011-2020); Sub-Alternative A3e

Month	Inside A3e	Inside A3e*	Outside
January	0.00	2.85	4.34
February	0.00	3.65	5.55
March	0.00	2.11	3.21
April	0.00	1.06	1.61
May	0.00	0.36	0.54
June	0.00	1.79	2.20
July	0.00	2.89	3.56
August	0.00	2.71	3.34
September	0.00	3.08	3.79
October	0.00	2.03	3.09
November	0.00	1.85	2.82
December	0.00	2.04	3.10

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.77. Average monthly bigeye tuna CPUE (per 1,000 hooks), inside Sub-Alternative A3e Jun-Sep or Sub-Alternative A3e Oct-May ("Inside A3e"), inside Sub-Alternative A3e Jun-Sep* or Sub-Alternative A3e Oct-May* ("Inside A3e*"), or outside (but in the reference area) the current East Florida Coast closed area (2011-2020); Sub-Alternative A3e

Month	Inside A3e	Inside A3e*	Outside
January	0.00	1.28	3.18
February	0.00	0.91	2.25
March	0.00	0.68	1.69

April	0.00	0.56	1.39
May	0.00	0.35	0.87
June	0.00	0.79	1.57
July	0.00	1.77	3.54
August	0.00	2.22	4.43
September	0.00	2.45	4.91
October	0.00	2.12	5.25
November	0.00	0.99	2.45
December	0.00	1.13	2.80

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.78. Estimated annual numbers of target species caught inside the current East Florida Coast closed area (Sub-Alternative A3e Jun-Sep + Sub-Alternative A3e Jun-Sep* + Sub-Alternative A3e Oct-May + Sub-Alternative A3e Oct-May*) or outside (but in the reference area) the current East Florida Coast closed area; Sub-Alternative A3e

	Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
Inside	3,653	513	293	4,459
Outside	7,068	1,553	1,401	10,022
Total	10,721	2,066	1,694	14,481

We estimated revenue for Sub-Alternative A3e by following the social and economic calculations described in the Sub-Alternative A3a. Table 5.79 shows the estimated annual revenue for each target species and the combined target species revenue is $4,187,669 (2021 real dollars). This sub-alternative would generate slightly more revenue from swordfish, but less from yellowfin tuna and bigeye tuna relative to the No Action sub-alternative. When combined the total revenue difference between this sub-alternative and the No Action sub-alternative is -$8,762 resulting in minor negative direct economic impacts in the short- and long-term, which could also lead to negative direct social impacts. However, fishermen are unlikely to fish in areas with lower catch rates, so reductions in revenue may not be realized. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Since fishing effort is not expected to change, large changes to landings are not expected either. Thus, indirect impacts to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be neutral. From 2016 through 2020, 96 dealers purchased swordfish, yellowfin tuna, or bigeye tuna products in North Carolina, South Carolina, Georgia, and the east coast of Florida, which are the states in the vicinity of the East Florida Coast closed area. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

This sub-alternative would shift the northeastern boundary of the closed area to the west, potentially opening fishing opportunities closer to shore, so vessel transit times and distances may decrease. Thus, reduced fuel costs for fishermen could provide minor beneficial social and economic impacts and reduce greenhouse gas emissions.

Table 5.79. Estimated annual revenue of target species caught in the reference area (2021 real dollars); Sub-Alternative A3e

Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
$3,212,440	$542,056	$433,173	$4,187,669

5.1.3.6 Comparison of Alternative Suite A3 Sub-Alternatives

There were notable differences among the Suite A3 Sub-Alternatives, pertaining to spatial and temporal modifications to the current East Florida Coast closed area. The Sub-Alternative A3a (No Action) ranked the lowest for the amount of bycatch protection of modeled species, based on the overall metric scores. In other words, the spatial and temporal extent of the current closed area would provide the least protection to areas where potential bycatch interaction is the highest. Sub-Alternative A3d, the Preferred Sub-Alternative and Sub-Alternative A3b had the highest overall metric scores, followed by Sub-Alternatives A3e, A3c, and A3a, descending score order (Table 5.80).

The Sub-Alternative A3a had the highest scope of zero because the current closed area is closed year-round and any sub-alternatives where fishing would be allowed would result in a smaller scope than the No Action sub-alternative. After the Sub-Alternative A3a, scope in decreasing order went A3b, A3d, A3e, and lastly A3c.

Under all of the A3 sub-alternatives the species with the highest metric total scores was leatherback sea turtle, followed by shortfin mako shark and billfish species (Table 5.80). In contrast, the metric total scores for loggerhead sea turtles were zero for all sub-alternatives. The Preferred Sub-Alternative A3d has the highest metric total score for leatherback sea turtle and shortfin mako shark, though, not the highest for billfish species While Sub-Alternative A3b had an equal overall metric score to the preferred sub-alternative (A3d) and scored higher for billfish protection, the difference was not large. Furthermore, Alternative A3b would designate low-bycatch-risk area in places just over 40 nm from shore during certain times of the year. Depending on the data collection program matched to the East Florida Coast low-bycatch-risk area, gear conflicts could occur, including with recreational fishermen.

Table 5.80. Total Metric Scores by species and scope for Suite A3 Sub-Alternative

Species	A3a - No Action	A3b	A3c	A3d - Preferred	A3e
Leatherback Sea Turtle	21	23	21	**23**	22
Shortfin Mako Shark	12	16	17	**18**	18
Billfish Species	10	10	6	**8**	7
Loggerhead Sea Turtle	0	0	0	**0**	0
Overall Metric Score	43	49	44	**49**	47
Scope* compared to No Action sub-alternative	0 (no change)	-74,547	-171,600	**-95,953**	-123,606

*Scope: For the purpose of this DEIS, a measure of the spatial and temporal extent of a particular management area used to compare options and alternatives: square nautical miles of area x the number of closure months.

Table 5.81 and Table 5.82 provide high-level descriptions of the sub-alternatives, the estimated target species catch, and revenue from those species. The differences among the A3 sub-alternatives with respect to estimated target species catch and revenue were relatively small.

Sub-Alternative A3c had the highest estimated swordfish catch, followed by Sub-Alternative A3d (the Preferred Sub-Alternative), Sub-Alternative A3e, Sub-Alternative A3b, and Sub-Alternative A3a (No Action). The No Action sub-alternative had the highest estimated yellowfin tuna and bigeye tuna catch, whereas the differences among the catch estimates for the other Sub-Alternatives were small.

Table 5.81. Comparison of Suite A3 Sub-Alternatives and total estimated target catch (numbers of fish) by species.

	Summary Description	Swordfish	Yellowfin tuna	Bigeye tuna
A3a - No Action	*Spatial*: Status quo *Temporal*: Status quo (January-December)	10,261	2,269	2,059
A3b	*Spatial 1*: Reduce to west of 40 nm from coastline *Temporal 1*: December-April *Spatial 2*: Status quo *Temporal 2:* May-November	10,294	2,087	1,912
A3c	*Spatial*: Reduce to west of 40 nm from coastline north of	10,835	2,024	1,697

	28° 17' 24" N *Temporal*: January-December			
A3d - Preferred	***Spatial*: Reduce to west of ~79° 30' W** ***Temporal*: January-December**	**10,822**	**2,101**	**1,722**
A3e	*Spatial 1*: Reduce to west of 40 nm from coastline *Temporal 1*: June-September *Spatial 2*: Reduce to west of ~79° 30' W *Temporal 2*: October-May	10,721	2,066	1,694

Preferred Sub-Alternative A3d had the highest estimated revenue, followed by Sub-Alternative A3c, Sub-Alternative A3a, and Sub-Alternative A3e (Table 5.82). Sub-Alternative A3b had the lowest estimated revenue compared to all other A3 Sub-Alternatives.

Table 5.82. Comparison of total estimated revenue and net difference from the No Action of Suite A3 Sub-Alternatives (2021 real dollars)

A3a - No Action	A3b (net difference)	A3c (net difference)	A3d - Preferred (net difference)	A3e (net difference)
$4,196,431	$4,120,978 (-$75,453)	4,211,576 (+$15,145)	**4,234,276 (+$37,845)**	$4,187,669 (-$8,762)

Sub-Alternative A3e has a lower estimated target catch, the second highest overall metric score, and a large decrease in scope relative to the No Action sub-alternative. Although Sub-Alternative A3a (No Action) protects the most area across the year (highest scope), its low overall metric score indicates that the area could continue to protect areas where bycatch interaction is the highest, while providing some areas for fishermen to fish. The area defined by Sub-Alternative A3b would be smaller than the No Action sub-alternative, while more efficiently protecting areas of high bycatch interaction. However, the sub-alternative did not result in estimated target species catch and revenue greater than the No Action sub-alternative. Sub-Alternative A3c had larger estimated revenue than the No Action sub-alternative, but the overall metric score was virtually the same as that of the No Action sub-alternative.

5.1.3.7 Conclusions - Alternative Suite A3

The Preferred Sub-Alternative A3d, provides the best balance between the socio-economic and ecological impacts (bycatch conservation) because it was the sub-alternative with the highest estimated revenue and largest overall metric score.

The Preferred Sub-Alternative A3d would provide notably increased protection for shortfin mako sharks and slightly improved protection for leatherback sea turtle compared to the No Action sub-alternative because the areas where bycatch interaction was expected to be the highest remained protected year-round from the pelagic longline fishery despite the reduction in scope (total area protected by the closure multiplied by the number of closure months). Although the Preferred Sub-Alternative A3d would have a larger estimated swordfish catch than the No Action sub-alternative, it would have less yellowfin or bigeye tuna catch. It should be noted that the actual target catch associated with the preferred sub-alternative would depend upon many factors including the amount of commercial fishing allowed under the Data Collection Alternatives ("B" Alternatives) and whether the CPUE values used to estimate catch reflect future catch. The shape and location of the new area may provide commercial fishermen access to potentially productive areas that were previously closed. For example, the area defined by Sub-Alternative A3d assumed no fishing, but if combined with an alternative such as Alternative B4, there would be additional revenue for the fishery. Further, it is important to note that there is high variability in the catches of both the modeled bycatch species and the target species in the pelagic longline fishery due to the ecology of the species, and dynamic ocean conditions. The preferred sub-alternative provides the best balance between bycatch conservation and revenue for pelagic longline fishermen.

The only area where Preferred Sub-Alternative A3d did not score among the highest was the total billfish species metric score, though the difference was not large. The No Action Sub-Alternative A3a scored higher in billfish protection, but scored lower in every other metric. Sub-Alternative A3b scored higher in billfish protection with an overall metric score equal to that of the preferred sub-alternative, however, it scored lower in shortfin mako shark protection. Furthermore, Sub-Alternative A3b would designate low-bycatch-risk area in places just over 40 nm from shore during certain times of the year. Depending on the data collection program matched to the East Florida Coast low-bycatch-risk area, gear conflicts, including with recreational fishermen, could be higher with Sub-Alternative A3b than with the preferred sub-alternative. Recreational fishermen typically operate closer to shore than pelagic longline fishermen, although they also often travel distances greater than 40 nm from shore. If data collection programs are implemented in the low-bycatch-risk area that include pelagic longline fishing, conflict between drifting commercial gear and trolled recreational gear could occur. Preferred Sub-Alternative A3d avoids this problem by maintaining high-bycatch-risk area farther offshore, up to distances greater than 100 nm from shore. Section 5.4.6 contains more information on impacts to the offshore recreational fisheries.

5.1.4 Alternative Suite A4: DeSoto Canyon Spatial Management Area

General Methods

Ecological Impacts

Target Species: Descriptions of the ecological impact analysis methodologies are in the impacts discussion for each sub-alternative.

Bycatch species modeled by HMS PRiSM: The ecological impacts of each sub-alternative on bycatch species that were modeled by HMS PRiSM were based on metric scores (described in Chapters 2 and 3; see also Appendix 5) generated by HMS PRiSM. The metric scores are various ways of measuring the likelihood of the fishery interacting with bycatch species and can be interpreted as a measure of conservation. Four metrics were used:

- Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
- Metric 2: Does the spatial management area protect the most at-risk areas?
- Metric 3: What percent of total high-bycatch-risk area across the whole fishery domain does the spatial management area protect?
- Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Other bycatch and incidental species: Descriptions of the ecological impact analysis methodologies are in the impacts discussion for each sub-alternative.

Social and Economic Impacts

Although there are no recent catch data from within the current DeSoto Canyon closed area, we estimated potential target species catch under the Suite A4 Alternatives using the reference area method described in the introduction to Section 5.1. Each sub-alternative considers spatial and temporal changes to the current DeSoto Canyon closed area and we estimated target catch by multiplying effort (number of hooks) by CPUE (catch per 1,000 hooks) for each species.

Effort estimates: We estimated the number of hooks that would be deployed using the method described in the social and economic impacts section of each sub-alternative. In areas within the current closure, we used logbook data prior to implementation of the closure (1995 through 2000) to estimate proportional distribution of effort among the areas analyzed in each sub-alternative. The analysis applied those proportions to more recent logbook data from 2016 through 2020 to estimate expected effort levels. Because the number of hooks inside versus outside is based on a percent, it was assumed that the total number of hooks in the entire reference area across the DeSoto Canyon closed area sub-alternatives would remain the same, and the percentages inside versus outside would change for each sub-alternative. Note that this methodology is slightly modified in the Sub-Alternative A4d analysis, as described in Section 5.1.4.4, since the spatial modification would extend beyond the current closed area footprint.

CPUE estimates: Using pelagic longline logbook data from 1995 through 2000, we calculated species-specific CPUEs and averaged across years within the areas considered in each sub-alternative. We then calculated a ratio of each species' averaged CPUE inside the analyzed area with that outside the current closure but within the reference area. Next, we multiplied the ratio(s) by the average monthly CPUE outside the current DeSoto Canyon closed area within the reference area from 2011 through 2020 to calculate an estimated current CPUE inside each analyzed area. Note that this methodology is slightly modified in the Sub-Alternative A4d analysis, as described in Section 5.1.4.4, since the spatial modification would extend beyond the current closed area footprint.

Catch estimates: NOAA Fisheries estimated the monthly catch (expressed as numbers of fish) within each sub-alternative for each target species by multiplying the estimated monthly effort by the monthly CPUE in each analyzed area. The estimated monthly catch within the reference area outside the current DeSoto Canyon closed area was also calculated using the same approach. The sum of the estimated species-specific catch inside and outside the current DeSoto Canyon closed area across the entire reference area is the total estimated species-specific catch.

Note that it is difficult to predict fishing effort and CPUE given the number of factors that may influence each. Therefore, the data on fishing effort, CPUE, target species catch and revenue should be considered estimates that are intended primarily to compare among sub-alternatives and not provide precise predictions. Alterations in the spatial or temporal aspects of spatial management areas may result in changes in fishing behavior such as increases in fishing effort and catch that are not reflected in the estimated social and economic impacts.

5.1.4.1 Sub-Alternative A4a - No Action

This Sub-Alternative would maintain the current DeSoto Canyon closed area in effect with respect to its spatial and temporal extent, as shown in Chapter 3 Figure 15.

Ecological Impacts on Target Species

The ecological impacts of Sub-Alternative A4a on target species catch is expected to be neutral. The target species are quota-managed species, and this sub-alternative would not affect the overall U.S. quotas for swordfish, yellowfin tuna, or bigeye tuna, which prevent overfishing, are based on the best scientific information available, and are consistent with the ICCAT-recommended TACs and quotas.

Ecological Impacts on Bycatch Species Modeled by HMS PRiSM

The individual metric scores for this sub-alternative for each bycatch species are listed in Table 5.83. For example, for shortfin mako shark and billfish the Metric 1 score of 12 indicates that the probability of the fishery interacting with shortfin mako shark and billfish inside the area is higher than the probability of interacting outside of the closed area for each of the 12 months the closure (i.e., one point for each month). The total metric scores by species indicate that this sub-alternative would be most effective for the protection of billfish species, followed by leatherback sea turtle and shortfin mako shark.

The overall metric score for Sub-Alternative A4a is relatively high with a score of 65. Under this sub-alternative (No Action), recent interaction rates of these bycatch species would be maintained, resulting in neutral indirect ecological impacts.

Table 5.83. Sub-Alternative A4a metric scores* for modeled species

Species	Metric 1	Metric 2	Metric 3	Metric 4	Total
Leatherback Sea Turtle	2	4	8	7	21
Shortfin Mako Shark	12	3	3	2	20
Billfish Species	12	2	6	4	24
Overall Metric Score					65

*For all sub-alternatives, the highest score possible for a single metric and species is 12. The highest possible total metric score for a species is 48. The highest possible overall metric score is 144.
Underlying questions:
Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
Metric 2: Does the spatial management area protect the most at-risk areas?
Metric 3: What percent of total high-bycatch-risk area across the whole fishery domain does the spatial management area protect?
Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Ecological Impacts on Other Bycatch and Incidental Species

The Gulf of Mexico Rice's whale was listed as endangered under the ESA in 2019 (84 FR 15446; April 15, 2019) and is distributed in the northeastern Gulf of Mexico in and around the DeSoto Canyon spatial management area. The species was reviewed as the Gulf of Mexico Bryde's whale since, at the time, it was thought to be a sub-species of the Bryde's complex. However, it was later determined to be a separate species and renamed the Rice's whale. In 2021, NOAA Fisheries updated the taxonomy and common name and determined that the updated nomenclature does not alter the species' ESA endangered listing (86 FR 47022; August 23. 2021). To support the original ESA listing decision-making, the SEFSC prepared a status review technical memorandum in 2016 (NOAA Fisheries 2016). The status review identified a biologically important area for the species and provided a map with the area overlaying the current DeSoto Canyon closed area (Figure 5.11). The status review noted that the current Desoto Canyon closure covered 2/3 of Rice's whale biologically important area.

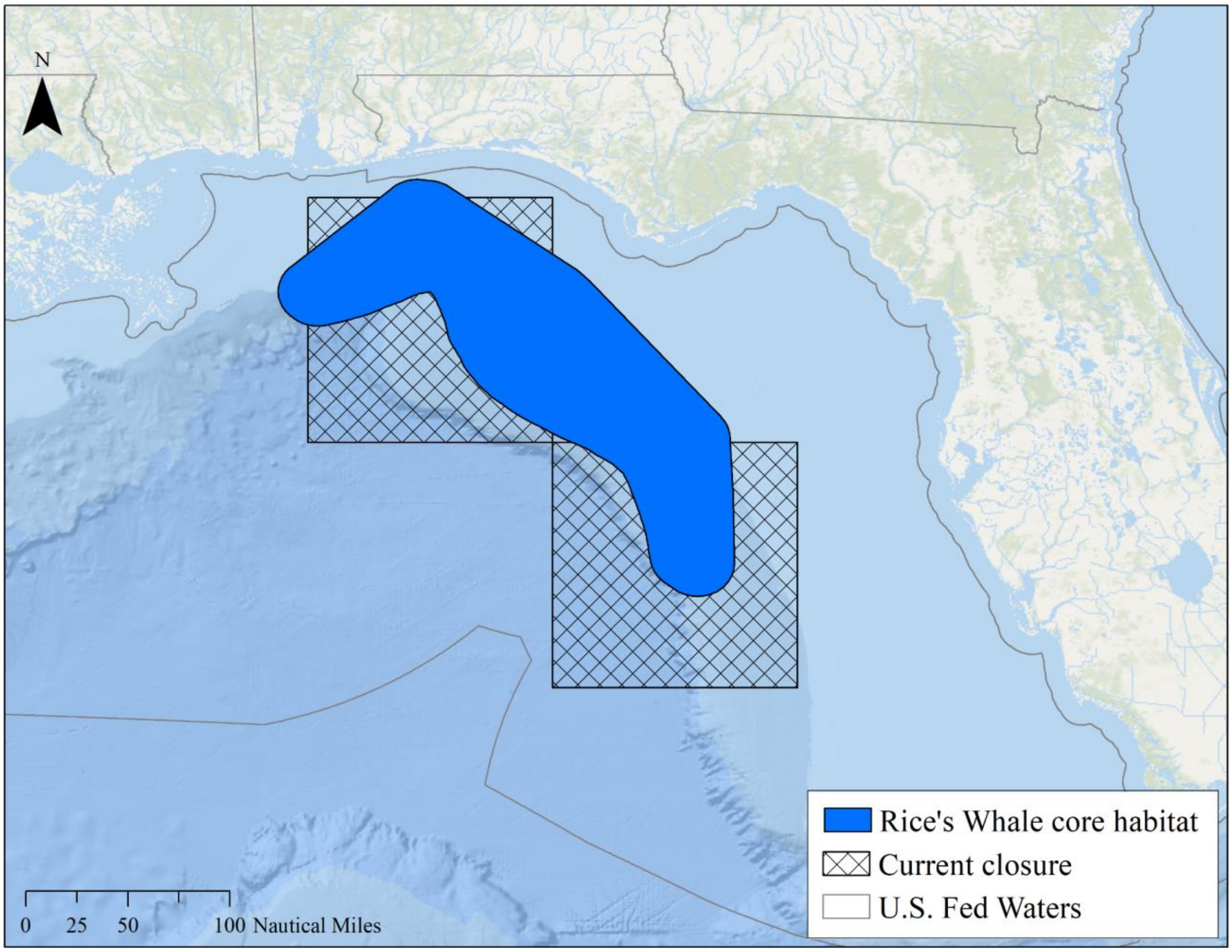

Figure 5.11. Gulf of Mexico Rice's whale biologically important area (blue) overlayed with the current DeSoto Canyon closed area (transparent cross-hatch). Source: NOAA 2016.

Since Sub-Alternative A4a would not alter the DeSoto Canyon spatial management area, indirect impacts in the short and long-term to Rice's whales would be neutral.

Under Sub-Alternative A4a, effort in pelagic longline fishery is unlikely to increase and, if recent trends continue, could decrease. Thus, fishing impacts to other bycatch and incidental species of concern such as bluefin tuna, oceanic whitetip shark, scalloped hammerhead shark, dusky shark, sandbar shark, or longfin mako shark are unlikely to change and neutral indirect ecological impacts are expected. Further, the IBQ Program has been successful in reducing the incidental catch of bluefin tuna (NOAA Fisheries 2019, National Academies 2021).

Social and Economic Impacts

Methods

Sub-Alternative-specific effort estimate: For Sub-Alternative A4a (the current DeSoto Canyon closed area), it was assumed that zero percent of the hooks occurred in the closed area, when the area was closed. Because the annual number of hooks in the reference area from 1995 through 2000 was greater than the annual number of hooks in recent years, NOAA Fisheries used the percentages from 1995 through 2000 but the actual number of hooks from 2016 through 2020 (similar to East Florida Coast closed area analysis). Specifically, the percentages inside (0 percent) and outside (100 percent) the closed area were multiplied by the average total number of hooks each month across years that occurred in the reference area to calculate the estimated number of hooks each month that occurred in Sub-Alternative A4a and inside the reference area outside the current DeSoto Canyon closed area.

Sub-alternative-specific CPUE estimate: We only calculated CPUE outside the current East Florida Coast closed area since the area inside would remain closed under Sub-Alternative A4a. Species-specific CPUEs inside the area were assumed to be zero.

Estimated Impacts

Table 5.84 shows the average number of monthly hooks and percentage of total hooks inside the current DeSoto Canyon closed area and outside the area within the reference area, on a monthly basis, from 2016 through 2020. Because fishing has not been allowed in the current DeSoto Canyon closed area we expect the total number of hooks deployed in that area for a given year to be zero, while 1,091,417 hooks were estimated in the reference area outside the current DeSoto Canyon closed area. Table 5.85, Table 5.86, and Table 5.87 show CPUEs for swordfish, yellowfin tuna and bigeye tuna, respectively, inside and outside the current DeSoto Canyon closed area for 2011 through 2020. Table 5.88 below shows the estimated numbers of swordfish, yellowfin tuna, and bigeye tuna target catch inside the reference area within the current DeSoto Canyon closed area compared to outside (within the reference area) for this sub-alternative. The estimated catch of all target species was zero inside the closed area, whereas estimated target species outside the closed area, but inside the reference area was 3,346 swordfish, 8,409 yellowfin tuna, and 118 bigeye tuna. As noted above we compared the estimated catch for the target species inside the reference area, using the method described above, to the actual average catch from 2016 through 2020 inside the reference area, based on logbook data. The average annual (2016-2020) number of fish caught from the reference area was 2,860 swordfish, 8,582 yellowfin tuna, and 147 bigeye tuna.

Table 5.84. Average number of monthly hooks and percentage of hooks inside or outside (but in the reference area) the current DeSoto Canyon closed area (2016-2020); Sub-Alternative A4a

Month	Inside	Outside
January	0 (0%)	89,092 (100%)
February	0 (0%)	72,240 (100%)
March	0 (0%)	83,843 (100%)

April	0 (0%)	54,989 (100%)
May	0 (0%)	75,962 (100%)
June	0 (0%)	118,251 (100%)
July	0 (0%)	146,174 (100%)
August	0 (0%)	101,938 (100%)
September	0 (0%)	79,887 (100%)
October	0 (0%)	81,608 (100%)
November	0 (0%)	102,070 (100%)
December	0 (0%)	85,363 (100%)

Table 5.85. Average monthly swordfish CPUE (per 1,000 hooks) inside or outside (but in the reference area) the current DeSoto Canyon closed area (2011-2020); Sub-Alternative A4a

Month	Inside	Outside
January	0.00	3.98
February	0.00	4.95
March	0.00	6.24
April	0.00	6.76
May	0.00	2.59
June	0.00	1.74
July	0.00	1.36
August	0.00	1.18
September	0.00	1.79
October	0.00	2.82
November	0.00	3.65
December	0.00	3.18

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.86. Average monthly yellowfin tuna CPUE (per 1,000 hooks) inside or outside (but in the reference area) the current DeSoto Canyon closed area (2011-2020); Sub-Alternative A4a

Month	Inside	Outside
January	0.00	8.91
February	0.00	4.48
March	0.00	3.88
April	0.00	4.30
May	0.00	8.62
June	0.00	9.57
July	0.00	8.80
August	0.00	8.45
September	0.00	7.33
October	0.00	8.47
November	0.00	7.52
December	0.00	8.79

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.87. Average monthly bigeye tuna CPUE (per 1,000 hooks) inside or outside (but in the reference area) the current DeSoto Canyon closed area (2011-2020); Sub-Alternative A4a

Month	Inside	Outside
January	0.00	0.11
February	0.00	0.17
March	0.00	0.10
April	0.00	0.05
May	0.00	0.04
June	0.00	0.02
July	0.00	0.03

August	0.00	0.04
September	0.00	0.11
October	0.00	0.26
November	0.00	0.22
December	0.00	0.21

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.88. Estimated annual numbers of target species caught inside or outside (but in the reference area) the current DeSoto Canyon closed area; Sub-Alternative A4a

	Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
Inside	0	0	0	0
Outside	3,346	8,409	118	11,873
Total	3,346	8,409	118	11,873

Table 5.88 presents the target species catch estimates used to estimate the effect of the sub-alternative on commercial pelagic longline revenue. We first calculated the average ex-vessel price per fish in pounds dressed weight (lb dw) for the Atlantic using average price per lb dw from 2016 through 2020. We then multiplied the average price per lb dw (in 2021 real dollars - swordfish: $4.62; yellowfin tuna: $4.51; bigeye tuna: $5.89) by the average lb dw of one fish for the Atlantic to estimate the average price per fish. Lastly, we multiplied the average price per fish by the total species catch estimates in the reference area. These steps were conducted for three of the target species: swordfish, yellowfin tuna, and bigeye tuna.

Table 5.89 shows the estimated annual revenue for each target species and the combined target species revenue is $4,618,912 (2021 real dollars). This sub-alternative would maintain the recent fishing effort, catch levels, and revenues, resulting in direct neutral social and economic impacts on pelagic longline fishermen. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Since fishing effort is not expected to change, changes to landings are not expected either. Thus, indirect impacts to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be neutral. From 2016 through 2020, 44 dealers purchased swordfish, yellowfin tuna, or bigeye tuna products in Texas, Louisiana, Mississippi, Alabama, and the west coast of Florida, which are the states in the vicinity of the DeSoto Canyon closed area. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

This sub-alternative would not alter the footprint of the current closed area, so vessel transit times and distances are unlikely to change. Thus, no impacts to fuel costs or greenhouse gas emissions are expected.

Table 5.89. Estimated annual revenue of target species caught in the reference area (2021 real dollars); Sub-Alternative A4a

Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
$1,398,661	$3,157,748	$62,503	$4,618,912

5.1.4.2 Sub-Alternative A4b

This sub-alternative would maintain the current spatial extent of the DeSoto Canyon while changing the timing of the closed areas, as shown in Chapter 3 Figure 16. Specifically, both boxes would remain closed from April 1 through October 31 instead of all year. Additionally, from November through March, the top northwest box would be closed while the bottom southeast box would be designated a low-bycatch-risk area.

Ecological Impacts on Target Species

The ecological impacts of Sub-Alternative A4b on target species catch is expected to be neutral. The target species are quota-managed species, and this sub-alternative would not affect the overall U.S. quotas for swordfish, yellowfin tuna, or bigeye tuna, which prevent overfishing, are based on the best scientific information available, and are consistent with the ICCAT-recommended TACs and quotas.

Ecological Impacts on Bycatch Species Modeled by HMS PRiSM

Table 5.90 lists the individual metric scores for this sub-alternative for each bycatch species. Based on the overall metric score ranking for the modeled bycatch species, this sub-alternative reduced the overall metric score compared to the No Action sub-alternative. Protections of leatherback sea turtles and shortfin mako sharks are equal to the status quo sub-alternative (leatherback sea turtle scores are 21 for both; shortfin mako shark scores are 20 for both). In contrast, the total metric scores for billfish species is lower than the status quo sub-alternative (21 compared to 24). Due to the decreased score for billfish species, this sub-alternative had a slightly lower overall metric score than the No Action sub-alternative (62 compared to 65). In addition, the scope was 21 percent smaller compared to that of the No Action sub-alternative because for five months, fishing would be allowed in parts of the closed area. Sub-Alternative A4b would likely have short and long-term minor negative indirect ecological impacts for the bycatch species.

Table 5.90. Sub-Alternative A4b metric scores* for modeled species

Species	Metric 1	Metric 2	Metric 3	Metric 4	Total
Leatherback Sea Turtle	2	4	8	7	21
Shortfin Mako Shark	12	3	3	2	20
Billfish Species	9	2	6	4	21
Overall Metric Score					62

*For all sub-alternatives, the highest score possible for a single metric and species is 12. The highest possible total metric score for a species is 48. The highest possible overall metric score is 144.
Underlying questions:
Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
Metric 2: Does the spatial management area protect the most at-risk areas?
Metric 3: What percent of total high-bycatch-risk area across whole fishery domain does the spatial management area protect?
Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Ecological Impacts on Other Bycatch and Incidental Species

Since Sub-Alternative A4b would reduce the amount of time Desoto Canyon spatial management area is closed to pelagic longline fishing, protections for Rice's whales would be reduced. Background information on Rice's whale is provided in the Ecological Impacts on Other Bycatch and Incidental Species section of Sub-Alternative A4a.

Under Sub-Alternative A4b, effort in pelagic longline fishery is unlikely to increase and, if recent trends continue, could decrease. Thus, fishing impacts to other bycatch and incidental species of concern such as bluefin tuna, oceanic whitetip shark, scalloped hammerhead shark, dusky shark, sandbar shark, or longfin mako shark are unlikely to change and neutral indirect ecological impacts are expected. Further, the IBQ Program has been successful in reducing the incidental catch of bluefin tuna (NOAA Fisheries 2019, National Academies 2021). Specifically for Rice's whales, this sub-alternative would reduce protections of the core habitat and would thus have minor indirect adverse ecological impacts on the species.

Social and Economic Impacts

Methods

Sub-alternative-specific effort estimate: For this sub-alternative from November through March, the entire reference area can be divided into three areas: Sub-Alternative A4b Nov-Mar (which is inside the current DeSoto Canyon closed area), the area inside the current DeSoto Canyon closed area that is outside Sub-Alternative A4b Nov-Mar (herein referred to as "Sub-Alternative A4b Nov-Mar*"), and the reference area outside the current DeSoto

Canyon closed area (Figure 5.12). Using pelagic longline logbook data from 1995 through 2000, the percent of the total number of hooks in the reference area deployed each year in Sub-Alternative A4b Nov-Mar and Sub-Alternative A4b Nov-Mar* was averaged across years. NOAA Fisheries then assumed that all effort inside Sub-Alternative A4b Nov-Mar would shift into Sub-Alternative A4b Nov-Mar* because under this Sub-Alternative fishing is not allowed inside Sub-Alternative A4b Nov-Mar (zero percent of hooks), but is allowed inside Sub-Alternative A4b Nov-Mar*. We subtracted that percent (7 percent) from 100 percent to estimate a percent of hooks that occurred in the reference area outside the current DeSoto Canyon closed area from November through March. Next, we multiplied the percentages by the average monthly number of hooks inside the reference area from 2016 through 2020 to calculate the estimated number of hooks each month that occurred in Sub-Alternative A4b Nov-Mar* and inside the reference area outside the current DeSoto Canyon closed area. For April through October (Figure 5.13), because no fishing was allowed inside the current DeSoto Canyon closed area, similar to Sub-Alternative A4a, 100 percent of the effort was assumed to occur outside the current DeSoto Canyon closed area. Meaning, the same estimated number of hooks outside the current DeSoto Canyon closed area inside the reference area from April through October was the same for this sub-alternative and Sub-Alternative A4a.

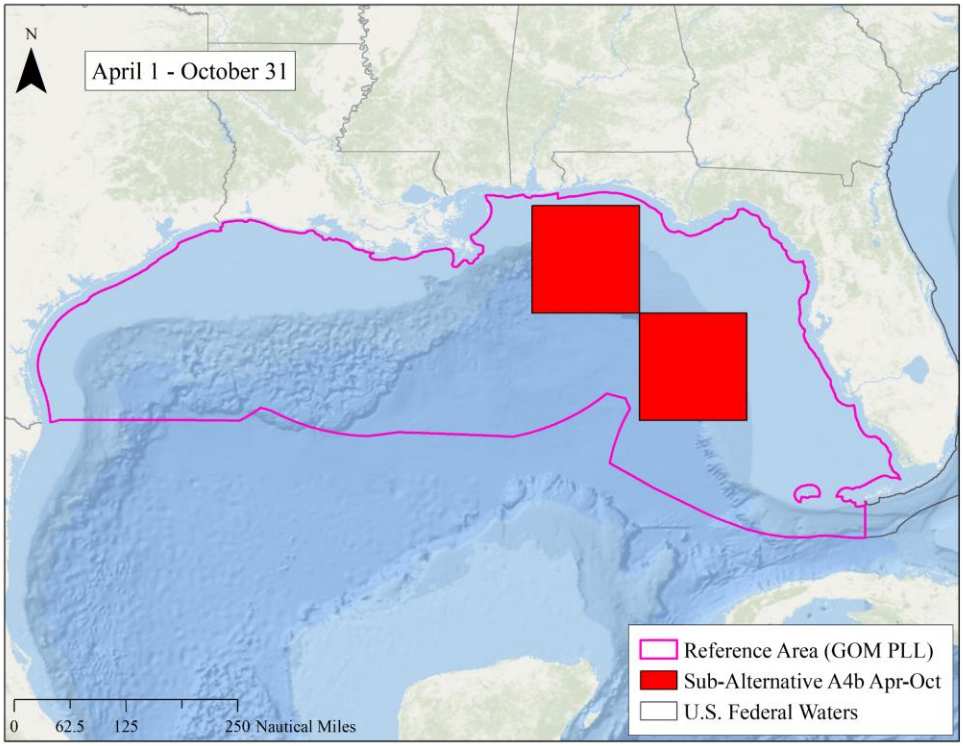

Figure 5.12. Areas defined by Sub-Alternative A4b Apr-Oct within the Gulf of Mexico reference area.

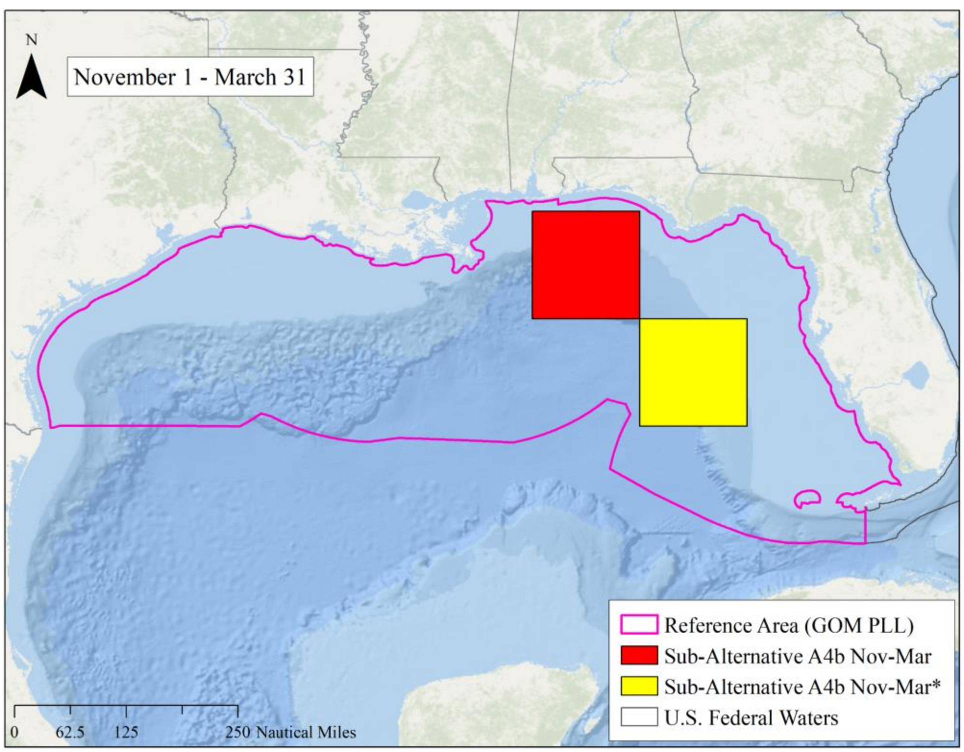

Figure 5.13. Areas defined by Sub-Alternative A4b Nov-Mar and Sub-Alternative A4b Nov-Mar* within the Gulf of Mexico reference area.

Sub-alternative-specific CPUE estimate: We averaged species-specific CPUEs across years within the Sub-Alternative A4b Nov-Mar* and within the reference area outside the current DeSoto Canyon closed area from November through March. These two values generated the ratio for each species representing November through March. The ratio was then multiplied by the average monthly (from November through March) CPUE outside the current DeSoto Canyon closed area within the reference area from 2011 through 2020 to calculate an estimated current CPUE inside Sub-Alternative A4b Nov-Mar*. For April through October, a separate ratio was calculated inside Sub-Alternative A4b Apr-Oct and outside the current DeSoto Canyon closed area and then multiplied by the average monthly (from April through October) CPUE outside the closed area within the reference area from 2011 through 2020 to calculate an estimated current CPUE inside Sub-Alternative A4b Apr-Oct. However, similar to Sub-Alternative A4a, the effort in Sub-Alternative A4b Apr-Oct was zero percent, therefore, current species-specific CPUEs were assumed to be zero. These steps provided a separate monthly CPUE for each species inside and outside the closed area for a recent time period.

__Estimated Impacts__

Of the estimated average annual total number of hooks in the reference area (1,091,417), NOAA Fisheries estimated that 29,627 hooks would be deployed within areas Sub-Alternative A4b Nov-Mar* (only area inside current DeSoto Canyon closed area where fishing would be allowed for part of the year) annually (7 percent of total hooks), while 1,061,790 hooks (would be deployed in the reference area outside the current DeSoto Canyon closed area (93 percent of the total hooks; Table 5.91)). CPUE estimates (Table 5.92, Table 5.93, and Table 5.94), for swordfish, yellowfin tuna, and bigeye tuna inside Sub-Alternative A4b Nov-Mar* and outside the current closed area by month are variable. Most notable was the greater CPUEs for swordfish occurred inside Sub-Alternative A4b Nov-Mar* in February and March, whereas, the greater CPUEs for swordfish outside the DeSoto Canyon closed area were in March and April. Under this Sub-Alternative, 3,598 swordfish would be caught in the reference area analyzed (Table 5.95), which is 200 more than the No Action sub-alternative. Estimated yellowfin tuna catch (8,233) decreased in the reference area, while bigeye tuna catch (116) is similar to the No Action sub-alternative.

Table 5.91. Average number of monthly hooks and percentage of hooks inside Sub-Alternative A4b Nov-Mar or Sub-Alternative A4b Apr-Oct ("Inside A4b"), Sub-Alternative A4b Nov-Mar* ("Inside A4b*"), or outside (but in the reference area) the current DeSoto Canyon closed area (2016-2020); Sub-Alternative A4b

Month	Inside A4b	Inside A4b*	Outside
January	0 (0%)	6,101 (7%)	82,990 (93%)
February	0 (0%)	4,948 (7%)	67,293 (93%)
March	0 (0%)	5,742 (7%)	78,101 (93%)

April	0 (0%)	0 (0%)	54,989 (100%)
May	0 (0%)	0 (0%)	75,962 (100%)
June	0 (0%)	0 (0%)	118,251 (100%)
July	0 (0%)	0 (0%)	146,174 (100%)
August	0 (0%)	0 (0%)	101,938 (100%)
September	0 (0%)	0 (0%)	79,887 (100%)
October	0 (0%)	0 (0%)	81,608 (100%)
November	0 (0%)	6,990 (7%)	95,080 (93%)
December	0 (0%)	5,846 (7%)	79,517 (93%)

Table 5.92. Average monthly swordfish CPUE (per 1,000 hooks), inside Sub-Alternative A4b Nov-Mar or Sub-Alternative A4b Apr-Oct ("Inside A4b"), inside Sub-Alternative A4b Nov-Mar* ("Inside A4b*"), or outside (but in the reference area) the current DeSoto Canyon closed area (2011-2020); Sub-Alternative A4b

Month	Inside A4b	Inside A4b*	Outside
January	0.00	11.80	3.98
February	0.00	14.67	4.95
March	0.00	18.48	6.24
April	0.00	0.00	6.76
May	0.00	0.00	2.59
June	0.00	0.00	1.74
July	0.00	0.00	1.36
August	0.00	0.00	1.18
September	0.00	0.00	1.79
October	0.00	0.00	2.82
November	0.00	10.81	3.65
December	0.00	9.43	3.18

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.93. Average monthly yellowfin tuna CPUE (per 1,000 hooks), inside Sub-Alternative A4b Nov-Mar or Sub-Alternative A4b Apr-Oct ("Inside A4b"), inside Sub-Alternative A4b Nov-Mar* ("Inside A4b*"), or outside (but in the reference area) the current DeSoto Canyon closed area (2011-2020); Sub-Alternative A4b

Month	Inside A4b	Inside A4b*	Outside
January	0.00	1.20	8.91
February	0.00	0.60	4.48
March	0.00	0.52	3.88
April	0.00	0.00	4.30
May	0.00	0.00	8.62
June	0.00	0.00	9.57
July	0.00	0.00	8.80
August	0.00	0.00	8.45
September	0.00	0.00	7.33
October	0.00	0.00	8.47
November	0.00	1.01	7.52
December	0.00	1.18	8.79

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.94. Average monthly bigeye tuna CPUE (per 1,000 hooks), inside Sub-Alternative A4b Nov-Mar or Sub-Alternative A4b Apr-Oct ("Inside A4b"), inside Sub-Alternative A4b Nov-Mar* ("Inside A4b*"), or outside (but in the reference area) the current DeSoto Canyon closed area (2011-2020); Sub-Alternative A4b

Month	Inside A4b	Inside A4b*	Outside
January	0.00	0.07	0.11
February	0.00	0.11	0.17
March	0.00	0.07	0.10

April	0.00	0.00	0.05
May	0.00	0.00	0.04
June	0.00	0.00	0.02
July	0.00	0.00	0.03
August	0.00	0.00	0.04
September	0.00	0.00	0.11
October	0.00	0.00	0.26
November	0.00	0.14	0.22
December	0.00	0.14	0.21

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.95. Estimated annual numbers of target species caught inside the current DeSoto Canyon closed area (Sub-Alternative A4a Apr-Oct + Sub-Alternative A4a Nov-Mar + Sub-Alternative A4a Nov-Mar*) or outside (but in the reference area) the current DeSoto Canyon closed area; Sub-Alternative A4b

	Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
Inside	381	27	3	411
Outside	3,217	8,206	113	11,536
Total	3,598	8,233	116	11,947

We estimated revenue for Sub-Alternative A4b by following the social and economic calculations described in the Sub-Alternative A4a. Table 5.96 shows the estimated annual revenue for each target species and the combined target species revenue is $4,657,100 (2021 real dollars). This sub-alternative would generate more revenue from swordfish, but less from yellowfin tuna and similar from bigeye tuna relative to the No Action sub-alternative. When combined the total revenue difference between this sub-alternative and the No Action sub-alternative is $38,188 resulting in minor positive direct economic impacts in the short- and long-term, which would also lead to positive direct social impacts. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Since fishing effort is not expected to change, large changes to landings are not expected either. Thus, indirect impacts to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be neutral. From 2016 through 2020, 44 dealers purchased swordfish, yellowfin tuna, or bigeye tuna products in Texas, Louisiana, Mississippi, Alabama, and the west coast of Florida, which are the states in the vicinity of the DeSoto Canyon closed area. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

This sub-alternative would provide some fishing opportunities in the southern portion of the closed area during portions of the year, potentially opening fishing opportunities closer to shore, so vessel transit times and distances may decrease. Thus, reduced fuel costs for fishermen could provide minor beneficial social and economic impacts and reduce greenhouse gas emissions.

Table 5.96. Estimated annual revenue of target species caught in the reference area (2021 real dollars); Sub-Alternative A4b

Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
$1,504,000	$3,091,656	$61,444	$4,657,100

5.1.4.3 Sub-Alternative A4c

This sub-alternative would modify the spatial extent of the DeSoto Canyon closed area, and would maintain a year-round closure, shown in Chapter 3 Figure 17. The spatial extent would be reduced by shifting the southern boundary of the current closed area north to 27° 00' N. lat. The remainder of the current closed area footprint would be designated a low-bycatch-risk area throughout the year.

Ecological Impacts on Target Species

The ecological impacts of Sub-Alternative A4c on target species catch is expected to be neutral. The target species are quota managed species, and this sub-alternative would not affect the overall U.S. quotas for swordfish, yellowfin tuna, or bigeye tuna, which prevent overfishing, are based on the best scientific information available, and are consistent with the ICCAT-recommended TACs and quotas.

Ecological Impacts on Bycatch Species Modeled by HMS PRiSM

Table 5.97 lists the individual metric scores for this sub-alternative for each bycatch species. Based on the overall metric score ranking for the modeled bycatch species, this sub-alternative reduced the overall metric score compared to the No Action sub-alternative. Protections of leatherback sea turtles are higher than the status quo sub-alternative (23 compared to 21) and protections for shortfin mako sharks are equal (both scores are 20). In contrast, the total metric scores for billfish species is lower than the status quo sub-alternative (16 compared to 24). Due to the decreased score for billfish species, this sub-alternative had a slightly lower overall metric score than the No Action sub-alternative (59 compared to 65). In addition, the scope was 25 percent smaller compared to that of the No Action sub-alternative because for all months, fishing would be allowed in parts of the closed area. Sub-Alternative A4c would likely have short- and long-term minor negative indirect ecological impacts for the bycatch species.

Table 5.97. Sub-Alternative A4c metric scores* for modeled species

Species	Metric 1	Metric 2	Metric 3	Metric 4	Total
Leatherback Sea Turtle	3	5	8	7	23
Shortfin Mako Shark	12	3	3	2	20
Billfish Species	11	0	1	4	16
Overall Metric Score					59

*For all sub-alternatives, the highest score possible for a single metric and species is 12. The highest possible total metric score for a species is 48. The highest possible overall metric score is 144.
Underlying questions:
Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
Metric 2: Does the spatial management area protect the most at-risk areas?
Metric 3: What percent of total high-bycatch-risk area across the whole fishery domain does the spatial management area protect?
Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Ecological Impacts on Other Bycatch and Incidental Species

Since Sub-Alternative A4c would remove protections in the southern portion of DeSoto Canyon spatial management area, protections for Rice's whales would be reduced. Background information on Rice's whale is in the Ecological Impacts on Other Bycatch and Incidental Species section of Sub-Alternative A4a.

Under Sub-Alternative A4c, effort in pelagic longline fishery is unlikely to increase and, if recent trends continue, could decrease. Thus, fishing impacts to other bycatch and incidental species of concern such as bluefin tuna, oceanic whitetip shark, scalloped hammerhead shark, dusky shark, sandbar shark, or longfin mako shark are unlikely to change and neutral indirect ecological impacts are expected. Further, the IBQ Program has been successful in reducing the incidental catch of bluefin tuna (NOAA Fisheries 2019, National Academies 2021). Specifically for Rice's whales, this sub-alternative would maintain most of the protections of the core habitat and would thus have neutral indirect ecological impacts on the species.

Social and Economic Impacts

Methods

Sub-alternative-specific effort estimate: For this sub-alternative, the entire reference area can be divided into three areas: Sub-Alternative A4c, the area inside the current DeSoto Canyon closed area that is outside Sub-Alternative A4c (herein referred to as "Sub-

Alternative A4c*"), and the reference area outside the current DeSoto Canyon closed area (Figure 5.14). The percent of the total number of hooks deployed each year from 1995 through 2000 in the reference area that occurred in Sub-Alternative A4c and Sub-Alternative A4c* was averaged across years. NOAA Fisheries then assumed that all effort inside Sub-Alternative A4c would shift into Sub-Alternative A4c* because under this Sub-Alternative fishing is not allowed inside Sub-Alternative A4c (0 percent of hooks), but is allowed inside Sub-Alternative A4c*. We subtracted that percent (10 percent) from 100 percent to estimate a percent of hooks that occurred in the reference area outside the current DeSoto Canyon closed area. Next, we multiplied the percentages by the average monthly number of hooks inside the reference area from 2016 through 2020 to calculate the estimated number of hooks each month that occurred in Sub-Alternative A4c* and inside the reference area outside the current DeSoto Canyon closed area.

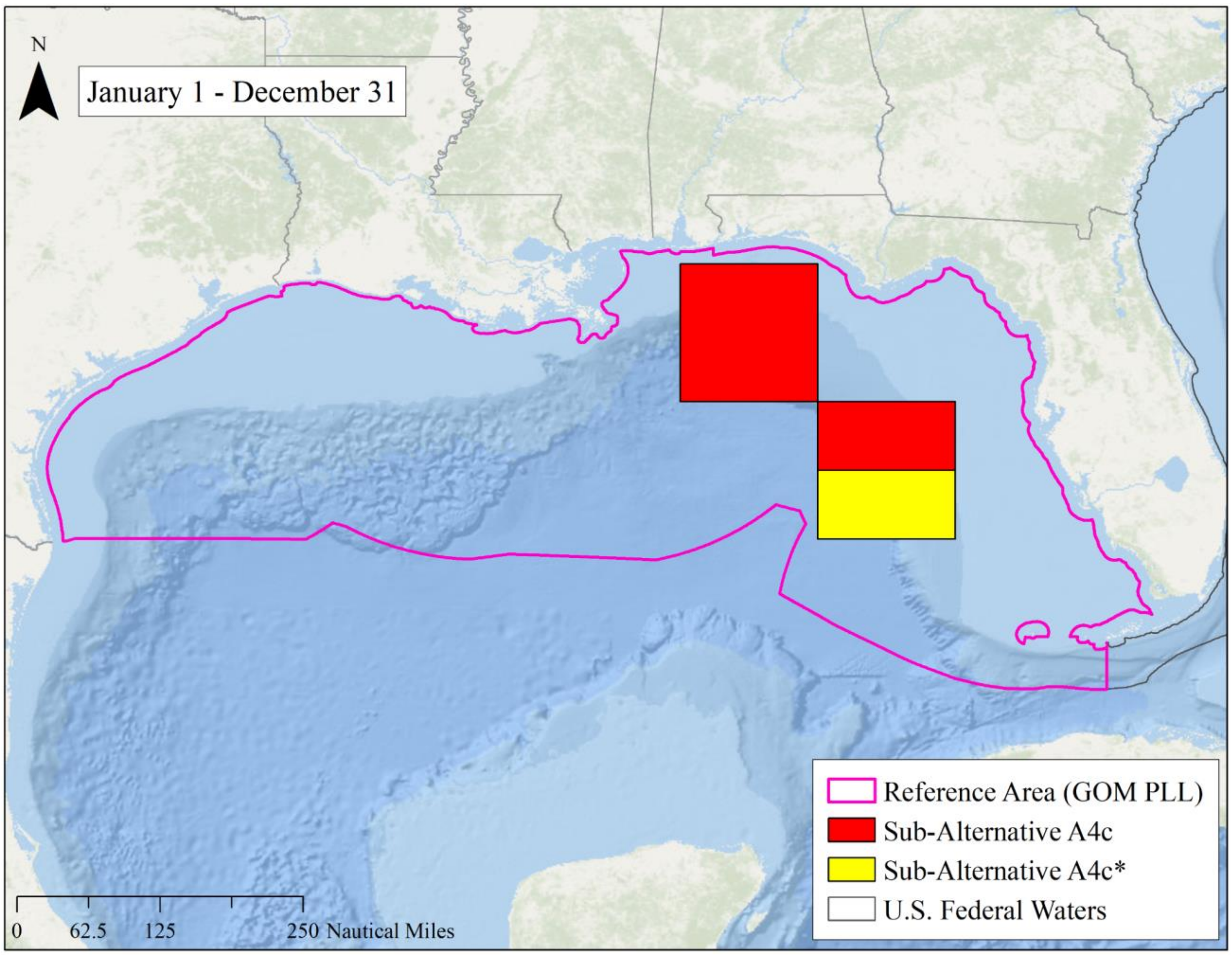

Figure 5.14. Areas defined by Sub-Alternative A4c and Sub-Alternative A4c* within the Gulf of Mexico reference area.

Sub-alternative-specific CPUE estimate: We averaged species-specific CPUEs across years within the Sub-Alternative A4c* and within the reference area outside the current DeSoto Canyon closed area. These two values generated the ratio for each species. The ratio was then multiplied by the average monthly CPUE outside the current DeSoto Canyon closed area within the reference area from 2011 through 2020 to calculate an estimated current CPUE inside Sub-Alternative A4c*. This provided a separate monthly CPUE for each species inside and outside the different spatial management areas for a recent time period.

Estimated Impacts

Table 5.98 shows the average number of monthly hooks and percentage of total hooks inside Sub-Alternative A4c* and outside the current DeSoto Canyon closed area within the reference area, on a monthly basis, from 2016 through 2020. Of the estimated average annual total number of hooks in the reference area (1,091,417), NOAA Fisheries estimated that 107,657 hooks would be deployed within area Sub-Alternative A4c* annually (10 percent of total hooks), while 983,760 hooks would be deployed in the reference area outside the current DeSoto Canyon closed area (90 percent of the total hooks). CPUE estimates (Table 5.99, Table 5.100, and Table 5.101), for swordfish, yellowfin tuna, and bigeye tuna inside Sub-Alternative A4c* and outside the current closed area by month are variable. For swordfish, the highest CPUEs occurred during March and April inside Sub-Alternative A4c*, and the lowest CPUEs during June, July, and August outside the current closed area. Under this sub-alternative, 3,993 swordfish would be caught in the reference area analyzed (Table 5.102), which is over 600 more than the estimated swordfish catch under the No Action sub-alternative. The number of yellowfin tuna and bigeye tuna estimates under this sub-alternative is 8,435 and 115, which is similar to the No Action sub-alternative, respectively.

Table 5.98. Average number of monthly hooks and percentage of hooks inside Sub-Alternative A4c (“Inside A4c”), Sub-Alternative A4c* (“Inside A4c*”), or outside (but in the reference area) the current DeSoto Canyon closed area (2016-2020); Sub-Alternative A4c

Month	Inside A4c	Inside A4c*	Outside
January	0 (0%)	8,788 (10%)	80,304 (90%)
February	0 (0%)	7,126 (10%)	65,114 (90%)
March	0 (0%)	58,270 (10%)	75,573 (90%)
April	0 (0%)	5,424 (10%)	49,565 (90%)
May	0 (0%)	7,493 (10%)	68,469 (90%)
June	0 (0%)	11,664 (10%)	106,586 (90%)
July	0 (0%)	14,419 (10%)	131,756 (90%)
August	0 (0%)	10,055 (10%)	91,883 (90%)
September	0 (0%)	7,880 (10%)	72,007 (90%)

October	0 (0%)	8,050 (10%)	73,559 (90%)
November	0 (0%)	10,068 (10%)	92,002 (90%)
December	0 (0%)	8,420 (10%)	76,943 (90%)

Table 5.99. Average monthly swordfish CPUE (per 1,000 hooks), inside Sub-Alternative A4c* ("Inside A4c"), inside Sub-Alternative A4c* ("Inside A4c*"), or outside (but in the reference area) the current DeSoto Canyon closed area (2011-2020); Sub-Alternative A4c

Month	Inside A4c	Inside A4c*	Outside
January	0.00	11.78	3.98
February	0.00	14.65	4.95
March	0.00	18.46	6.24
April	0.00	20.01	6.76
May	0.00	7.65	2.59
June	0.00	5.16	1.74
July	0.00	4.02	1.36
August	0.00	3.49	1.18
September	0.00	5.29	1.79
October	0.00	8.36	2.82
November	0.00	10.80	3.65
December	0.00	9.42	3.18

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.100. Average monthly yellowfin tuna CPUE (per 1,000 hooks), inside Sub-Alternative A4c* ("Inside A4c"), inside Sub-Alternative A4c* ("Inside A4c*"), or outside (but in the reference area) the current DeSoto Canyon closed area (2011-2020); Sub-Alternative A4c

Month	Inside A4c	Inside A4c*	Outside
January	0.00	9.19	8.91
February	0.00	4.62	4.48

March	0.00	4.00	3.88
April	0.00	4.44	4.30
May	0.00	8.89	8.62
June	0.00	9.86	9.57
July	0.00	9.07	8.80
August	0.00	8.72	8.45
September	0.00	7.56	7.33
October	0.00	8.73	8.47
November	0.00	7.75	7.52
December	0.00	9.06	8.79

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.101. Average monthly bigeye tuna CPUE (per 1,000 hooks), inside Sub-Alternative A4c* ("Inside A4c"), inside Sub-Alternative A4c* ("Inside A4c*"), or outside (but in the reference area) the current DeSoto Canyon closed area (2011-2020); Sub-Alternative A4c

Month	**Inside A4c**	**Inside A4c***	**Outside**
January	0.00	0.09	0.11
February	0.00	0.13	0.17
March	0.00	0.08	0.10
April	0.00	0.04	0.05
May	0.00	0.03	0.04
June	0.00	0.02	0.02
July	0.00	0.02	0.03
August	0.00	0.03	0.04
September	0.00	0.09	0.11
October	0.00	0.20	0.26
November	0.00	0.17	0.22

December	0.00	0.17	0.21

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.102. Estimated numbers of target species caught inside the current DeSoto Canyon closed area (Sub-Alternative A4c + Sub-Alternative A4c*) or outside (but in the reference area) the current DeSoto Canyon closed area; Sub-Alternative A4c

	Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
Inside	977	855	9	1,841
Outside	3,016	7,580	106	10,702
Total	3,993	8,435	115	12,543

We estimated revenue for Sub-Alternative A4c by following the social and economic calculations described in the Sub-Alternative A4a. Table 5.103 shows the estimated annual revenue for each target species and the combined target species revenue is $4,897,539 (2021 real dollars). This sub-alternative would generate more revenue from swordfish and yellowfin tuna, but less from bigeye tuna relative to the No Action sub-alternative. When combined, the total revenue difference between this sub-alternative and the No Action sub-alternative is $278,627 resulting in moderate positive direct and indirect economic impacts in the short- and long-term, which would also lead to positive social impacts. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Since fishing effort is not expected to change, large changes to landings are not expected either. Thus, indirect impacts to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be neutral. From 2016 through 2020, 44 dealers purchased swordfish, yellowfin tuna, or bigeye tuna products in Texas, Louisiana, Mississippi, Alabama, and the west coast of Florida, which are the states in the vicinity of the DeSoto Canyon closed area. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

This sub-alternative would provide some fishing opportunities in the southern portion of the closed area, potentially opening fishing opportunities closer to shore, so vessel transit times and distances may decrease. Thus, reduced fuel costs for fishermen could provide minor beneficial social and economic impacts and reduce greenhouse gas emissions.

Table 5.103. Estimated annual revenue of target species caught in the reference area (2021 real dollars); Sub-Alternative A4c

Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
$1,669,114	$3,167,511	$60,914	$4,897,539

5.1.4.4 Sub-Alternative A4d - Preferred Sub-Alternative

This sub-alternative would modify the spatial extent of the DeSoto Canyon closed area, and would maintain a year-round closure. The spatial configuration is a parallelogram through the current area, as shown in Chapter 3 Figure 18. The parallelogram connects southern points; 27° 00' N. lat., 86° 30' W. long. and 27° 00' N. lat., 83° 48' W. long., while the northern boundary would be defined by the state water boundary between 88° 24' 58" W. long. and 85° 22' 34" W. long. The areas outside this parallelogram that are currently closed would reopen to normal fishing.

Ecological Impacts on Target Species

The ecological impacts of Sub-Alternative A4d on target species catch is expected to be neutral. The target species are quota-managed species, and this sub-alternative would not affect the overall U.S. quotas for swordfish, yellowfin tuna, or bigeye tuna, which prevent overfishing, are based on the best scientific information available, and are consistent with the ICCAT-recommended TACs and quotas.

Ecological Impacts on Bycatch Species Modeled by HMS PRiSM

Table 5.104 lists the individual metric scores for this sub-alternative for each bycatch species. Based on the overall metric score ranking for the modeled bycatch species, this sub-alternative increased the overall metric score compared to the No Action sub-alternative and was the highest among the sub-alternatives. Protections of leatherback sea turtles and shortfin mako sharks are higher than the status quo sub-alternative (leatherback sea turtle score of 26 compared to 21; shortfin mako shark score of 25 compared to 20). In contrast, the total metric scores for billfish species is lower than the status quo sub-alternative (17 compared to 24). Due to the increased score for leatherback sea turtles and shortfin mako sharks, this sub-alternative had a higher overall metric score than the No Action sub-alternative (68 compared to 65). In addition, the scope was 5 percent larger compared to that of the No Action sub-alternative because although fishing would be allowed in some areas inside the DeSoto Canyon closed area, the extension of the spatial extent to other areas was greater. Sub-Alternative A4d would likely have short- and long-term minor beneficial indirect ecological impacts for the bycatch species.

Table 5.104. Sub-Alternative A4d metric scores* for modeled species

Species	Metric 1	Metric 2	Metric 3	Metric 4	Total
Leatherback Sea Turtle	3	5	10	8	26
Shortfin Mako Shark	12	1	8	4	25
Billfish Species	11	0	3	3	17
Overall Metric Score					68

*For all sub-alternatives, the highest score possible for a single metric and species is 12. The highest possible total metric score for a species is 48. The highest possible overall metric score is 144.
Underlying questions:
Metric 1: How does the probability of fishery interaction compare inside the spatial management area to outside?
Metric 2: Does the spatial management area protect the most at-risk areas?
Metric 3: What percent of total high-bycatch-risk area across whole fishery domain does the spatial management area protect?
Metric 4: What percentage of the spatial management area protects high-bycatch-risk area?

Ecological Impacts on Other Bycatch and Incidental Species

The spatial modification to the DeSoto Canyon spatial management area under Sub-Alternative A4d would increase protection for Rice's whales. As detailed in the *Ecological Impacts on Other Bycatch and Incidental Species* section of Sub-Alternative A4a (Section 5.1.4.1), the species is listed as endangered under the ESA and biologically important area has been designated in the northeastern Gulf of Mexico in and around the DeSoto Canyon spatial management area. Sub-Alternative A4d would expand high-bycatch-risk area to include a greater portion of Rice's whale biologically important area, specifically in the medial portion of the range (Figure 5.15). Currently the DeSoto Canyon closed area encompasses approximately 69 percent of Rice's whale biologically important area. Sub-Alternative A4d would increase coverage to 94 percent.

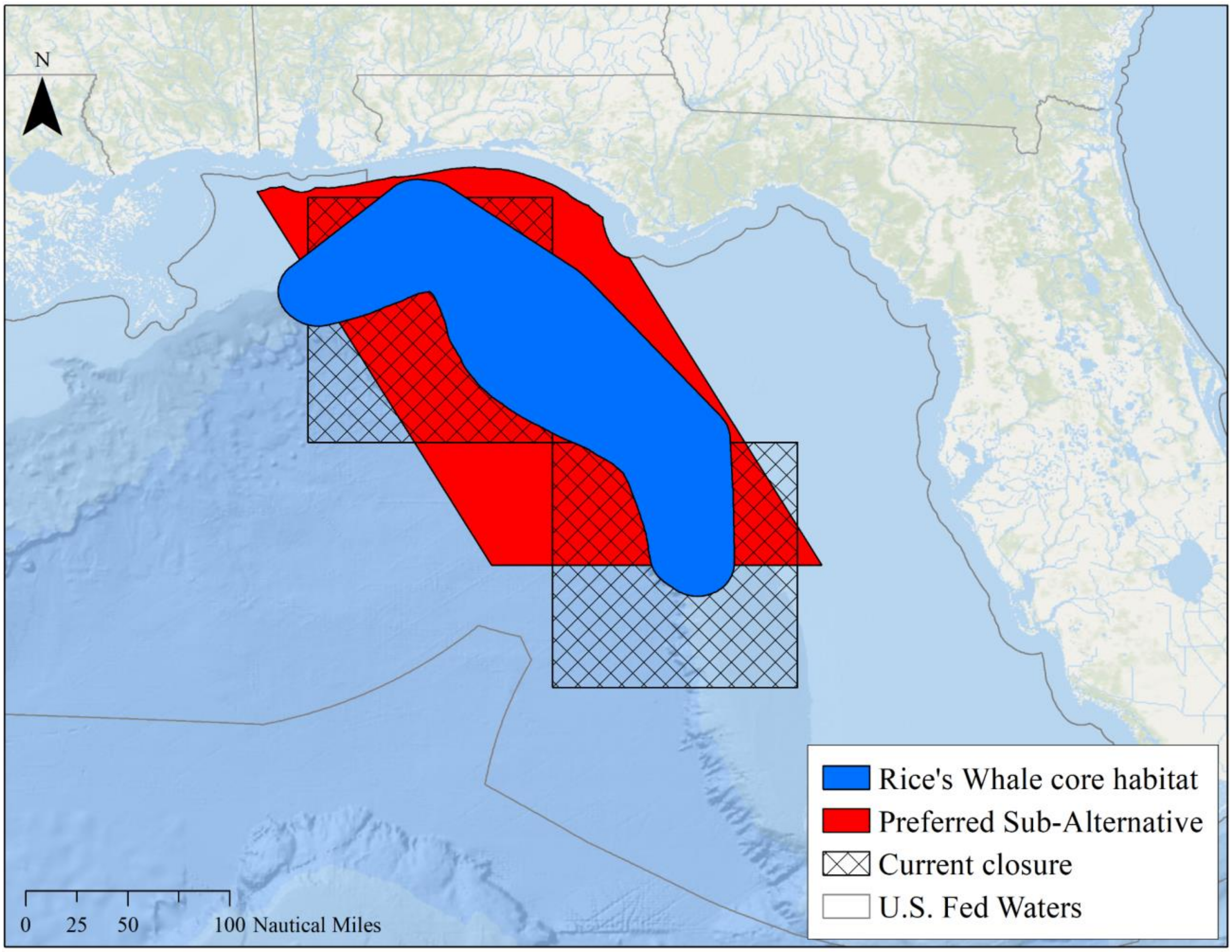

Figure 5.15. Sub-Alternative A4d and Rice's whale biologically important area.

Under Sub-Alternative A4d, effort in pelagic longline fishery is unlikely to increase and, if recent trends continue, could decrease. Thus, fishing impacts to other bycatch and incidental species of concern such as bluefin tuna, oceanic whitetip shark, scalloped hammerhead shark, dusky shark, sandbar shark, or longfin mako shark are unlikely to change and neutral indirect ecological impacts are expected. Further, the IBQ Program has been successful in reducing the incidental catch of bluefin tuna (NOAA Fisheries 2019, National Academies 2021).

Social and Economic Impacts

Methods

Sub-Alternative-specific effort estimate: We treated this Sub-Alternative slightly differently because there were areas inside Sub-Alternative A4d that were outside the current DeSoto Canyon closed area. NOAA Fisheries assumed those sets would simply shift to areas outside Sub-Alternative A4d. For this sub-alternative, the entire reference area can be divided into three areas: Sub-Alternative A4d, the area inside the current DeSoto Canyon closed area that is outside Sub-Alternative A4d (herein referred to as "Sub-Alternative A4d*"), and the reference area outside the current DeSoto Canyon closed area (Figure 5.16). The percent of the total number of hooks deployed each year from 1995 through 2000 in the reference area that occurred in the current DeSoto Canyon closed area was averaged across years. That percent effort (10 percent) was assumed to shift into the Sub-Alternative A4d* because under this sub-alternative those are new areas where fishing may be allowed, if combined with one of the B Alternatives that allow data collection. Then we subtracted that percent from 100 percent to estimate a percent of hooks that occurred in the reference area outside both Sub-Alternative A4d and the current DeSoto Canyon closed area. The percentages were then multiplied by the average monthly number of hooks inside the reference area from 2016 through 2020 to calculate the estimated number of hooks each month that occurred inside Sub-Alternative A4d* and inside the reference area outside both Sub-Alternative A4d and the current DeSoto Canyon closed area. For example in January, on average 10 percent of historical hooks (1995-2000) occurred inside the area defined by the current DeSoto Canyon closed area and 89,092 hooks were fished on average in the reference area (2016-2020). Therefore, 8,909 hooks would be estimated to occur inside the current DeSoto Canyon closed area and shift in Sub-Alternative A4d*, as mentioned above. Please note the total hooks in January do not match exactly to the value in Table 5.105 due to rounding.

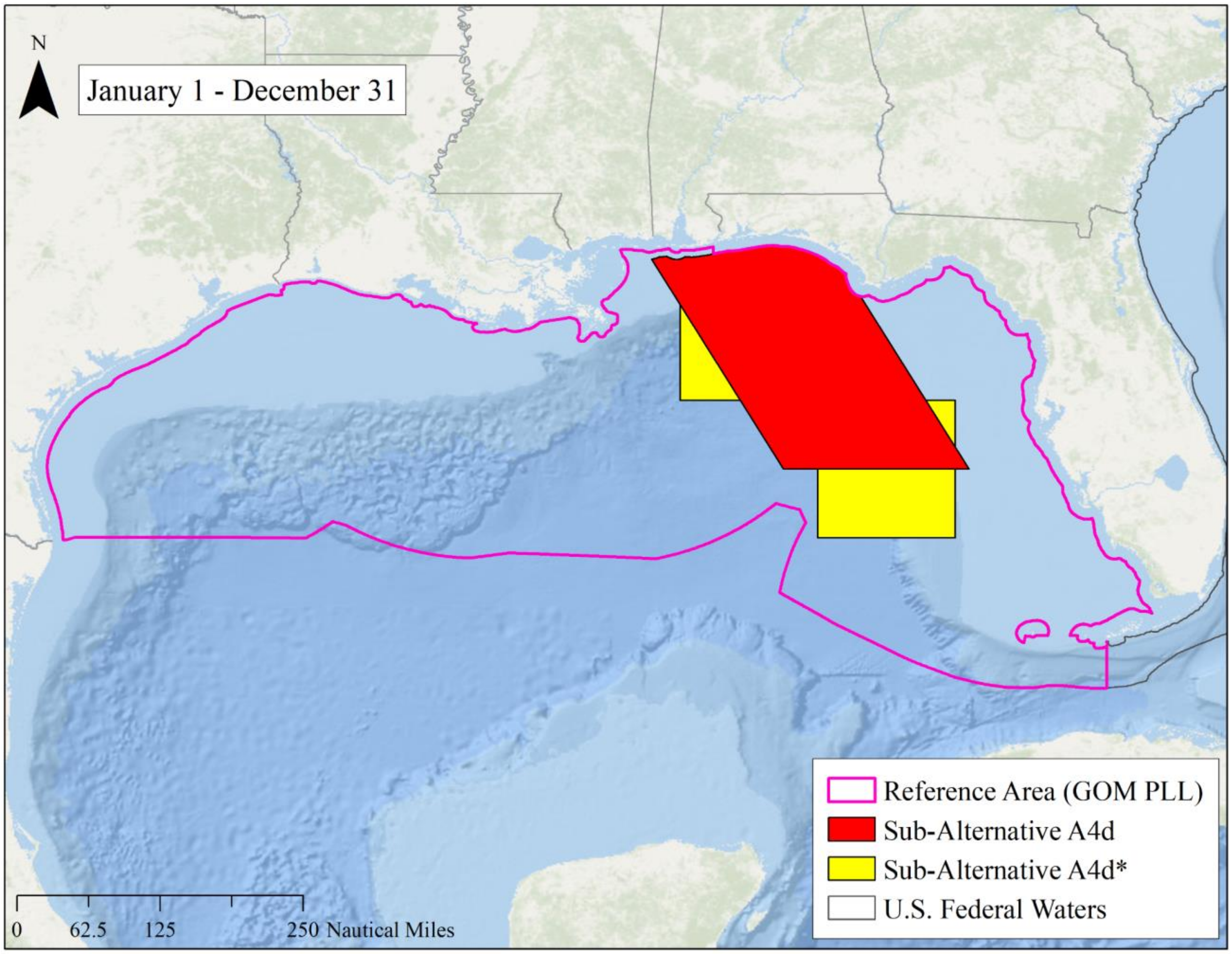

Figure 5.16. Areas defined by Sub-Alternative A4d and Sub-Alternative A4d* within the Gulf of Mexico reference area.

Sub-alternative-specific CPUE estimate: We followed the methodology outlined in the introduction of Section 5.1.4 to calculate CPUE inside and outside Sub-Alternative A4d*.

Estimated Impacts

NOAA Fisheries estimated that within the DeSoto Canyon closed area 107,657 hooks would occur, while 983,760 hooks would occur inside the reference area outside both the DeSoto Canyon closed area and Sub-Alternative A4d in a current year. Under this sub-alternative, the lowest estimated swordfish catch inside the DeSoto Canyon closed area (346) and within the entire reference area (2,936) was expected to occur compared to the No Action sub-alternative. The total estimated catch of yellowfin tuna in the reference area was approximately 500 less fish compared to the No Action sub-alternative. There was essentially no difference in estimated bigeye tuna catch in the reference area relative to the No Action sub-alternative (Table 5.112). Thus, short- and long-term minor negative impacts are expected for target species under Sub-Alternative A4d.

Table 5.105 shows the average number of monthly hooks and percentage of total hooks inside Sub-Alternative A4d* and outside the current DeSoto Canyon closed area within the reference area, on a monthly basis, from 2016 through 2020. Of the estimated average annual total number of hooks in the reference area (1,091,417), NOAA Fisheries estimated that 107,657 hooks would be deployed within area Sub-Alternative A4d* annually (10 percent of total hooks), while 983,760 hooks would be deployed in the reference area outside the current DeSoto Canyon closed area (90 percent of the total hooks). CPUE estimates (Table 5.106, Table 5.107, and Table 5.108), for swordfish, yellowfin tuna, and bigeye tuna inside Sub-Alternative A4d* and outside the current closed area by month are variable. For yellowfin tuna, CPUE was always higher inside Sub-Alternative A4d* compared to CPUEs outside the current closed area. For swordfish the highest CPUEs occurred during March and April inside Sub-Alternative A4d*. Under this sub-alternative, 3,282 swordfish would be caught in the reference area analyzed (Table 5.109), which is slightly less than the estimated swordfish catch under the No Action sub-alternative. The number of yellowfin tuna estimates (7,890) were approximately 500 less than the No Action sub-alternative, while bigeye tuna estimates (113) were similar to the No Action sub-alternative, respectively.

Table 5.105. Average number of monthly hooks and percentage of hooks inside Sub-Alternative A4d ("Inside A4d"), Sub-Alternative A4d* ("Inside A4d*"), or outside (but in the reference area) the current DeSoto Canyon closed area (2016-2020); Sub-Alternative A4d

Month	Inside A4d	Inside A4d*	Outside
January	0 (0%)	8,788 (10%)	80,304 (90%)
February	0 (0%)	7,126 (10%)	65,114 (90%)
March	0 (0%)	8,270 (10%)	75,573 (90%)
April	0 (0%)	5,424 (10%)	49,565 (90%)
May	0 (0%)	7,493 (10%)	68,469 (90%)
June	0 (0%)	11,664 (10%)	106,586 (90%)
July	0 (0%)	14,419 (10%)	131,756 (90%)
August	0 (0%)	10,055 (10%)	91,883 (90%)
September	0 (0%)	7,880 (10%)	72,007 (90%)
October	0 (0%)	8,050 (10%)	73,559 (90%)
November	0 (0%)	10,068 (10%)	92,002 (90%)
December	0 (0%)	8,420 (10%)	76,943 (90%)

Table 5.106. Average monthly swordfish CPUE (per 1,000 hooks), inside Sub-Alternative A4d* ("Inside A4d"), inside Sub-Alternative A4d* ("Inside A4d*"), or outside (but in the reference area) the current DeSoto Canyon closed area (2011-2020); Sub-Alternative A4d

Month	Inside A4d	Inside A4d*	Outside
January	0.00	4.00	3.72
February	0.00	5.32	4.94
March	0.00	6.95	6.46
April	0.00	7.17	6.66
May	0.00	2.29	2.13
June	0.00	1.58	1.47
July	0.00	1.38	1.28
August	0.00	1.41	1.31
September	0.00	1.96	1.82
October	0.00	3.10	2.88
November	0.00	3.72	3.46
December	0.00	3.44	3.20

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.107. Average monthly yellowfin tuna CPUE (per 1,000 hooks), inside Sub-Alternative A4d* ("Inside A4d"), inside Sub-Alternative A4d* ("Inside A4d*"), or outside (but in the reference area) the current DeSoto Canyon closed area (2011-2020); Sub-Alternative A4d

Month	Inside A4d	Inside A4d*	Outside
January	0.00	9.34	8.91
February	0.00	4.51	4.30
March	0.00	3.77	3.59
April	0.00	4.29	4.09

May	0.00	9.05	8.63
June	0.00	9.19	8.77
July	0.00	8.70	8.30
August	0.00	8.27	7.88
September	0.00	7.18	6.85
October	0.00	7.82	7.46
November	0.00	6.71	6.40
December	0.00	8.65	8.25

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.108. Average monthly bigeye tuna CPUE (per 1,000 hooks), inside Sub-Alternative A4d* ("Inside A4d"), inside Sub-Alternative A4d* ("Inside A4d*"), or outside (but in the reference area) the current DeSoto Canyon closed area (2011-2020); Sub-Alternative A4d

Month	Inside A4d	Inside A4d*	Outside
January	0.00	0.06	0.11
February	0.00	0.09	0.17
March	0.00	0.05	0.10
April	0.00	0.03	0.05
May	0.00	0.02	0.04
June	0.00	0.01	0.02
July	0.00	0.02	0.03
August	0.00	0.02	0.04
September	0.00	0.05	0.10
October	0.00	0.13	0.25
November	0.00	0.11	0.22
December	0.00	0.12	0.23

*After multiplying the number of hooks by CPUE (per 1,000 hooks) it is important to divide by 1,000 to calculate the correct monthly catch estimate.

Table 5.109. Estimated annual numbers of target species caught inside the Sub-Alternative A4d or Outside (but in the reference area) the current DeSoto Canyon closed area; Sub-Alternative A4d

	Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
Inside	346	812	6	1,164
Outside	2,936	7,078	107	10,121
Total	3,282	7,890	113	11,285

We estimated revenue for Sub-Alternative A4d by following the social and economic calculations described in the Sub-Alternative A4a. Table 5.110 shows the estimated annual revenue for each target species and the combined target species revenue is $4,394,617 (2021 real dollars). This sub-alternative would generate less revenue from all three target species relative to the No Action sub-alternative. When combined, the total revenue difference between this sub-alternative and the No Action sub-alternative is -$224,295 resulting in moderate negative direct and indirect economic impacts in the short- and long-term, which could lead to negative social impacts. However, fishermen are unlikely to fish in areas with lower catch rates, so reductions in revenue may not be realized. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Since fishing effort is not expected to change, large changes to landings are not expected either. Thus, indirect impacts to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be neutral. From 2016 through 2020, 44 dealers purchased swordfish, yellowfin tuna, or bigeye tuna products in Texas, Louisiana, Mississippi, Alabama, and the west coast of Florida, which are the states in the vicinity of the DeSoto Canyon closed area. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

This sub-alternative would alter the shape of the closed area, providing fishing opportunities closer to shore and ports in some areas but further away in other areas. Thus, there is a mixed impact of vessel transit times and distances. On balance, vessel transit times and distances are unlikely to change. Thus, no impacts to fuel costs or greenhouse gas emissions are expected.

Table 5.110. Estimated annual revenue of target species caught in the reference area (2021 real dollars); Sub-Alternative A4d

Swordfish	Yellowfin Tuna	Bigeye Tuna	Total
$1,371,909	$2,962,853	$59,855	$4,394,617

5.1.4.5 Comparison of Alternative Suite A4 Sub-Alternatives

There were notable differences among the Suite A4 Sub-Alternatives, pertaining to spatial and temporal modifications to the current DeSoto Canyon closed area. The Sub-Alternative A4c ranked the lowest for the overall metric scores, meaning the spatial extent and temporal extent could be better optimized to protect the areas where potential bycatch interaction is the highest. The Sub-Alternative A4b overall metric score was slightly higher than Sub-Alternative A4c. Sub-Alternative A4a (No Action) saw a further increase in the overall metric score. Lastly, Sub-Alternative A4d (the Preferred Sub-Alternative) had the highest overall metric score across all Sub-Alternatives (Table 5.111).

The Preferred Sub-Alternative A4d had the highest scope because spatial management area increased in size and maintained year-round closure. Sub-Alternative A3a had the next largest scope, followed by Sub-Alternative A3b and Sub-Alternative A3c, both of which had negative scopes because relative to the No Action sub-alternative, the area was reduced in size (Table 5.111).

The highest metric total score for a sub-alternative and species was for billfish species and Sub-Alternative A4a (No Action). In contrast, the metric total scores for leatherback sea turtle and shortfin mako shark were the same as or greater than the No Action sub-alternative for the other sub-alternatives. The metric total scores for leatherback sea turtle and shortfin mako shark were largest under the Preferred Sub-Alternative A4d (Table 5.111).

Furthermore, Sub-Alternative A4d would increase protections for Rice's whale in their biologically important area (specifically in the medial portion of their range), while the other sub-alternatives would maintain or decrease such protections.

Table 5.111. Total metric scores by species and scope for Suite A4 Sub-Alternatives

Species	**A4a - No Action**	**A4b**	**A4c**	**A4d - Preferred**
Leatherback Sea Turtle	21	21	23	**26**
Shortfin Mako Shark	20	20	21	**25**
Billfish Species	24	21	16	**17**
Overall Metric Score	65	62	60	**68**
Scope* compared to No Action	0 (no change)	-64,128	-77,288	**14,207**

*Scope: For the purpose of this DEIS, a measure of the spatial and temporal extent of a particular management area used to compare options and alternatives: square nautical miles of area x the number of closure months.

Table 5.112 and Table 5.113 provide high-level descriptions of the sub-alternatives, the estimated target species catch, and revenue from those species.

The highest total estimated swordfish catch occurred in Sub-Alternative A4c, followed by Sub-Alternative A4b, Sub-Alternative A4a (No Action), and Sub-Alternative A4d, the Preferred Sub-Alternative. For yellowfin tuna, the highest total estimated catch occurred in Sub-Alternative A4c, followed by the No Action sub-alternative, Sub-Alternative A4b, and Sub-Alternative A4d. There were very small differences (e.g., five fish) among the sub-alternatives for bigeye tuna estimated catch.

Table 5.112. Comparison of Suite A4 Sub-Alternatives and total estimated target catch (numbers of fish) by species.

	Summary Description	Swordfish	Yellowfin tuna	Bigeye tuna	Total Number
A4a - No Action	*Spatial*: Status quo *Temporal*: Status quo (January-December)	3,346	8,409	118	11,873
A4b	*Spatial 1*: Status quo *Temporal 1*: April-October *Spatial 2*: Only northwest box *Temporal 2:* November-March	3,598	8,233	116	11,947
A4c	*Spatial*: Reduce current extent to north of 27° 00' N *Temporal*: January-December	3,993	8,435	115	12,543
A4d - Preferred	***Spatial*: Parallelogram set through both boxes** ***Temporal*: January-December**	**3,282**	**7,890**	**113**	**11,285**

Sub-Alternative A4d, the Preferred Sub-Alternative, generated the lowest estimated revenue compared to all other sub-alternatives. Sub-Alternative A4c, had the highest estimated revenue, followed by Sub-Alternative A4b, and the No Action sub-alternative (Table 5.113).

Table 5.113. Comparison of total estimated revenue and net difference from the No Action of Suite A4 Sub-Alternatives (2021 real dollars)

A4a - No Action	A4b (net difference)	A4c (net difference)	A4d - Preferred (net difference)
$4,618,912	$4,657,100 (+$38,188)	$4,897,539 (+$278,627)	**$4,394,617 (-$224,295)**

5.1.4.6 Conclusions - Alternative Suite A4

Sub-Alternative A4b and Sub-Alternative A4c could provide the highest estimated target species catch and revenue. However, both sub-alternatives have the lowest overall metric scores and scope (total area protected by the closure multiplied by the number of closure months), thus providing less protection of areas of high bycatch interaction. Although Sub-Alternative A4a (No Action) protects bycatch species and the spatial and temporal extent would remain the same, one of the other sub-alternatives may optimize the shape of the area and achieve a better balance among the objectives of this amendment. Sub-Alternative A4d, the Preferred Sub-Alternative, would result in increased conservation of bycatch species through the reconfiguration of the spatial area. The preferred sub-alternative had the highest conservation of leatherback sea turtle and shortfin mako shark compared to all other A4 Sub-Alternatives. Furthermore, Preferred Sub-Alternative A4d would increase protection of Rice's whale, particularly in the medial portion of the range, and would increase protections of the species' biologically important area to 94 percent. Although the preferred sub-alternative had a slight increase in the scope relative to the No Action sub-alternative and the lowest estimated revenue, however, fishermen are unlikely to fish in areas with lower catch rates, so reductions in revenue may not be realized. The shape and location of the new area may provide commercial fishermen access to potentially productive areas that were previously closed. For example, the southernmost portion of the current DeSoto Canyon closed area may provide new fishing opportunities for vessel operators fishing for swordfish, which at times occur in larger numbers in the southeast portion of the Gulf of Mexico. As detailed in Section 5.4.6, the preferred DeSoto Canyon spatial management area would continue to prevent pelagic longline fishermen from operating around the Okaloosa fish aggregating devices (FADs), an important recreational fishing location, in the northeastern portion of the Gulf of Mexico.

5.2 "B" Alternatives: Commercial Data Collection

As described in Chapter 3, the "B" Alternatives describe the methods used to obtain data from within the spatial management areas. These data collection alternatives will be combined with the "A" and "C" Alternatives in order to meet the multiple objectives of this management action.

5.2.1 Alternative B1 - No Action - Preferred Alternative for high-bycatch-risk area in the Mid-Atlantic spatial management area and for low-bycatch-risk area in the DeSoto Canyon spatial management area

Alternative B1 would not implement any new closed area data collection approaches to support HMS spatial management.

Ecological Impacts

Since Alternative B1 would not implement any new data collection programs, ecological impacts to target species (e.g., swordfish, yellowfin tuna, bigeye tuna) would be neutral in the short-term. Similarly, in the short-term, indirect ecological impacts to bycatch and incidentally caught species would also be neutral because fishing practices, effort, location, and timing would not change. In the long-term, because there would not be any way to collect data from the spatial management areas and modify them accordingly, the impacts to various species would be unknown. The spatial management areas could be appropriate for the changing needs of the species and aid in protecting critical areas from fishing activities. Similarly, the areas could also be inappropriate and focus fishing activities in areas that are critically important to the species.

Social and Economic Impacts

Because Alternative B1 would not implement any new data collection programs, direct social and economic impacts to fishermen would be neutral in the short-term. Similarly, in the short-term, indirect social and economic impacts to supporting businesses such as dealers and bait/tackle suppliers would also be neutral. In the long-term, as described above, because there would not be any way to collect data from the spatial management areas and modify them accordingly, the impacts to the species, and therefore the impacts to the fishermen and the economy, would be unknown. If the spatial management areas are appropriate and the species and their habitat are protected, fishermen and related industries might experience an increase in revenue if species become more abundant. However, if the spatial management areas are inappropriate and do not protect the species and their habitat, fishermen and related industries might experience a decrease in revenue if the species abundance declines. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

5.2.2 Alternative B2: NOAA Fisheries spatial management area research fishery

This alternative would create a new research fishery for the pelagic longline fishery, which would be similar to the existing Shark Research Fishery. This alternative would be the No Action alternative for the bottom longline fishery since the Shark Research Fishery already operates in the Mid-Atlantic shark closed area. Under this alternative, permitted commercial fishing vessel operators could apply, and a small number would be selected, for participation in the spatial management area research fishery.

Ecological Impacts

Alternative B2 would result in neutral ecological impacts to target species. A spatial management research fishery would rely on commercial fishermen's willingness to fish under the program and, since they would not be compensated, the decision to fish would largely be based on fish availability and market conditions. The target species are quota-managed species, and this alternative would not affect the overall U.S. quotas for swordfish, yellowfin tuna, bigeye tuna (species targeted in the pelagic longline fishery), or sharks (species target in the bottom longline fishery), which prevent overfishing, are based on the best scientific information available, and are consistent with the ICCAT-recommended TACs and quotas.

Indirect ecological impacts to bycatch and incidentally caught species in the short-term would be neutral since the level of fishing effort is unlikely to change due to implementation of a research fishery. However, Alternative B2 may result in minor long-term beneficial ecological impacts since data collection in spatial management areas may lead to more efficient protections for bycatch and incidentally caught species.

Social and Economic Impacts

Alternative B2 would be a voluntary program and fishermen would continue to decide whether to fish based on market conditions, fish availability, and the restrictions and conditions of the research fishery. Because of the limited nature of the research fishery, large beneficial social and economic impacts to fishermen are not expected. Providing fishermen with more options of areas to fish in would provide option value in preserving the opportunity into the future for fishermen to choose whether to participate in the research fishery. However, if research fishing in spatial management areas provides equally or more productive fishing grounds closer to port, shorter transit times and trips could lower costs resulting in higher profits for fishermen. Another benefit of a research fishery is that it may be more likely to provide data on a continuing basis, and reduce management uncertainty. However, the administrative costs of the program to the Agency are likely to be higher than externally planned and funded projects approved under an EFP. Thus, Alternative B2 would have minor beneficial social and economic impacts. Indirect social and economic impacts to supporting businesses such as dealers and bait/tackle suppliers would be neutral. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

5.2.3 Alternative B3: Monitoring area – Preferred Alternative for low-bycatch-risk areas in the Charleston Bump and East Florida Coast spatial management areas

Under Alternative B3, commercial fishing vessel operators would be permitted to fish inside previously closed areas subject to the current applicable regulations, but also subject to other conditions to monitor and limit fishing activities to mitigate potential adverse ecological impacts. As described in Chapter 3, access to the monitoring areas is intended to provide data on the costs and benefits of the spatial management area and the status of achievement of relevant objectives. To the extent practicable, the monitoring area would allow commercial fishing gear and practices similar to that employed outside the area, in order to be comparable to fishing using routine practices.

Ecological, social, and economic impacts of monitoring areas which include impacts of Sub-Alternatives B3a through B3f (management tools for monitoring areas), are described below. After the overarching impacts discussion for Alternative B3, pros and cons of each sub-alternative are described as well as additional economic impacts, if any. In addition, there is further explanation within the Preferred Alternatives Packages of the preferred B3 Sub-Alternatives.

Ecological Impacts

Alternative B3 would result in neutral ecological impacts to target species. The amount of fishing effort in the monitoring area would reflect commercial fishermen's decisions to fish in the area based on market conditions, fish availability, and the restrictions of the monitoring area. The target species are quota-managed species, and this alternative would not affect the overall U.S. quotas for swordfish, yellowfin tuna, bigeye tuna (species targeted in the pelagic longline fishery), or sharks (species target in the bottom longline fishery), which prevent overfishing, are based on the best scientific information available, and are consistent with the ICCAT-recommended TACs and quotas.

Indirect ecological impacts to bycatch and incidentally caught species are likely to be neutral in the short-term because of the conditions and restrictions associated with the monitoring area(s), and the fact that the spatial and temporal aspects of the monitoring areas are specified locations and times for which the risk of interactions with the HMS PRiSM- modeled bycatch species are relatively low. Monitoring areas in high-bycatch-risk areas, if implemented, would require more robust conditions and restrictions. In the long-term this alternative would likely result in minor beneficial ecological impacts because the data collected from monitoring areas would support future evaluation and optimization of spatial management areas and lead to more efficient protections for bycatch and incidentally caught species.

Social and Economic Impacts

Fishing effort in the monitoring area(s) would rely on commercial fishermen's willingness to fish in the area based on market conditions, fish availability, and the restrictions of the monitoring area. Although it is difficult to predict the amount of fishing effort and fish availability that would occur in the monitoring areas, the socio-economic impact is likely to be either neutral or minor and beneficial. Access to previously closed areas would provide the flexibility to fish in locations previously closed to fishing. Such flexibility, in addition to the potential for generating revenue, may yield valuable social benefits that support the sustainable participation of vulnerable communities. For fishermen in communities with high commercial engagement and reliance upon fishing, such flexibility may decrease uncertainty in their businesses. If access to fishing in monitoring areas decreases the amount of steaming time required to reach the fishing locations, operating costs may be reduced, and a shorter trip duration would facilitate participation in the fishery. Shorter transit times would also result in reduced fuel consumption. Owners of fishing vessels can often have difficulty finding and hiring crew willing to work on vessels, in part due to the duration of fishing trips, and the impact of fishing trips on crew members' lives. Lastly, if the distance from shore to the location of fishing is reduced, it may slightly reduce the safety risks associated with longline fishing. The increased revenue and flexibility associated with monitoring areas would be limited by the restrictions and costs associated with the monitoring areas such as effort caps or the cost of electronic monitoring. The indirect social and economic impacts to supporting businesses such as dealers and bait/tackle suppliers would also be neutral or minor beneficial. There may be minor adverse social and economic impacts on the participants in recreational fisheries in monitoring areas if pelagic longline fishing in the area affects recreational fishing through gear conflicts or competition for target species. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

5.2.3.1 Sub-Alternative B3a: Effort caps– Preferred Sub-Alternative for low-bycatch-risk areas in the Charleston Bump and East Florida Coast spatial management areas

This sub-alternative would implement effort caps (i.e., the number of longline sets) in the monitoring areas to ensure excessive fishing does not occur in the area in order to backstop bycatch protection. In conjunction with effort caps, vessel operators would be required to report all sets and all catch via VMS. When the number of sets reaches, or is projected to reach, the effort cap, fishing would be prohibited in the monitoring area. NOAA Fisheries may also close the monitoring area before the effort cap is reached and/or not reopen areas, if warranted by conservation and management concerns raised by unexpectedly high bycatch, high data collection efforts, fishing effort that is overly clustered temporally or spatially, or other relevant considerations.

Pros

Fishing effort caps ensure that the amount of fishing that occurs in monitoring areas is limited, and, therefore, can provide an indirect method of limiting the amount of potential bycatch within the monitoring area. Because effort caps limit overall fishing effort and affect both target catch and bycatch, they can constrain the level of catch of a wide range of species. Effort caps are relatively simple to monitor and enforce. Under current regulations, pelagic longline vessel operators already report sets using VMS; bottom longline vessel operators do not have this requirement at this time. Further, VMS data provides the means to track the location of sets. NOAA Fisheries receives VMS reports in real-time, which would allow for us to quickly make a determination of the amount of effort relative to the effort cap. NOAA Fisheries could provide public updates on effort caps, similar to what is currently done on a monthly basis for landings updates, and then close monitoring areas quickly once effort caps are reached. Rapidly closing the monitoring area once the effort cap is reached is important for migratory species with changing distributions. If there is a long delay between reaching the effort cap and closure, species may have already moved out of the monitoring area, obviating the need for protection. Additionally, NOAA Fisheries can use fishing effort estimates to calculate the bycatch cap levels for each species by extrapolating observer reports. Because effort is a key component of bycatch cap calculation, limiting effort may result in a similar level of bycatch protection as a bycatch cap. The effort and catch data obtained through VMS would serve as one of the sources of data used to evaluate the effectiveness of spatial management areas. In conjunction with effort caps, NOAA Fisheries would have the authority to close the fishery. The Agency would have the authority to further restrict or end access to the monitoring areas if caution is warranted due to unexpectedly high bycatch, high data collection efforts, fishing effort that is overly clustered temporally or spatially, or other relevant considerations.

Cons

Effort caps do not provide for direct limits on the amount of catch of individual bycatch species. Effort caps rely on the assumption of the proportional relationship between fishing effort and the bycatch. In other words, effort caps assume that less fishing effort results in less bycatch. Although this relationship is true overall, the relative amount of bycatch associated with a level of fishing effort likely varies by bycatch species and could depend on environmental conditions at the time of fishing. Second, effort caps may limit target catch. An effort cap applied to the level of the fishery would not preclude individual vessel operators from deploying a disproportionate amount of fishing effort, and may result in a "race-to-fish." However, additional requirements, for example implementation of Sub-Alternative B3e (expanded EM review requirements), could present increased costs, which could reduce incentives, and therefore mitigate "race-to-fish" concerns.

5.2.3.2 Sub-Alternative B3b: Bycatch caps

Sub-Alternative B3a would implement bycatch caps for some species. All catch, regardless of disposition, would count toward the bycatch cap. Reaching bycatch caps would close the monitoring area to future fishing. In conjunction with bycatch caps, vessel operators would be required to report all sets and all catch via VMS.

Pros

Implementation of bycatch caps would allow for direct limits on the amount of catch of relevant bycatch species in monitoring areas. These limits would help ensure that data collection from commercial fishing in areas and times that were previously closed would not result in adverse levels of interactions with bycatch species. The Agency would have the authority to further restrict or end access to the monitoring areas if caution is warranted due to unexpectedly high bycatch, high data collection efforts, fishing effort that is overly clustered temporally or spatially, or other relevant considerations.

Cons

While bycatch caps can theoretically directly limit the amount of catch of bycatch species, a number of practical considerations reduce their potential effectiveness. First, interactions between the fishery and bycatch species are relatively rare events and the rate of interactions vary. The uncertainty regarding the likelihood of interactions with various species makes it difficult to select which species should have bycatch caps, and to determine the appropriate level of each bycatch cap. Multiple species may be in need of consideration, however, as more species are included, the complexity of monitoring and administering bycatch caps increases. Second, the calculated bycatch caps for some species are so small as to not be practical. For example, the calculated bycatch cap for longbill spearfish would be one fish in most areas. Such a small bycatch cap is difficult to enforce and does not provide flexibility for rare events. In a situation where there are bycatch caps for several species, and the catch of any of the caps would result in terminating access to the area, the smallest cap may function as the default cap. Third, although VMS reporting of catch is relatively quick, other reporting methods that may be used to corroborate VMS reports have a longer time frame. Data from logbooks, observer reports, or electronic monitoring systems are not available until well after the trip has been completed. Given that there may be incentives to underreport bycatch, corroboration of VMS data may be required to provide a full accounting of bycatch events. If there is a time delay between the catch events and full accounting for bycatch, the effectiveness of a bycatch cap at limiting catch would be reduced. If attainment of a bycatch cap resulted in closing access to the monitoring area, highly mobile species may no longer be in the area by the time the monitoring area is closed.

5.2.3.3 Sub-Alternative B3c: Trip level effort controls

Sub-Alternative B3c considers trip-level effort controls in monitoring areas (i.e., limiting the number of hooks and sets an individual vessel operator may take in a monitoring area). In conjunction with trip-level effort caps, vessel operators would be required to report all sets and all catch via VMS.

Pros

Limiting the number of sets or hooks an individual vessel operator may deploy while collecting data in spatial management areas provides similar limits on fishing effort and therefore bycatch reduction, but are easier to implement. Fishermen would have no new effort reporting requirements and the Agency would not need to actively track effort or initiate closures if set effort levels are exceeded. The Agency would have the authority to further restrict or end access to the monitoring areas if caution is warranted due to unexpectedly high bycatch, high data collection efforts, fishing effort that is overly clustered temporally or spatially, or other relevant considerations.

Cons

Trip-level effort controls would be set at a level near the average number of hooks per set and sets per trip. However, these limits could still result in data collection that does not match normal fishing practices. This mismatch can reduce the utility of comparing spatial management catch rates and composition with those that occur outside the area. Trip-level effort controls also do not limit total effort, rather, they slow the rate of effort. Additionally, the absence of active tracking would delay identification of excessive effort in the monitoring areas. Also, trip-level effort caps may limit target catch.

5.2.3.4 Sub-Alternative B3d: Observer Coverage

Sub-Alternative B3d would require an observer to be onboard for all trips in monitoring areas.

Pros

Requiring observers on board vessels in spatial management areas would provide high-quality, verified catch and fishery operation data, and would provide data that could not be collected easily without the observer (e.g., biological information about the catch or information on how the turtle or fish was hooked). In the long-term, data provided by observers could be used as one of the sources of data used to evaluate the effectiveness of spatial management areas.

Cons

There is a time delay between the time observer data is collected, and when it may be used by fishery managers due to the duration of fishing trips; and the process of observer debriefing, quality control and data finalization. Therefore observer data has limitations on its usefulness to monitor catch in real time. Secondly, observers are provided by NOAA Fisheries for only a limited number of trips. For example, the Pelagic Observer Program is structured, funded, and staffed to implement specific objectives in the Gulf of Mexico and Atlantic. Fishermen that have not been assigned an observer but wish to fish inside spatial management areas would need to work directly with contracting companies providing observers to the SEFSC. Observers may not be available unless additional observers are hired, trained, and on standby for the purpose of deployment to monitoring areas.

Additional Economic Impacts

Vessel owners would be required to pay costs associated with an observer, which can be expensive. In addition to feeding and housing the observers, fishermen would need to pay the contracting company approximately $777 per day. Thus, a five day trip would cost $3,885 to carry an observer and longer trips incur a higher cost. Note that this estimate is preliminary and assumes that the existing staff support and infrastructure could handle the increase in observer requirements. If additional staff support and infrastructure support is needed, for example additional training, equipment and supplies, shoreside support, trip debriefing, data entry and other data processing needs, the price per day would increase. Additionally, an observer may not be available during the times they are needed by the fishermen, either delaying or shortening trips.

5.2.3.5 Sub-Alternative B3e: Electronic Monitoring– Preferred Sub-Alternative for low-bycatch-risk areas in the Charleston Bump and East Florida Coast spatial management areas

Sub-Alternative B3e would require review of electronic monitoring video on all trips in monitoring areas on which there is not an observer deployed. In conjunction with electronic monitoring, vessel operators would be required to report all sets and all catch via VMS.

Pros

Electronic monitoring is currently required in the HMS pelagic longline fishery (but not the bottom longline fishery), and most vessels already have the equipment installed and are familiar with the operational requirements. Electronic monitoring would enable the collection of data on catch, fishing effort and location. For example, review of all video from a trip may enable determination of catch composition. Data collected from electronic monitoring could be used to corroborate fisherman-reported catch information, and serve as one of the sources of data used to evaluate the effectiveness of spatial management areas.

Cons

Currently, the electronic monitoring program and sampling design for video review is primarily used to corroborate fisherman-reported bluefin tuna catch data and shortfin mako shark discard data and is not used to provide a census of catch. Additionally, EM is not required in the bottom longline fishery so equipment would need to be installed on those vessels. Although EM systems can provide valuable information on catch and other fishing metrics, the data may not be available on a real-time basis, so its utility for inseason monitoring of bycatch catch is limited.

Additional Economic Impacts

Expanding the use of electronic monitoring to 100-percent video review of all sets that occur within the monitoring area would require owners or operators of fishing vessels to pay for the additional review. Each set would cost approximately $290 for a full video review, thus, a typical ten day trip consisting of six sets would cost $1,740. Note that this estimate is preliminary and assumes that the existing EM program, or a modified one under the "F" Alternatives, has the capacity to review additional videos without added infrastructure or staff. Should vendors providing video review require additional support or staff, costs could be higher. If cost reduction measures in the "F" Alternatives are implemented or if other efficiencies are developed, costs could be lower. Additionally, EM systems are not currently installed on bottom longline vessels and, if implemented, bottom longline vessel owners would need to purchase and install the equipment at a cost of approximately $15,000.

5.2.3.6 Sub-Alternative B3f: Data Sharing and Communication

This sub-alternative would require fishermen in monitoring areas to communicate the location of bycatch and relocate to areas that are less likely to result in interactions with bycatch species. Meeting these requirements would require the industry to establish a third-party reporting system to collect and distribute/communicate the information.

Pros

This sub-alternative could increase bycatch protection in near real time since, once identified, the location of bycatch interactions could be avoided. As bycatch species move through the monitoring area, information on catch location could continually be updated, even on a day-to-day basis, depending on the distribution of fishing effort. Sharing information about bycatch among fishermen on the water has been one method of bycatch avoidance that has been supported by fishermen and implemented by the Agency (e.g., to avoid interactions with pilot whales as part of the Pelagic Longline Take Reduction Plan or avoid interactions with dusky sharks as part of Amendment 5b to the HMS FMP).

Cons

Creating a third-party reporting and communicating program would require an investment of time, money, and administrative efforts by the industry. Data sharing and communication is difficult to enforce and the level of compliance with similar requirements in the fishery is not clear.

5.2.4 Alternative B4: Cooperative research via EFP – Preferred Alternative for high- and low-bycatch-risk areas in the Charleston Bump and East Florida Coast spatial management areas and high-bycatch-risk area in the DeSoto Canyon spatial management area.

Under this alternative, data would be collected from within a spatial management area, which would otherwise be closed, through the issuance of an EFP. This EFP would be issued to fishing vessels, researchers, and fishermen participating in specific research. The EFP would exempt participating vessel operators from certain regulatory requirements for specific research during a limited time frame. To be considered consistent with this impact analysis, an application for gear-specific research in spatial management areas should incorporate the elements detailed in Section 3.2.4.

Ecological Impacts

Alternative B4 would result in neutral ecological impacts to target species. Research conducted via an EFP would involve very limited effort and would not necessarily be deployed to maximize target catch. Instead, effort would be distributed across the spatial management area to ensure proper study design. The target species are quota-managed species, and the issuance of an EFP for research and data collection within a spatial management area would not affect the overall U.S. quotas for swordfish, yellowfin tuna, bigeye tuna (species targeted in the pelagic longline fishery), or sharks (species target in the bottom longline fishery), are based on the best scientific information available, and are consistent with the ICCAT-recommended TACs and quotas.

Indirect ecological impacts to bycatch and incidentally caught species in the short-term would be neutral due to the standardized elements and restrictions designed to limit bycatch described in detail in Alternative B4 in Section 3.2.4. These standardized elements for conducting research in spatial management areas include effort caps, bycatch caps, reporting and monitoring requirements, exclusion areas, fleet communication, and an approved study design.

Effort caps in each of the spatial management areas would be established to ensure that fishing levels are set at conservative levels. Effort cap calculations are detailed for each area in Chapter 3. Once the effort cap is reached, all research activity in that area would cease.

Bycatch would also be directly controlled through bycatch caps. Each area has a calculated limit on the number of individuals of various species (depending on the area) that may be caught in any one year. For example, for the East Florida Coast Spatial Management Area, the annual bycatch cap for shortfin mako sharks is 24 individuals (see Table 16 in Chapter 3). Once any single species' cap is reached, all research in that area must cease. As described in Chapter 3, the bycatch cap for each species (except Rice's whale, which would have a precautionary bycatch cap of one) is set at a level equal to the rate of interactions across the rest of the fishery so research activities would not have a rate of bycatch impact different than normal fishing operations. The rest of the required conditions for cooperative EFP research in spatial management areas directly or indirectly support the limitation of bycatch while collecting data.

Alternative B4 would likely result in indirect long-term minor beneficial ecological impacts because data collection in spatial management areas would lead to more efficient protections for bycatch and incidentally caught species.

Social and Economic Impacts

Fishermen participating in research under an EFP are likely to be compensated through some combination of commercial target catch sales and research funds. Since the fishermen are likely to operate in areas of unknown target catch rates, researchers may partially or fully fund fishing activities to ensure trips do not have negative profits. As such, fishermen operating under the EFP are unlikely to experience adverse economic impacts nor are they expected to realize larger profits than regular commercial fishing. Thus, Alternative B4 would have neutral social and economic impacts. Indirect social and economic impacts to supporting businesses such as dealers and bait/tackle suppliers would also be neutral. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

5.2.5 Comparison of Commercial Data Collection - B Alternatives

Each of the B Alternatives have unique advantages, particularly when applied as a condition of access to specific spatial management areas. Alternative B1, the No Action alternative, would be the easiest to implement and result in the fewest regulatory changes for the affected community. If an area already has sufficient data collection, the No Action alternative may be appropriate. In contrast, Alternative B2 (Research Fishery) would likely be the most complex to implement and administer. However, a research fishery program may be able to collect data in a more organized manner leading to more useful analyses in a shorter amount of time since data collection would occur under a planned research program.

Alternative B3 would implement a monitoring area, which allows commercial fishing in a spatial management area provided vessel operators meet certain criteria and comply with specific requirements in order to mitigate potential adverse ecological impacts. A monitoring area would likely gather a large amount of data, but unlike an EFP program (Alternative B4) or a research fishery (Alternative B2), fishing effort would not necessarily be distributed across time and space in a manner that would lead to robust analyses in the near-term. Rather, the Agency would need to wait until fishing effort is sufficiently distributed to analyze catch rates across the entire area and time. However, in those areas and times where fishermen concentrate effort, analyses could be completed more quickly. Furthermore, analyses would be most relevant to normal commercial fishing since vessels operating in the monitoring area would not have different gear configuration requirements than fishing outside the area.

Alternative B3 also includes six sub-alternatives to consider if implementing a monitoring area. Sub-Alternative B3a would implement effort caps to ensure that total gear-specific commercial effort stays at a low level. Sub-Alternative B3b would implement bycatch caps to ensure that catch of certain species stays at low levels. Implementation of effort caps and bycatch caps have the same ultimate goal in monitoring areas: to limit bycatch of species that may be protected by the current closure. Since both effort caps and bycatch caps have the same goal, implementing both may introduce unnecessary redundancy. Bycatch caps would provide direct limits on bycatch, however, two key disadvantages exist. First, narrowing the list of species to monitor is difficult. Some species, such as leatherback sea turtles in the pelagic longline fishery, would be a priority, however, others, such as some large coastal sharks may not warrant hard caps on bycatch. Selecting species for bycatch caps is further complicated by the need to keep the list to a reasonable number of species to avoid unnecessary reporting and administrative burdens. The number of species that is a "reasonable number" is also difficult to determine. Second, there is a timing delay with catch data, the length of which depends on the reporting program. Managing access and effort inside a monitoring area would have a delay between the catch event and the triggered bycatch cap measures due to the reporting delay. The shortest delay would occur with fishermen-reported data, likely within 24 hours of the catch event. However, fishermen could have incentives to underreport bycatch events without some method of verification such as electronic monitoring.

A more robust source of bycatch information would come from on board fishery observers (Sub-Alternative B3d). Fishery observers are trained in species identification and reporting and are unlikely to have an incentive to underreport. However, only a portion of the fishery is observed in any one year and observed bycatch levels would need to be extrapolated based on total fishery effort. Such extrapolations would take time and may need a full year of data. Thus, the delay between exceeding the bycatch cap and taking management action would likely be several months, reducing the utility of the triggered measures. Effort caps do not have the disadvantages associated with species-specific bycatch catch. First, limiting effort would reduce catch of all species including all bycatch species without the need for creating a priority list of species. Second, effort data is available more quickly (through VMS). Thus, once an effort cap is reached, triggered measures such as prohibiting further effort in the monitoring area could be implemented relatively quickly. Trip-level effort controls (Sub-Alternative B3c) may require fishermen to fish in a manner that differs from normal fishing practices, limiting the utility of data collected to be applied to normal commercial fishing.

This amendment analyzes two sub-alternatives to verify catch information in monitoring areas: Sub-Alternative B3d (observer coverage) and Sub-Alternative B3e (electronic monitoring). Observer coverage would provide the highest quality data with respect to catch, effort, and fishing practices since a trained onboard fishery observer provides first-hand accounts and can ask clarifying questions in the case of ambiguities. Observers also carry the higher cost between the two options. The Agency would pay for observers that are assigned through the current observer program, however, the current level of observer coverage is unlikely to cover the total number of trips longline fishermen may choose to make in monitoring areas. Furthermore, if observer coverage through the current program becomes clustered in monitoring areas, the observer would likely distribute the coverage to other areas. Fishermen wishing to fish inside closed areas that have not been assigned an observer would need to work directly with fishery observer contracting companies to secure and pay for coverage. Costs for the coverage are detailed in the social and economic impacts of Sub-Alternative B3d.

Electronic monitoring provides another option to verify catch information and, in the case of pelagic longline vessels, is already required to verify bluefin tuna catch and shortfin mako shark discards. Because of this requirement, the equipment is already installed on most vessels, and fishermen are familiar with the process. Note that bottom longline vessels do not currently have electronic monitoring equipment installed and would need to do so. In addition to possible equipment costs, the only additional requirement would be for fishermen to pay for 100 percent video review of their camera footage when operating inside the monitoring area. Costs associated with 100-percent video review are detailed in the social and economic impacts of Sub-Alternative B3e. Electronic monitoring data on catch may not be as high quality as that collected by observers since catch cannot be directly measured, first-hand species ID cannot be made, and clarifying questions cannot be asked in real-time. However, catch data collected through EM is likely sufficient to fully characterize catch.

NOAA Fisheries also considered Sub-Alternative B3f which would require data sharing and communication to avoid bycatch in monitoring areas. However, due to the cost and coordination required to set up a third party communication system and the difficulty enforcing such a requirement, this sub-alternative is not preferred.

5.2.6 Conclusions

The No Action alternative (Alternative B1) would not implement any new closed area data collection approaches to support HMS spatial management and, therefore, would not achieve the objectives of this Amendment. A research fishery (Alternative B2) would provide modest ecological or social benefits because it would be limited in the number of volunteer participants and the ability of the Agency to place observers. Monitoring areas (Alternative B3) in low-bycatch-risk areas (as determined using HMS PRiSM) has several strengths. Data collected would likely be comparable to fishing activity outside of the monitoring area; the amount of data collected may be greater than under a research fishery or EFP; and there would be reporting and monitoring conditions that mitigate potential impacts on bycatch species. The ecological impacts to bycatch and incidentally caught species of monitoring areas are likely to be neutral because of the conditions and restrictions associated with the monitoring area(s), and the fact that the spatial and temporal aspects of the monitoring areas are specified locations and times for which the risk of interactions with the HMS PRiSM-modeled bycatch species are relatively low. If monitoring areas are implemented in high-bycatch-risk areas, we could increase the number of requirements and conditions to minimize ecological impacts. NOAA Fisheries would have the authority to end access to the monitoring area. Access to previously closed areas would provide the flexibility to fish in locations previously closed to fishing. Such flexibility, in addition to the potential for generating revenue, may yield valuable social benefits that support the sustainable participation of vulnerable communities. For fishermen in communities with high commercial engagement and reliance upon fishing, such flexibility may decrease uncertainty in their businesses.

Research conducted via an EFP (Alternative B4) in either high-bycatch-risk areas or low risk bycatch areas would involve very limited effort and would not necessarily be deployed to maximize target catch. Instead, effort would be distributed across the spatial management area to ensure proper study design. Indirect ecological impacts to bycatch and incidentally caught species in the short-term would be neutral due to the standardized elements and restrictions designed to limit extensive bycatch. NOAA Fisheries would have the authority to end the EFP research if necessary.

5.3 "C" Alternatives: Evaluation Timing of Spatial Management Areas

As described in Chapter 3, the "C" Alternatives consider the timing of when to evaluate whether the spatial management areas are effective and meeting their respective management goals. The timing alternatives are intended to be combined with the "A" and "B" Alternatives in order to meet the multiple objectives of this DEIS. For Alternatives C2, C3 and C4, NOAA Fisheries is proposing regulatory text with factors for consideration when reviewing areas.

5.3.1 Alternative C1: No Action

Under this alternative, NOAA Fisheries would not commit to a schedule to evaluate the spatial management modifications using data collected under the programs proposed by this action. Selection of this alternative would not preclude future evaluation, but the timing would not be set through this action.

Ecological Impacts

Evaluations of spatial management areas are administrative in nature and would not have any short-term impacts on target species, bycatch, or incidentally-caught species. If ocean or environmental dynamics change substantially and spatial management areas are not evaluated periodically, those areas may not address changing needs of species and changes in fishing activities. In the long-term, evaluation of spatial management areas could result in minor beneficial ecological impacts due to optimized protections for bycatch and incidentally-caught species.

Social and Economic Impacts

Evaluations of spatial management areas are administrative in nature and would not have any short-term social and economic impacts on fishermen or indirect impacts on supporting businesses. In the long-term, evaluation of spatial management areas could result in minor beneficial social and economic impacts due to the achievement of a better balance between the ecological and socioeconomic impacts of spatial management areas. This No Action Alternative has no time period for reviews or factors to consider when reviewing areas, and thus has less clarity process-wise than Alternatives C2, C3 and C4. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

5.3.2 Alternative C2: Evaluate once three years of data are available (or since most recent evaluation) – Preferred Alternative

Under Alternative C2, NOAA Fisheries would evaluate the four spatial management areas once three years of catch and effort data is finalized and available. Subsequent reviews would occur after three full years of data are available after the conclusion of the previous evaluation. For this alternative, NOAA Fisheries is proposing regulatory text with factors for consideration when reviewing areas. During the evaluation, NOAA Fisheries would analyze a range of data and information including catch and discard data, social and economic data, oceanographic features and variations and other technical considerations. Additionally, catch data from inside and outside the spatial management areas would be analyzed and potentially added to updated HMS PRiSM models. The results from the evaluation would inform next steps. For example, if higher bycatch occurs during data collection than expected, additional protections or modifications to the high- and low-risk areas could be considered through framework adjustment, as appropriate (see 50 C.F.R. 635.34). Any changes to the programs or modifications implemented in this action would not be changed without a full rulemaking including proposed rule, public comment period, and final rule.

Ecological Impacts

Evaluations of spatial management areas are administrative in nature and would not have any short-term impacts on target species, bycatch, or incidentally caught species. In the long-term, evaluation of spatial management areas could result in minor beneficial ecological impacts due to optimized protections for bycatch and incidentally caught species.

Social and Economic Impacts

Evaluations of spatial management areas are administrative in nature and would not have any short-term social and economic impacts on fishermen or indirect impacts on supporting businesses or recreational fisheries. In the long-term, evaluation of spatial management areas could result in minor beneficial social and economic impacts due to the achievement of a better balance among the ecological, social, and economic impacts of spatial management areas. Evaluation of spatial management areas on a regular basis would increase administrative costs to NOAA Fisheries.

5.3.3 Alternative C3: Evaluate once five years of data are available (or since most recent evaluation)

Spatial management area evaluation under Alternative C3 would be the same as Alternative C2, except that the evaluation would occur after five years of data are available post-implementation of modifications and then subsequently in five-year intervals of data availability after the conclusion of the previous evaluation.

Ecological Impacts

Evaluations of spatial management areas are administrative in nature and would not have any ecological impacts on target species or short-term impacts on bycatch or incidentally caught species. In the long-term, evaluation of spatial management areas could result in minor beneficial ecological impacts due to optimized protection of bycatch and incidentally caught species.

Social and Economic Impacts

Evaluations of spatial management areas are administrative in nature and would not have any short-term social and economic impacts on fishermen or indirect impacts on supporting businesses or recreational fisheries. In the long-term, evaluation of spatial management areas could result in minor beneficial social and economic impacts due to the achievement of a better balance among the ecological, social, and economic impacts of spatial management areas. Evaluation of spatial management areas on a regular basis would increase administrative costs to NOAA Fisheries, but this alternative would have less administrative costs than Alternative C2 given the longer period between regular reviews.

5.3.4 Alternative C4: Triggered Evaluation – Preferred Alternative

Under Alternative C4, spatial management area evaluation would be the same as under Alternatives C2 and C3, with the exception of the timing component. In addition to preferring the three-year evaluation schedule (Alternative C2), NOAA Fisheries also prefers Alternative C4, under which the Agency would monitor data collection activities and may review spatial management areas if specific concerns arise, which may include but are not limited to unexpectedly high or low bycatch, high or low data collection efforts, fishing effort that is overly clustered temporally or spatially, changed conditions within the fishery as a whole, or changed status of relevant stocks.

Ecological Impacts

Evaluations of spatial management areas are administrative in nature and would not have any short-term ecological impacts on target species or on bycatch or incidentally caught species. In the long-term, evaluation of spatial management areas could result in minor beneficial ecological impacts due to optimized protection for bycatch and incidentally caught species.

Social and Economic Impacts

Evaluations of spatial management areas are administrative in nature and would not have any short-term social or economic impacts on commercial or recreational fishermen or on supporting businesses. In the long-term, evaluation of spatial management areas could result in minor beneficial social and economic impacts due to the achievement of a better balance among the ecological, social, and economic impacts of spatial management areas. Evaluation of spatial management areas on a regular basis would increase administrative costs to NOAA Fisheries.

5.3.5 Alternative C5: Sunset Provision

Ecological Impacts

Alternative C5 would eliminate spatial management areas after a set number of years (i.e., "sunset" them) unless the Agency takes action to extend them. Alternative C5 would likely have neutral ecological impacts on target species because the target species are quota-managed species, and this alternative would not affect the overall U.S. quotas for swordfish, yellowfin tuna, bigeye tuna (species targeted in the pelagic longline fishery), or sharks (species target in the bottom longline fishery). The quotas, which prevent overfishing, are based on the best scientific information available, and are consistent with the ICCAT-recommended TACs and quotas.

At this time, NOAA Fisheries is not preferring this alternative and not proposing specific sunset dates for the spatial management areas. The level of fishing and rate of bycatch or incidental catch interactions that could occur in spatial management areas is difficult to quantify. Thus, a sunset provision may not be sufficiently precautionary and could increase the risk of minor adverse ecological impacts due to the potential for increased interactions with bycatch or incidental catch species. If sunset dates are considered for particular areas, NOAA Fisheries would conduct analyses of ecological, economic and social impacts of potential dates and, as needed, establish criteria for potential extension or removal of the sunset dates

Social and Economic Impacts

Eliminating spatial management areas after a set number of years would provide additional flexibility for fishermen to fish in areas that were previously closed to fishing, and therefore increase the total amount of area to pursue target species. Further, the newly open area may include locations with potential advantages such as higher catch rates or lower trips costs. Thus, Alternative C5 would likely result in minor beneficial social and economic impacts. The social and economic impacts to supporting businesses are expected to be neutral. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

5.3.6 Comparison of Evaluation Timing Alternatives

The evaluation timing alternatives would result in a range of timing though short-term impacts are all neutral. Alternatives C2, C3, and C4 would provide clarity about anticipated timing for regular review of areas as well as factors for consideration during the reviews. Alternative C2 is preferred because it provides the Agency a balance between allowing sufficient time to collect data while also being responsive to oceanographic, fishery, and biological changes that can happen on short time scales. Alternative C4 is also preferred because it provides additional flexibility to begin an evaluation if conditions warrant it. As noted above, Alternative C5 is not preferred at this time.

5.4 "D" Preferred Alternative Packages (D1, D2, D3, and D4)

In this section, NOAA Fisheries describes the preferred alternatives and sub-alternatives for each of the four spatial management areas in "D" preferred alternative packages. These Preferred Alternative Packages are designed to work together to achieve the objectives of the spatial management areas, in consideration of the unique aspects of each of the spatial management areas. Given the number of possible combinations of alternatives, to simplify the analyses, Chapter 5 provides impact analyses of each unique alternative and sub-alternative then summarizes impacts for the preferred combination of A, B, and C Alternatives. While this DEIS provides NOAA Fisheries' preferred combination for each of the four spatial management areas, based on public comment and additional analyses, the preferred combinations may change in the FEIS

Regarding scope: The preferred modifications to the four spatial management areas would result in geographic and temporal changes to what have been static areas. As noted in the discussions above, since there are two components to the measurement of the spatial management areas, space and time, using only one of these metrics would not provide an adequate characterization of the change in protection offered by these areas. For example, a large geographic area closed for a short amount of time may not provide more protection than a small area closed for a long period of time. To combine space and time metrics, Table 5.114 uses "scope" to describe the change in space and time of the four spatial management areas. "Scope" equals square miles multiplied by the number of closure months. The table only applies to the high-bycatch-risk areas that are converted to the modified closed areas and do not include the low-bycatch-risk areas. Low-bycatch-risk areas are not open to normal commercial fishing, and, thus, provide additional protection for bycatch species.

Furthermore, a combined space and time comparison of the areas does not translate into a comparison of conservation value. HMS PRiSM results exhaustively demonstrate the value of designing spatial management areas around species interaction probabilities. A large spatial management area located in a region where interactions are unlikely would provide less conservation value than small areas targeted to high probability of fishery interactions. However, a simple "scope" comparison can provide some additional context particularly when reviewing the impacts of the overall preferred packages as discussed below.

Table 5.114. Change in "scope" for four spatial management areas under the preferred alternatives

Closed Area	Percent change in Scope from Status quo (Area * Month = Scope)
Mid-Atlantic Shark	+14%
Charleston Bump	+121%
East Florida Coast	-26%
DeSoto Canyon	+5%

5.4.1 D1: Preferred Mid-Atlantic Spatial Management Area Package

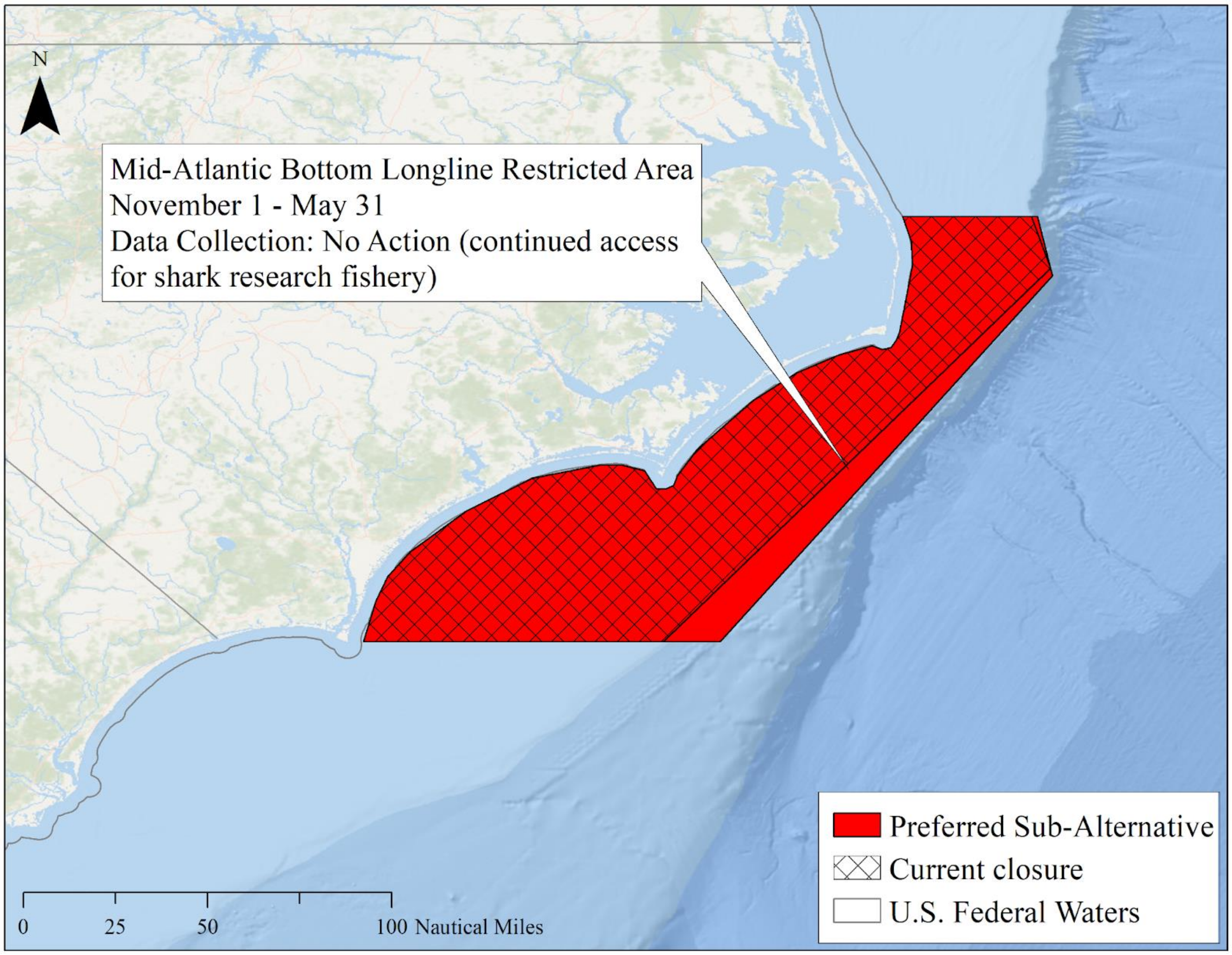

Figure 5.17. Preferred Mid-Atlantic Spatial Management Area Package. High-bycatch-risk area is in red.

Table 5.115. Mid-Atlantic Spatial Management Area - Preferred Alternative Package and combined impacts summary

Alternative	Preferred Alternative	Combined Ecological Impacts	Combined Social and Economic Impacts
"A" - Evaluation and Modification of Areas	A1d (extend eastern boundary; shift closed timing to November 1 – May 31)	Direct short and long-term neutral; Indirect short and long-term moderate beneficial	Direct short and long-term neutral; Indirect short and long-term neutral
"B" - Commercial Data Collection	High-Bycatch-Risk Area: B1 - No Action	Direct short-term neutral and long-term moderate beneficial; Indirect short- and long-term neutral	Direct short-term neutral and long-term moderate beneficial; Indirect short- and long-term neutral
	Low-Bycatch-Risk Area: No low-bycatch-risk area designated	N/A	N/A
"C"- Evaluation Timing	C2 - Evaluate every 3 years	Direct short- and long-term neutral; Indirect short-term neutral; Indirect long-term minor beneficial	Direct short- and long-term neutral; Indirect short- and long-term neutral
	C4 - Triggered evaluation	Direct short- and long-term neutral; Indirect short-term neutral; Indirect long-term minor beneficial	Direct short- and long-term neutral; Indirect short- and long-term neutral

Summary/Discussion:

The preferred Mid-Atlantic Spatial Management Area package would shift the eastern boundary of the current closed area eastward, shift the timing of the area to November 1 through May 31 (Sub-Alternative A1d), and not implement any new data collection program for either the high-bycatch-risk area or low-bycatch-risk area (Alternative B1). The preferred package would also evaluate the area every 3 years (Alternative C2) and, if needed, under a triggered evaluation (Alternative C4).

Regarding the ecological impacts, the spatial and temporal aspects of the Mid-Atlantic Spatial Management Area would increase protection of sandbar, dusky, and scalloped hammerhead sharks relative to the status quo, and, therefore, have moderate beneficial indirect ecological impacts. Direct ecological impacts to target species in the shark bottom longline fishery (including blacktip, spinner, tiger and, notably, sandbar sharks in the shark research fishery) would be neutral since effort in the shark bottom longline fishery is unlikely to increase and, if recent trends continue, could decrease. The spatial extent of the area would increase slightly, and the temporal extent would be shifted, but remain seven months in duration. The small increase in the spatial extent, particularly since it is further offshore, is unlikely to lead to an increase in effort. Data collected through the existing programs, including the shark research fishery, would provide information for future evaluations preferred under Alternatives C2 and C4. Future evaluations would provide information on the effectiveness of spatial and temporal modifications and allow for additional modifications if warranted. Future evaluations under the preferred alternatives would result in minor beneficial long-term indirect impacts due to increased and optimized bycatch species protections.

The preferred A1d modification alternative is not expected to result in a change in revenue relative to the No Action alternative. Indirect impacts to supporting businesses would likely be neutral. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

Overall, this package is preferred because the timing of the spatial management area is shifted earlier by two months, coinciding more closely with the presence of sandbar, dusky, and scalloped hammerhead sharks. When initially implemented in 2005, the timing of the area matched the presence of dusky and sandbar sharks. However, more recently, the two species are arriving and leaving earlier so shifting the timing provides greater protection for the species. Furthermore, the area extends further offshore to encompass the 350-m shelf break where HMS PRiSM results indicate is an important area for the species. While the preferred package would not implement any new data collection program, the preferred package would continue the existing shark research fishery (consistent with Alternative B2) that also implements a number of vessel-specific effort limits (consistent with effort caps considered in Sub-Alternative B3a) and bycatch limits for dusky sharks (consistent with bycatch caps considered in Sub-Alternative B3b). Because of these existing data collection programs, we have determined that additional data collection programs are not warranted at this time. Volunteer rates to participate in the research fishery have declined in recent years. Note that potential future interest in fishing in the shark research fishery, and in this area in particular, may continue to be low as a result of the overall decline in the fishing effort in the commercial shark fishery. If additional data collection programs are warranted in the future, we would consider options in a future rulemaking.

5.4.2. D2: Preferred Charleston Bump Spatial Management Area Package

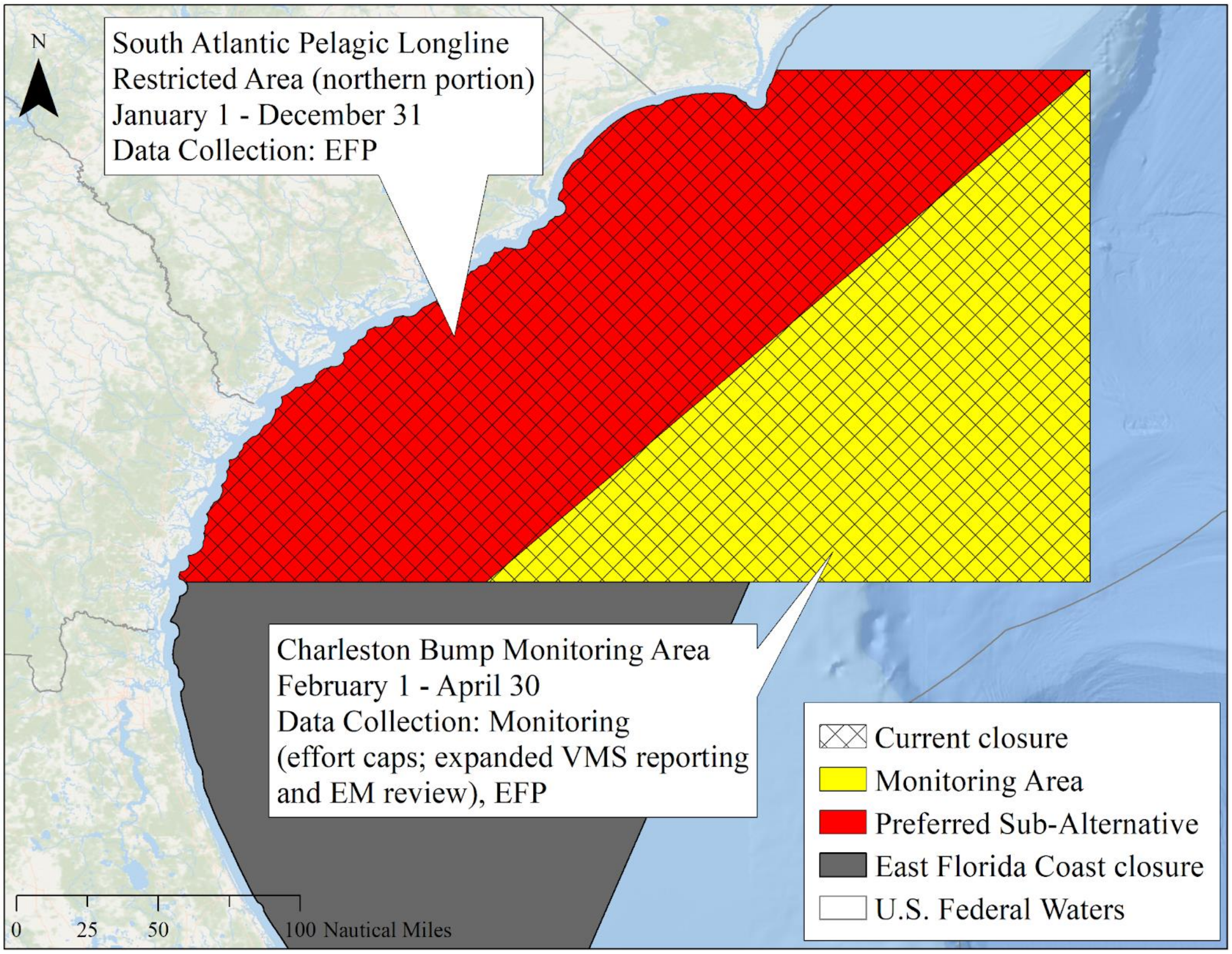

Figure 5.18. Preferred Charleston Bump Spatial Management Area Package. High-bycatch-risk area is in red and low-bycatch-risk area is in yellow.

Table 5.116. Charleston Bump Spatial Management Area - Preferred Alternative Package and combined impacts summary

Alternative	Preferred Alternative	Combined Ecological Impacts	Combined Social and Economic Impacts
"A" - Evaluation and Modification of Areas	A2c (shift eastern boundary to diagonal bisect; inshore portion high-bycatch-risk area year-round)	Direct short- and long-term moderate beneficial; Indirect short- and long-term moderate beneficial	Direct short- and long-term moderate beneficial; Indirect short- and long-term neutral
"B" - Commercial Data Collection	High-Bycatch-Risk Area: B4 - Cooperative research via EFP	Direct short- and long-term neutral; Indirect short-term neutral; Indirect long-term minor beneficial	Direct short- and long-term neutral; Indirect short- and long-term neutral
	Low-Bycatch-Risk Area: B3 - Monitoring Area; Sub-Alternative B3a (effort caps) and Sub-Alternative B3e (electronic monitoring) B4 - Cooperative research via EFP	Direct short- and long-term neutral; Indirect short-term neutral; Indirect long-term minor beneficial	Direct short- and long-term neutral; Indirect short- and long-term neutral
"C"- Evaluation Timing	C2 - Evaluate every 3 years	Direct short- and long-term neutral; Indirect short-term neutral; Indirect long-term minor beneficial	Direct short- and long-term neutral; Indirect short and long-term neutral
	C4 - Triggered evaluation	Direct short- and long-term neutral; Indirect short-term neutral; Indirect long-term minor beneficial	Direct short- and long-term neutral; Indirect short- and long-term neutral

Summary/Discussion:

The preferred Charleston Bump Spatial Management Area package would form a high-bycatch-risk area with a boundary inshore of the current boundary of the Charleston Bump closed area, and a low-bycatch-risk area to the east (Sub-Alternative A2c). The spatial and temporal aspects of this package would provide notably increased protection for leatherback sea turtles and shortfin mako sharks. Data from the high-bycatch-risk area would be collected via EFPs (Alternative B4) and data from the low-bycatch-risk area would be collected by defining the low-bycatch-risk area as a monitoring area (Alternative B3), subject to conditions and through EFPs (Alternative B4). Requirements associated with the EFPs would include effort and bycatch caps, reporting and monitoring elements and other requirements. Using EFPs to collect data in the high-bycatch-risk area provides extra conditions and protections to ensure that data collection activities do not jeopardize the protection of bycatch species. Strict effort and bycatch caps, coupled with reporting and monitoring requirements, would allow researchers and the Agency to closely track effort and catch so that data collection activities can be halted or modified if excessive bycatch occurs. Implementing a monitoring area in the low-bycatch-risk area would provide a higher level of data collection that more closely matches normal commercial pelagic longline fishing. Effort controls (Sub-Alternative B3a) and reporting and monitoring requirements (Sub-Alternative B3e) would allow the Agency to track activity in the monitoring area and to close if warranted. Commercial pelagic longline vessel fishing activity would be allowed in the monitoring area unless the overall effort cap (total number of sets) in the area is reached or is projected to be reached. Vessel operators would be required to submit EM data for full data review of all sets from trips in which the vessel fished in the monitoring area. Real-time monitoring of the fishing activity would be via VMS. Vessel owners and/or operators that intend to fish in a monitoring area would need to declare that intention via vessel monitoring system (VMS) through pre-trip or in-trip hail-out. Vessel operators would also need to report fishing effort (date and area of set and number of hooks) through VMS within 12 hours after the completion of each longline set. Furthermore, in addition to the current bluefin tuna reporting requirements, vessel owners and/or operators would be required to report through VMS within 12 hours after completion of each longline set, the actual length of the following species that are retained and the approximate length of species that are discarded dead or alive: blue marlin, white marlin, roundscale spearfish, sailfish, leatherback sea turtles, loggerhead sea turtles, and shortfin mako sharks. Vessels would be allowed to fish inside and outside of a monitoring area on the same trip, but any fishing effort would be considered to have occurred from within the monitoring area. Future evaluations of the spatial management area would occur every 3 years (Alternative C2), or earlier if specific concerns arise (Alternative C4).

Regarding the ecological impacts, the spatial and temporal aspects of the modification would increase protections of leatherback sea turtles, shortfin mako sharks, and billfish species relative to the status quo while maintaining protections for loggerhead sea turtles. Data collection activities would provide information upon which to base future evaluations of the effectiveness of the areas, leading to more effective fisheries management and bycatch protection.

The preferred A2c modification alternative is estimated to result in a positive $235,863 annual change in revenue relative to the No Action alternative. Indirect impacts to supporting businesses would likely be neutral. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

Overall this package is preferred because it would more efficiently protect bycatch species while providing risk-appropriate data collection for future evaluations. The definition of two distinct spatial management areas, with different methods of data collection, would be appropriate because different geographic areas have different levels of associated risk of interactions with the modeled bycatch species. This alternative package addresses the objectives of this amendment by minimizing bycatch and bycatch mortality, to the extent practicable, while also optimizing fishing opportunities for U.S. fishermen; specifying methods of collecting target and non-target species occurrence and catch rate data from the areas for the purpose of assessing area performance; addressing the need for regular evaluation and performance review; and modifying the current Charleston Bump closed area to achieve an optimal balance of ecological, social, and economic benefits and costs.

For ease of communication, enforcement, and compliance, the preferred modification of the Charleston Bump closed area would be combined with the preferred modification of the East Florida Coast closed area to create the “South Atlantic Pelagic Longline Restricted Area.” The modified boundaries of the two areas align and both would be closed year-round, creating a spatially and temporally contiguous closed area. Combining the two areas into a single named area simplifies communication, enforcement, and compliance.

5.4.3 D3: Preferred East Florida Coast Spatial Management Area Package

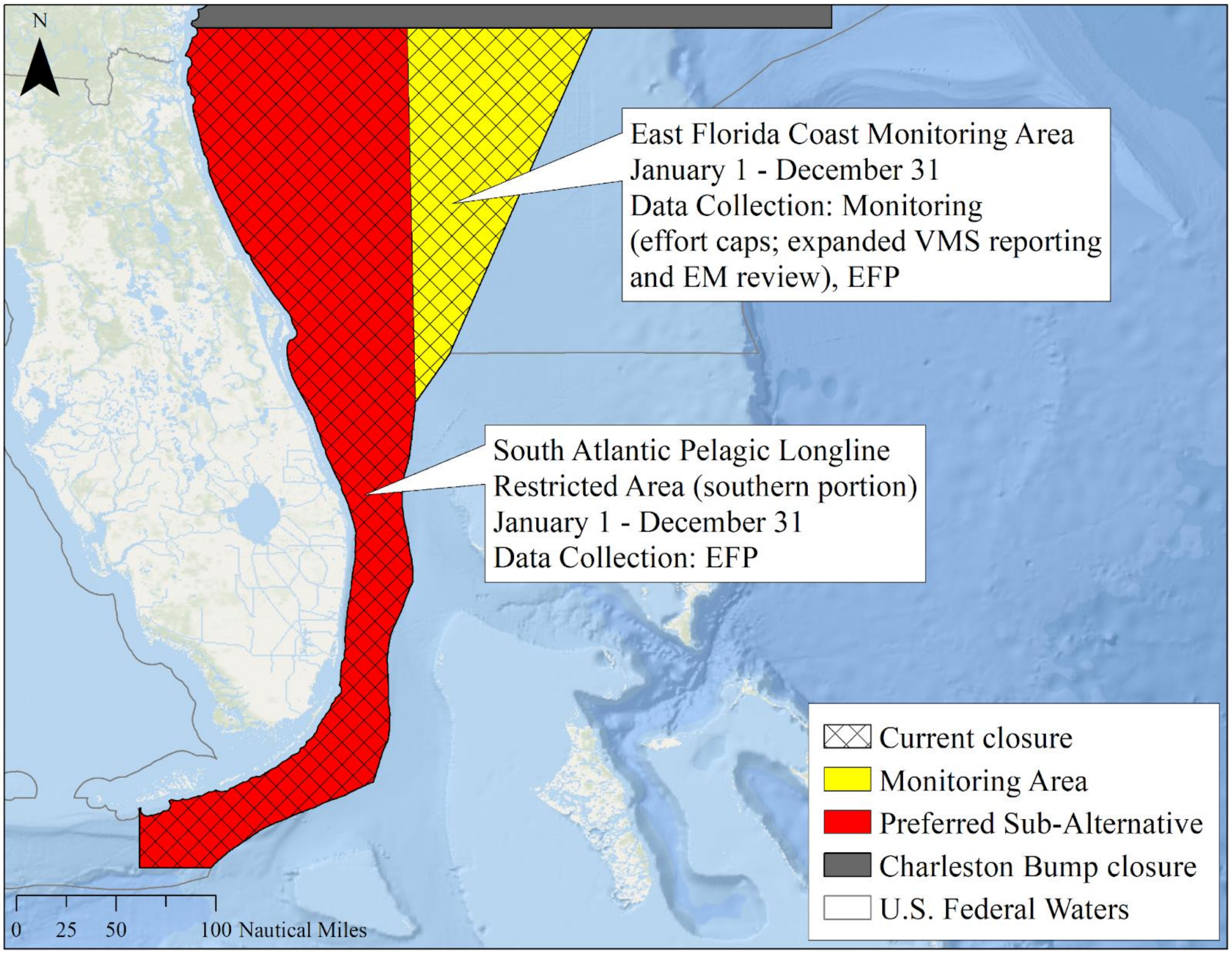

Figure 5.19. Preferred East Florida Coast Spatial Management Area Package. High-bycatch-risk area is in red and low-bycatch-risk area is in yellow.

Table 5.117 East Florida Coast Spatial Management Area - Preferred Alternative Package and combined impacts summary

Alternative	Preferred Alternative	Combined Ecological Impacts	Combined Social and Economic Impacts
"A" - Evaluation and Modification of Areas	A3d (shift northeastern boundary to 79° 32' 46" W. long; maintain year-round timing of high-bycatch-risk area)	Direct short- and long-term moderate beneficial; Indirect short- and long-term moderate beneficial	Direct short- and long-term minor beneficial; Indirect short- and long-term neutral
"B" - Commercial Data Collection	High-Bycatch-Risk Area: B4 - Cooperative research via EFP	Direct short- and long-term neutral; Indirect short-term neutral; Indirect long-term minor beneficial	Direct short- and long-term neutral; Indirect short- and long-term neutral
	Low-Bycatch-Risk Area: B3 - Monitoring Area; Sub-Alternative B3a (effort caps) and Sub-Alternative B3e (electronic monitoring) B4 - Cooperative research via EFP	Direct short- and long-term neutral; Indirect short-term neutral; Indirect long-term minor beneficial	Direct short- and long-term neutral; Indirect short- and long-term neutral
"C"- Evaluation Timing	C2 - Evaluate every 3 years	Direct short- and long-term neutral; Indirect short-term neutral; Indirect long-term minor beneficial	Direct short- and long-term neutral; Indirect short- and long-term neutral
	C4 - Triggered evaluation	Direct short- and long-term neutral; Indirect short-term neutral; Indirect long-term minor beneficial	Direct short- and long-term neutral; Indirect short- and long-term neutral

Summary/Discussion:

The preferred East Florida Coast Spatial Management Area package would form a high-bycatch-risk area with a boundary inshore of the current boundary of the East Florida Coast closed area, and a low-bycatch-risk area to the east (Sub-Alternative A3d). The spatial and temporal aspects of this package would be most effective for the protection of leatherback sea turtles, followed by shortfin mako sharks and billfish species. The spatial area provided the most protection of all the East Florida Coast alternatives for leatherback sea turtle and shortfin mako shark. Data from the high-bycatch-risk area would be collected via EFPs (Alternative B4) and data from the low-bycatch-risk area would be collected by defining the low-bycatch-risk area as a monitoring area (Alternative B3), subject to conditions, and through EFPs (Alternative B4). Requirements associated with the EFPs would include effort and bycatch caps, reporting and monitoring elements and other requirements. Using EFPs to collect data in the high-bycatch-risk area provides extra conditions and protections to ensure that data collection activities do not jeopardize the protection of bycatch species. Strict effort and bycatch caps, coupled with reporting and monitoring requirements, would allow researchers and the Agency to closely track effort and catch so that data collection activities can be halted or modified if excessive bycatch occurs. Implementing a monitoring area in the low-bycatch-risk area would provide a higher level of data collection that more closely matches normal commercial pelagic longline fishing. Effort controls (Sub-Alternative B3a) and reporting and monitoring requirements (Sub-Alternative B3e) would allow the Agency to track activity in the monitoring area and to close if warranted. Commercial pelagic longline vessel fishing activity would be allowed in the monitoring area unless the overall effort cap (total number of sets) in the area is reached or is projected to be reached. Vessel operators would be required to submit EM data for full data review of all sets from trips in which the vessel fished in the monitoring area. Real-time monitoring of the fishing activity would be via VMS. Vessel owners and/or operators that intend to fish in a monitoring area would need to declare that intention via vessel monitoring system (VMS) through pre-trip or in-trip hail-out. Vessel operators would also need to report fishing effort (date and area of set and number of hooks) through VMS within 12 hours after the completion of each longline set. Furthermore, in addition to the current bluefin tuna reporting requirements, vessel owners and/or operators would be required to report through VMS within 12 hours after completion of each longline set, the actual length of the following species that are retained and the approximate length of species that are discarded dead or alive: blue marlin, white marlin, roundscale spearfish, sailfish, leatherback sea turtles, loggerhead sea turtles, and shortfin mako sharks. Vessels would be allowed to fish inside and outside of a monitoring area on the same trip, but any fishing effort would be considered to have occurred from within the monitoring area. Future evaluations of the spatial management area would occur every three years (Alternative C2), or earlier if specific concerns arise (Alternative C4).

Regarding the ecological impacts, the spatial and temporal aspects of the modification would increase protections of leatherback sea turtles and shortfin mako sharks relative to the status quo while billfish species and loggerhead sea turtle protections would largely be maintained. Data collection activities would provide information upon which to base future evaluations of the effectiveness of the areas, leading to more effective fisheries management and bycatch protection.

The preferred A3d modification alternative is estimated to result in a positive $37,845 annual change in revenue relative to the No Action alternative. Indirect impacts to supporting businesses would likely be neutral. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

Overall this package is preferred because it would more efficiently protect bycatch species while providing risk-appropriate data collection for future evaluations. The definition of two distinct spatial management areas, with different methods of data collection would be appropriate because different geographic areas have different levels of associated risk of interactions with the modeled bycatch species. This alternative package addresses the objectives of this amendment by minimizing bycatch and bycatch mortality, to the extent practicable, while also optimizing fishing opportunities for U.S. fishermen; specifying methods of collecting target and non-target species occurrence and catch rate data from the areas for the purpose of assessing area performance; addressing the need for regular evaluation and performance review; and modifying the current East Florida Coast closed area to achieve an optimal balance of ecological, social, and economic benefits and costs.

For ease of communication, enforcement, and compliance, the preferred modification of the East Florida Coast closed area would be combined with the preferred modification of the Charleston Bump closed area to create the "South Atlantic Pelagic Longline Restricted Area." The modified boundaries of the two areas align and both would be closed year-round, creating a spatially and temporally contiguous closed area. Combining the two areas into a single named area simplifies communication, enforcement, and compliance.

5.4.4 D4: Preferred DeSoto Canyon Spatial Management Area Package

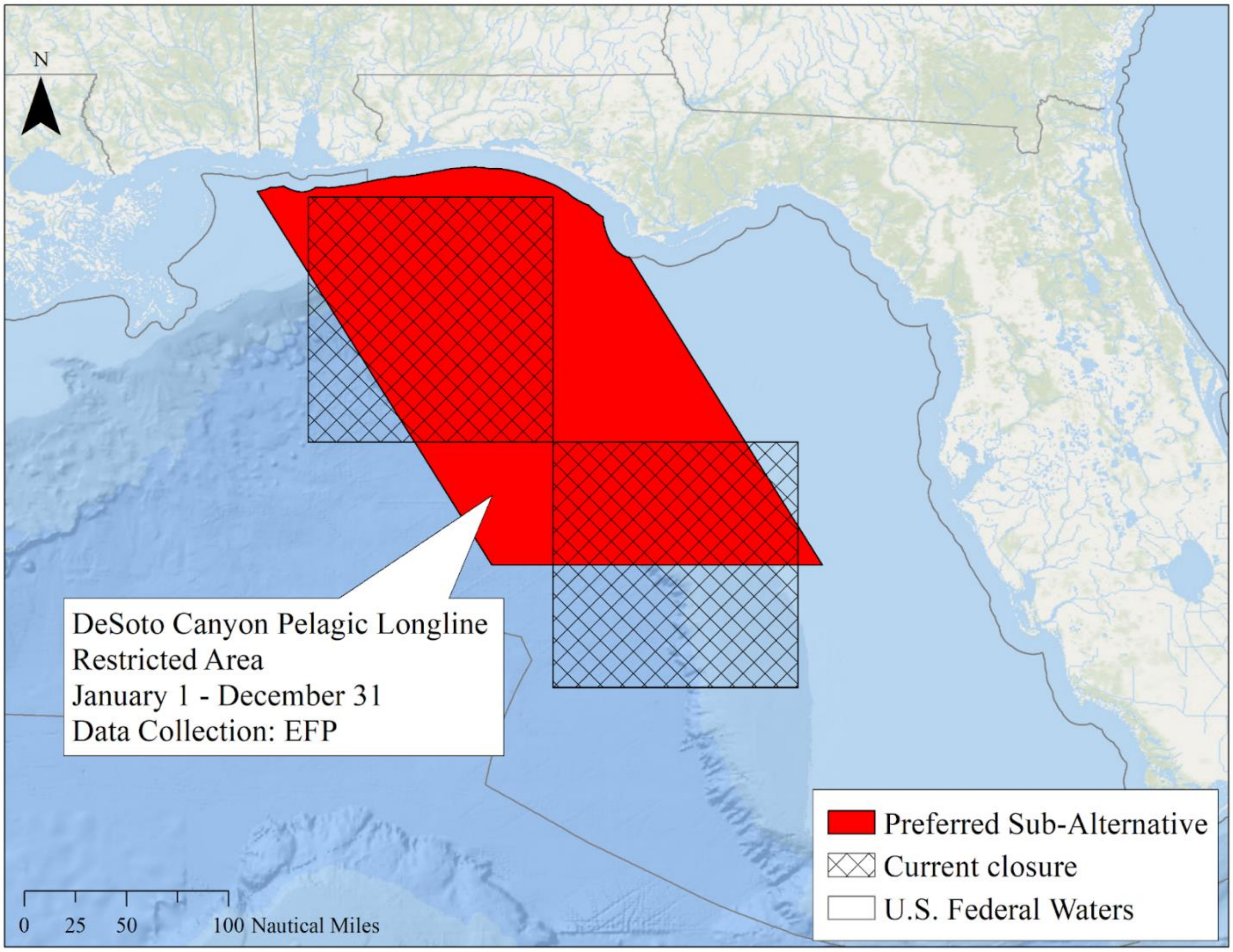

Figure 5.20. Preferred DeSoto Canyon Spatial Management Area Package. High-bycatch-risk area is in red and low-bycatch-risk area is in unshaded cross-hatch.

Table 5.118. DeSoto Canyon Spatial Management Area - Preferred Alternative Package and combined impacts summary

Alternative	Preferred Alternative	Combined Ecological Impacts	Combined Social and Economic Impacts
"A" - Evaluation and Modification of Areas	A4d (parallelogram; year-round high-bycatch-risk area)	Direct short- and long-term moderate beneficial; Indirect short- and long-term minor beneficial	Direct short- and long-term neutral; Indirect short- and long-term neutral
"B" - Commercial Data Collection	High-Bycatch-Risk Area: B4 - Cooperative research via EFP	Direct short- and long-term neutral; Indirect short-term neutral; Indirect long-term minor beneficial	Direct short- and long-term neutral; Indirect short- and long-term neutral
	Low-Bycatch-Risk Area: B1 - No Action	Direct short- and long-term neutral; Indirect short-term neutral; Indirect long-term minor adverse	Direct short- and long-term neutral; Indirect short- and long-term neutral
"C"- Evaluation Timing	C2 - Evaluate every 3 years	Direct short- and long-term neutral; Indirect short-term neutral; Indirect long-term minor beneficial	Direct short- and long-term neutral; Indirect short- and long-term neutral
	C4 - Triggered evaluation	Direct short- and long-term neutral; Indirect short-term neutral; Indirect long-term minor beneficial	Direct short- and long-term neutral; Indirect short- and long-term neutral

Summary/Discussion:

The preferred DeSoto Canyon Spatial Management Area package would form a high-bycatch-risk area with a boundary that modifies and simplifies the current boundary of the DeSoto Canyon closed area (Sub-Alternative A4d). The net protection of bycatch species would increase. This geographic area would be most effective for the protection of leatherback sea turtles, followed by shortfin mako sharks and billfish species. This geographic area would provide more protection for leatherback sea turtle and shortfin mako shark than any of the other DeSoto Canyon alternatives. Data from the high-bycatch-risk area would be collected via EFPs (Alternative B4). Using EFPs to collect data in the high-bycatch-risk area provides extra conditions and protections to ensure that data collection activities do not jeopardize the protection of bycatch species. Strict effort and bycatch caps, coupled with reporting and monitoring requirements, would allow researchers and the Agency to closely track effort and catch so that data collection activities can be halted or modified if excessive bycatch occurs. Requirements associated with the EFPs would include effort and bycatch caps, reporting and monitoring elements and other requirements. Future evaluations of the spatial management area would occur every 3 years (Alternative C2), or earlier if specific concerns arise (Alternative C4).

Regarding the ecological impacts, the spatial and temporal aspects of the modification would increase protections of leatherback sea turtles and shortfin mako sharks relative to the status quo while billfish species protections would be slightly lower. Data collection activities would provide information upon which to base future evaluations of the effectiveness of the areas, leading to more effective fisheries management and bycatch protection.

The preferred A4d modification alternative is estimated to result in a negative $224,295 annual change in revenue relative to the No Action alternative. However, fishermen are unlikely to fish in areas with lower catch rates, so reductions in revenue may not be realized. Indirect impacts to supporting businesses would likely be neutral. Indirect impacts to HMS recreational fisheries are discussed in Section 5.4.6.

Overall this package is preferred because it would more efficiently protect bycatch species while providing risk-appropriate data collection for future evaluations. The definition of a single distinct spatial management area would be appropriate because the creation of multiple areas in this case would be overly complex to administer and enforce. The potential for slightly greater risk of interactions with bycatch species in the areas that would no longer be in this spatial management area (i.e., part of the current DeSoto Canyon closed area) would be balanced by the increase in protection created by the area within the newly defined DeSoto Canyon Spatial Management Area. This alternative package addresses the objectives of this amendment by minimizing bycatch and bycatch mortality, to the extent practicable, while also optimizing fishing opportunities for U.S. fishermen; specifying methods of collecting target and non-target species occurrence and catch rate data from the areas for the purpose of assessing area performance; addressing the need for regular evaluation and performance review; and modifying the current DeSoto Canyon closed area to achieve an optimal balance of ecological, social, and economic benefits and costs.

5.4.6 Recreational Fishing Impacts

Although Amendment 15 does not directly address management of federal recreational fisheries, there could be concern that management measures for commercial fisheries could impact offshore recreational fisheries. In particular, the preferred alternatives to modify closed areas in time and geography and the associated data collection activities are most relevant. For that reason, this section provides a more detailed discussion of the impacts on recreational fisheries.

Federal HMS recreational fisheries generally operate offshore and target many of the species under HMS management including tunas, billfish, swordfish, and sharks. The HMS

Angling category permit is required to recreationally fish for, retain, or possess any federally regulated Atlantic HMS. This requirement includes catch-and-release fishing and the permit does not authorize the sale or transfer of HMS to any person for a commercial purpose. The HMS Charter/Headboat permit is required for vessels that embark on for-hire trips to fish recreationally, or in some cases, commercially. Additionally, there are some commercial handgear fishermen who regularly participate in recreational fishing tournaments. As a result, the regulations allow for fishermen who hold an Atlantic Tunas General category permit or who hold a Swordfish General Commercial permit to fish recreationally during a registered HMS tournament. Additionally, since 2018, vessel owners issued an HMS Angling or Charter/Headboat permit who intend to fish for sharks have been required to obtain a shark endorsement. This section focuses on the impacts on those permit holders who hold an Angling permit or a Charter/Headboat permit as the impacts would more directly impact those permit holders.

HMS Angling permits are issued to anglers in states and territories spanning the Atlantic, Gulf of Mexico, U.S. Caribbean and beyond with large concentrations in Florida, New Jersey, New York, Massachusetts, North Carolina, and Maryland. Table 5.119 and Figure 5.21 detail the distribution on HMS Angling permits among states and territories (HMS 2021 SAFE Report).

Table 5.119. Number of HMS Angling permits by State or County in 2021†

State/Country	Permits by Home Port*	Permits by Residence**	State/Country	Permits by Home Port*	Permits by Residence**
Alaska	3	1	North Carolina	1,411	1,333
Alabama	411	386	New Hampshire	274	314
Arkansas	11	14	New Jersey	4,197	3,735
Arizona	1	4	New Mexico	-	2
California	5	14	Nevada	3	1
Colorado	3	14	New York	2,735	2,811
Connecticut	984	1,058	Ohio	12	28
District of Columbia	2	7	Oklahoma	10	15
Delaware	905	626	Oregon	2	-
Florida	4,402	4,071	Pennsylvania	200	1,136
Georgia	94	172	Puerto Rico	315	321
Hawaii	1	-	Rhode Island	833	590

Iowa	-	2	South Carolina	496	478
Idaho	-	2	South Dakota	1	3
Illinois	9	21	Tennessee	23	42
Indiana	3	13	Texas	569	623
Kansas	3	8	Utah	1	2
Kentucky	6	11	Virginia	808	877
Louisiana	488	479	U.S. Virgin Islands	18	9
Massachusetts	2,566	2,604	Vermont	17	29
Maryland	1,152	1,091	Washington	4	6
Maine	450	391	Wisconsin	7	17
Michigan	25	36	West Virginia	7	13
Minnesota	2	8	Canada	4	2
Missouri	11	19	Not Reported	-	14
Mississippi	146	172	2021 totals, by port and by residence*	23,632	23,632
Montana	-	4	2020 totals, by port and by residence	22,833	22,833
Nebraska	-	2			

†As of October 2021. *The vessel port or other storage location. **The permit holder's billing address. Source: Atlantic HMS Management Division.

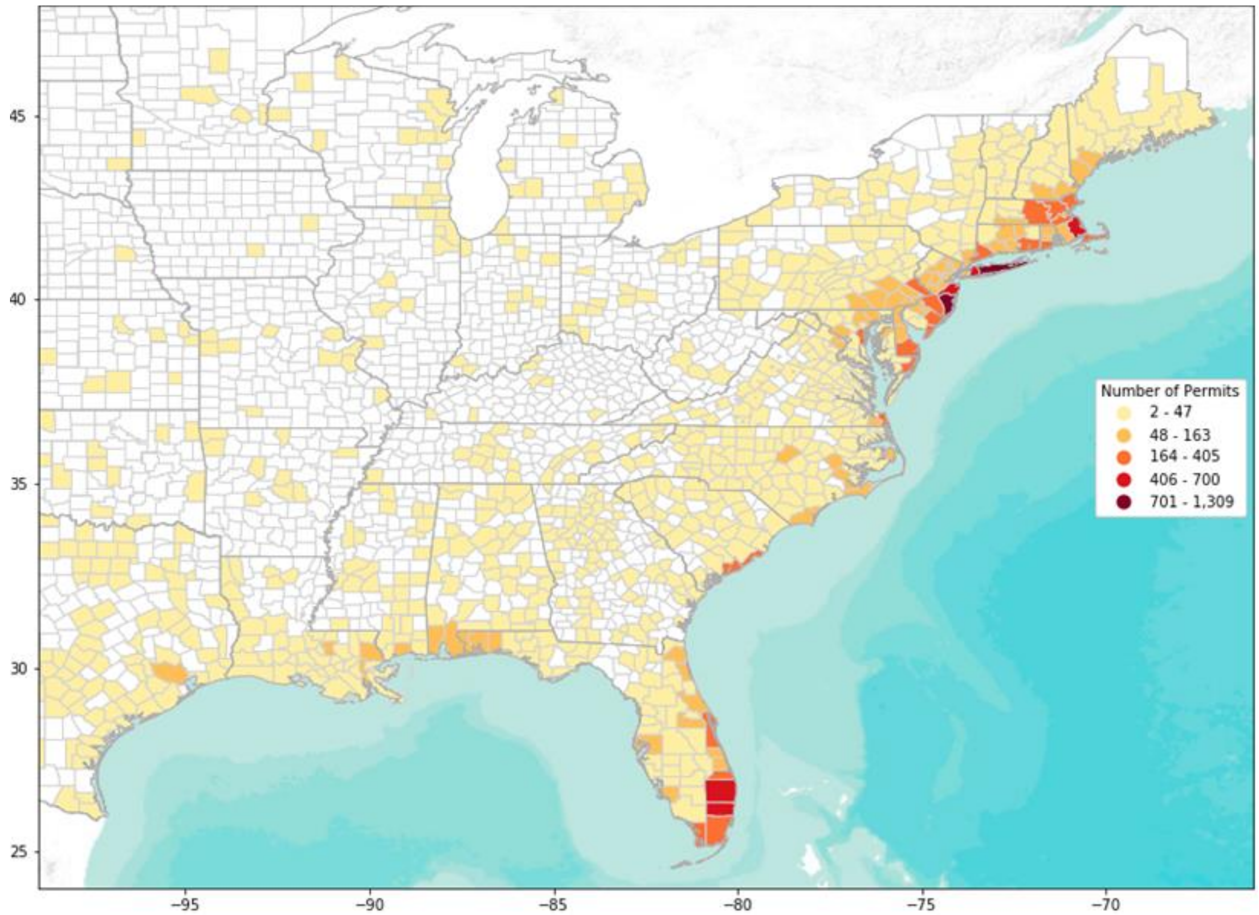

Figure 5.21. Distribution of HMS Angling permits as of October 2021

HMS Charter/Headboat permits are issued to anglers in states and territories spanning the Atlantic, Gulf of Mexico, U.S. Caribbean, and beyond with large concentrations in Florida, New Jersey, New York, Massachusetts, North Carolina, and Maryland. Table 5.120 and Figure 5.22 detail the distribution on HMS Charter/Headboat permits among states and territories (HMS 2021 SAFE Report).

Table 5.120. Number of HMS Charter/Headboat permits by State or County in 2021†

State/Territory	Permits Issued	State/Country	Permits Issued
Alabama	60	New Hampshire	95
California	1	New Jersey	407
Connecticut	92	New York	367
Delaware	73	North Carolina	386

Florida	782	North Dakota	1
Georgia	23	Pennsylvania	4
Louisiana	84	Puerto Rico	17
Maine	119	Rhode Island	163
Maryland	132	South Carolina	142
Massachusetts	791	Texas	97
Michigan	3	U.S. Virgin Islands	13
Minnesota	1	Virginia	83
Mississippi	18	2021 total	
Montana	1	2020 total	

†As of October 2021. *The vessel port or other storage location. **The permit holder's billing address.
Source: Atlantic HMS Management Division.

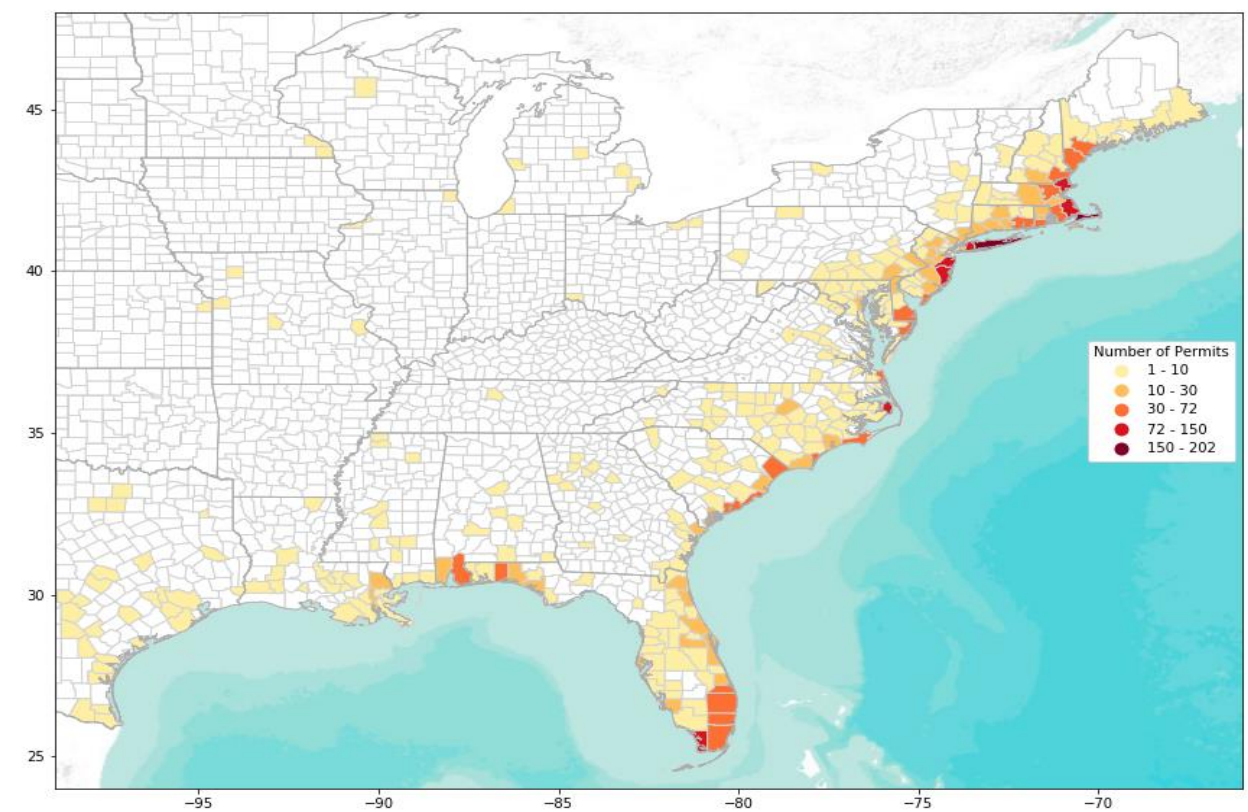

Figure 5.22. Distribution of HMS Charter/Headboat permits as of October 2021

Fishing location information for recreational HMS anglers is not reliably available since there are no location reporting requirements. Marine Recreational Information Program (MRIP) data does not include location information. The Large Pelagics Survey (LPS) program does collect fishing location information, however, the program focuses on the area between Maine and Virginia and does not collect data in the U.S. South Atlantic or Gulf of Mexico, the action area for the spatial management portions of Amendment 15.

As a proxy for HMS recreational fishing location, we made some general assumptions. In the Atlantic, offshore recreational fishermen most often make day trips, likely within 80 miles of their home port or launch location. Some trips can extend beyond the 80-mile range, but are likely rare. In the Gulf of Mexico, trips can be longer and sometimes include overnight or multi-day trips. For that reason, fishing locations can span further from home ports or launch areas.

In the Atlantic, Figure 5.21 shows that HMS Angling permits are issued along many of the coastal communities in North Carolina, South Carolina, Georgia, and Florida with particularly large concentrations in Charleston County, SC; Brevard County, FL; Martin County, FL; Palm Beach County, FL; Broward County, FL; and Miami-Dade County, FL. Figure 5.22 shows that HMS charter/headboat permits are issued in particularly large concentrations in Miami-Dade, FL; Broward, FL; Palm Beach, FL; Martin, FL; Charleston, SC; Horry, SC; New Hanover, NC; Carteret, NC; and Dare, NC. Each of these locations could be impacted by the preferred alternatives to modify and collect data in closed areas. Charleston County, SC is located near the middle of the coastal border of the Charleston Bump closed area and the listed Florida counties are near the middle and southern ends of the East Florida Coast closed area. There is some overlap in target species between commercial and recreational fishermen in these areas, including yellowfin tuna, swordfish, and non-HMS such as dolphin fish. Other target species for recreational fishermen including billfish and some pelagic sharks are not targeted by commercial pelagic longline fishermen.

In the Gulf of Mexico, Figure 5.21 shows that HMS Angling permits are issued along many of the coastal communities from Texas through Florida, with particularly large concentrations in Harris County, TX; Jefferson Parish, LA; St. Tammany Parish, LA; Harrison County, MS; Mobile County, AL; Baldwin County, AL; Escambia County, FL; Santa Rosa County, FL; Okaloosa County, FL; Pinellas County, FL; Hillsborough County, FL; Lee County, FL; and Monroe County, FL. Louisiana, Mississippi, Alabama, and Florida fishing communities in particular are near the DeSoto Canyon closed area. Figure 5.22 shows that HMS charter/headboat permits are issued in particularly large concentrations in Broward, AL and Monroe, FL. However, as noted above, recreational fishing trips in the Gulf of Mexico can travel long distances so all communities could potentially be impacted. There is some overlap in target species between commercial and recreational fishermen in these areas, including yellowfin tuna, swordfish, and non-HMS such as dolphin fish. Other target species for recreational fishermen including billfish and some pelagic sharks are not targeted by commercial pelagic longline fishermen.

HMS recreational and commercial pelagic longline fishermen do not often target the same species in the South Atlantic and Gulf of Mexico but the two fisheries can come into conflict in other ways. Two potential areas for such differences are physical gear conflicts and conservation concerns. Physical gear conflict can occur when recreational fishermen and commercial pelagic longline fishermen are operating in the same area. Both gear types can cover large surface areas of water since recreational fishermen often troll for target species and pelagic longline fishermen deploy many miles of mainline. These conflicts can be exacerbated in smaller areas where effort is concentrated such as the Straits of Florida north through the area between Florida and the Bahamian EEZ. For these reasons, Amendment 15 does not prefer any changes to closed areas south of approximately Sebastian Inlet, FL. North of that area, the U.S. EEZ expands, providing more room for both fisheries to operate. In the Charleston Bump area, Amendment 15 prefers creation of a monitoring area in the offshore portion of the closed area. Although the monitoring area could allow some additional limited pelagic longline effort in the monitoring area, the preferred alternative also closes the nearshore portion year-round. Although the Charleston Bump closed area is currently closed to pelagic longline fishing from February 1 through April 30, the preferred alternative to close the nearshore portion year-round closure would eliminate gear conflict concerns in that area for the whole year.

In the Gulf of Mexico, the preferred DeSoto Canyon closure is largely in the same area reducing the chance of new gear conflict concerns. In the bathymetric DeSoto Canyon feature in the northeastern portion of the Gulf of Mexico, Okaloosa FADs have been deployed. However, the preferred DeSoto Canyon modification would continue to prohibit pelagic longline fishing near the FADs.

Conservation concerns can also create conflict. For example, the large number of hooks deployed by pelagic longline fishermen can create the perception that large amounts of bycatch also occur, including species such as billfish that are important to some HMS recreational fishermen. However, one of the goals of Amendment 15 is to optimize closed areas to better protect certain bycatch species including billfish. As demonstrated in the HMS PRiSM modeling and metrics, current closed area designs are not protecting bycatch species as efficiently as they could. All modification alternatives, including the preferred alternatives, scored better on conservation protection based on HMS PRiSM metric scores. For this reason, the preferred measures in Amendment 15 are expected to better protect bycatch species, including recreational target species. This protection should, in the long-term, provide more fishing opportunities to both recreational and commercial fishermen.

5.5 "E" Alternatives: Spatial Management Area Regulatory Provisions

The "E" Alternatives consider reorganizing, clarifying, and adding provisions to the regulations to ensure that future and existing spatial management areas are designed to meet the intent for which they were created. The need to assess the effectiveness of spatial management measures is critical due to the static nature of the spatial management measures, the highly dynamic nature of HMS fisheries, and the highly dynamic nature of the ocean environment.

5.5.1 Alternative E1: Spatial Management Area Regulatory Provisions - No Action.

This alternative would make no changes considerations for framework adjustments for time/area closures and/or gear restricted areas.

Ecological Impacts

Consideration of high-level spatial management design elements or factors are administrative in nature and would not have any short-term or long-term impacts on target species or short- or long-term impacts on bycatch or incidentally caught species. Thus, short- and long-term direct and indirect ecological impacts would be neutral.

Social and Economic Impacts

Consideration of high-level spatial management design elements or factors are administrative in nature and would not have any short-term or long-term social or economic impacts on fishermen or short-term or long-term indirect impacts on supporting businesses. Thus, all social and economic impacts would be neutral.

5.5.2 Alternative E2: Revise Spatial Management Area Regulatory Provisions - Preferred Alternative

Under this alternative, NMFS would add considerations for review of spatial management areas at 50 CFR 635.35(c) and make consistency edits to the existing framework adjustment provisions at 635.34. These elements and factors would need to be followed and considered when modifying or establishing spatial management areas including when evaluating the timing, considering data collection, and considering access to the spatial management areas.

Ecological Impacts

Consideration of high-level spatial management design elements or factors are administrative in nature and would not have any impacts on bycatch or incidentally caught species. Thus, ecological impacts would be neutral.

Social and Economic Impacts

Consideration of high-level spatial management design elements or factors are administrative in nature and would not have any social or economic impacts on fishermen or supporting businesses. Thus, all social and economic impacts would be neutral.

5.5.3 Conclusion

Revising the existing high-level spatial management area design and evaluation criteria provides a plan for NOAA Fisheries and the public when modifying or establishing spatial management areas to ensure that each area is meeting the intent for which they were created and would be evaluated in the future. The need to assess the effectiveness of spatial management measures is critical due to the static nature of the spatial management measures, the highly dynamic nature of HMS fisheries, and the highly dynamic nature of the ocean environment. To ensure that future and existing spatial management areas are designed with this evaluation process in mind, Amendment 15 would also update and modify the regulatory language to include the high-level design elements of specific objectives, timing of evaluation, data collection and access.

5.6 "F" ALTERNATIVES: ELECTRONIC MONITORING

This section considers the impacts of modifying the current EM Program to be consistent with the NOAA Fisheries cost allocation policy (Procedure 04-115-02 "*Cost Allocation in Electronic Monitoring Programs for Federally Managed Fisheries*."). The current EM Program only applies to HMS pelagic longline fishery and its vessels, and is used to monitor bluefin tuna interactions and disposition under the IBQ Program and to verify that shortfin mako sharks are released with a minimum of harm. Therefore, the impacts considered here only apply to pelagic longline fishery.

5.6.1 Alternative F1- No Action

Under the No Action alternative, NOAA Fisheries would continue to fund the EM Program (both administrative and sampling costs) and utilize contracts with one or more vendors to conduct EM system installation, maintenance, and repair, as well as data storage, video review, and analyses. The EM Program is used to monitor bluefin tuna interactions and disposition under the IBQ Program and to verify that shortfin mako sharks are caught and released are released with a minimum of harm.

Ecological Impacts on Target Species

The ecological impacts of Alternative F1 on target species catch are expected to be neutral. No modifications to the funding or administration of the EM Program would be made.

Ecological Impacts on Bluefin Tuna, Bycatch Species, and Other Incidentally-Caught Species

The indirect ecological impacts of Alternative F1 on bluefin tuna, shortfin mako, and other bycatch and incidentally-caught species is expected to be neutral. No modifications to the funding or administration of the EM Program would be made. Bycatch and incidentally-caught species in the HMS pelagic longline fishery include shortfin mako sharks, leatherback sea turtles, loggerhead sea turtles, billfish species (blue marlin, white marlin, roundscale spearfish, and sailfish), longfin mako sharks, oceanic whitetip sharks, scalloped hammerhead sharks, dusky sharks, and sandbar sharks.

Social and economic Impacts

Since inception of the HMS pelagic longline EM program, NOAA Fisheries has paid 100 percent of the cost and has contracts with two companies to provide all the functions and services in the sampling cost category (as defined in Table 3.15 in Section 3.6). The social and economic impacts discussion for Alternative F2 in Section 5.6.2, including Table 5.121 provides details on the cost incurred by the Agency. Under Alternative F1, these costs would remain the responsibility of NOAA Fisheries.

Direct social and economic impacts of Alternative F1 on pelagic longline fishermen are expected to be neutral. No modifications to the funding or administration of the EM Program would be made. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Indirect social and economic impacts to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be neutral. From 2016 through 2020, 212 dealers purchased swordfish, yellowfin tuna, or bigeye tuna products along the Atlantic, Gulf of Mexico, and U.S. Caribbean coasts.

5.6.2 Alternative F2 - Transfer Electronic Monitoring Sampling Costs to Industry (Phased-In) - Preferred Alternative

Under Alternative F2, a vessel fishing with pelagic longline gear would be required to pay for all sampling costs associated with the EM Program requirements, in order to align with the cost allocation policy. To allow the fishery time to adapt to this change, the shift in cost would be phased in over three years with the proportion of sampling costs that the industry is responsible for increasing each year. As detailed in Section 3.5.2, there are four distinct components to this alternative: 1) vendor requirements; 2) vessel requirements; 3) vessel monitoring plan; and 4) modification of current IBQ Program's EM spatial/temporal requirements, to operationalize the sampling plan design. These components are addressed collectively vs. individually in the following impacts discussion unless otherwise specified. NOAA Fisheries notes that vessel monitoring plans are currently required in 50 C.F.R. § 635.9(e) and EM system components in § 635.9(c); vessel owner and operator requirements are in § 635.9(b)(2) and (e); and data maintenance, storage and viewing requirements are in § 635.9(d)). Alternative F2 would not substantively change many of these requirements.

Ecological Impacts on Target Species

The direct ecological impacts of Alternative F2 on target species catch are expected to be neutral. Target species in the pelagic longline fishery are quota managed, and this alternative would not affect either the overall U.S. quotas for swordfish, yellowfin tuna, or bigeye tuna, which prevent overfishing, are based on the best scientific information available, and are consistent with the ICCAT-recommended quotas, or the overall ICCAT-recommended total allowable catches (TACs). Alternative F2 would likely result in reduced effort. In general, fishermen choose to engage in commercial fishing when the expected revenue is sufficiently higher than the expected costs. Any increase in costs, such as is expected under this alternative, could result in fishermen deciding to make fewer or shorter trips, thereby reducing effort in the fishery. While reduced effort in general could reduce fishing impacts on the target species, harvest below science-based quotas are unlikely to result in beneficial impacts to target stocks.

Requiring EM within EM Data Review Areas (i.e., only for locations and times with a higher likelihood of bluefin tuna interactions instead of requiring EM in all locations and times) could result in fishermen changing their fishing behavior. Specifically, fishermen may choose to alter their fishing strategy or location in order to avoid fishing in areas where EM is required and the associated costs are higher. However, it is unlikely that changes in fishing behavior or location would have a noticeable change in catch composition of target, bycatch, or incidentally-caught species for two reasons. First, the EM Data Review Areas are large and span at least six months each. As such, there is little opportunity to direct effort around the areas to avoid EM requirements. Second, fishermen choose fishing locations based on the availability of target species. It is unlikely that fishermen would significantly alter fishing location to avoid EM Data Review Areas if doing so would result in lower target species CPUE since such action would reduce profitability of a trip. Fishermen operating in areas where multiple EM Data Review Areas are available, for example coastal North Carolina, may change fishing location without impacting CPUE, however, these instances would likely be uncommon. For these reasons, NOAA Fisheries does not expect this aspect of alternative F2 to significantly impact catch composition.

If NOAA Fisheries decides to modify the EM Data Review Areas in a future regulatory action, any modifications would have neutral direct ecological impacts for the same reasons described above.

Ecological Impacts on Bluefin Tuna, Bycatch Species, and Other Incidentally-Caught Species

The indirect ecological impacts are separated into three considerations: impacts to bluefin tuna, impacts to shortfin mako sharks, and impacts to other bycatch and incidentally-caught species. The EM program was expressly designed to monitor and incentivize bluefin tuna reporting and was later expanded to verify compliance with shortfin mako shark regulations. Since the EM program focuses on bluefin tuna and shortfin mako sharks and because this alternative considers changes to the EM program, impacts to these two species are analyzed separately from the other incidentally-caught species.

The indirect ecological impacts of Alternative F2 on bluefin tuna are expected to be neutral to minor beneficial, largely due to likely decreases in fishing effort. Other bycatch and incidentally-caught species in the HMS pelagic longline fishery include leatherback sea turtles, loggerhead sea turtles, billfish species (blue marlin, white marlin, roundscale spearfish, and sailfish), longfin mako sharks, oceanic whitetip sharks, scalloped hammerhead sharks, dusky sharks, and sandbar sharks.

The current EM program incentivizes fishermen to accurately report and avoid bluefin tuna interactions and to release bluefin tuna that are brought to the vessel alive. However, most of the conservation benefits are a result of the IBQ Program's cap on total bluefin tuna mortality in the pelagic longline fishery. Vessel and vendor requirements detailed in this alternative would ensure continuity in the core technical aspects of the EM program, including camera requirements and video review. Apart from restructuring these requirements, this alternative would not change the IBQ program. Nor does this alternative change the U.S. quota or the proportion of the quota provided to the pelagic longline fishery. Vessel and vendor requirements detailed in this alternative would ensure continuity in the core technical aspects of the EM program, including camera requirements and video review. Fishermen may change their fishing strategy or location in light of the EM Data Review Areas. However, this is not expected to result in a noticeable change in catch composition of bycatch or incidentally-caught species for the reasons explained in the Target Species discussion above.

Under this component of Alternative F2, vessel operators would only be required to comply with EM requirements in certain areas and times. When operating exclusively outside those areas, EM use would not be required because it is unlikely bluefin tuna interactions would occur in those areas. Instead, EM and video review would be needed only for sets that occur in areas with a high likelihood of interacting with bluefin tuna. Future changes to the timing of the EM Data Review Areas, as described in Chapter 3, would also not result in ecological impacts to bluefin tuna since any temporal modification would be based on catch rates of the species in each area. As bluefin tuna distribution shifts and the fishery changes, future temporal modifications to EM Data Review Areas would ensure that the current goals of the sampling design (to target areas of possible bluefin tuna interaction) are maintained.

Indirect ecological impacts to incidentally-caught shortfin mako sharks are similarly likely to be neutral to minor beneficial due to a likely decrease in fishing effort. Modification of spatiotemporal EM requirements are unlikely to affect the stock. Prior to the zero retention requirement effective July 5, 2022 (87 FR 39373), EM was used to monitor the disposition of shortfin mako sharks in the pelagic longline fishery. Based on ICCAT Recommendation 21-09, NOAA Fisheries implemented a zero retention requirement effective July 5, 2022 (87 FR 39373). Given that retention ban, EM is used for shortfin mako sharks primarily to verify that they are released with a minimum of harm. As noted above, the SEFSC video review sampling program is based on bluefin tuna interactions, not shortfin mako shark interactions.

Similarly, the EM Data Review Areas are not optimized to monitor shortfin mako interactions. There is, however, overlap with those areas and shortfin mako shark probabilities. If, in the future, the ICCAT Recommendation is modified to allow some retention of shortfin mako sharks by U.S. fishermen, modification of spatiotemporal EM requirements is unlikely to impact the ability of the program to monitor shortfin mako shark disposition. Figure 5.23 shows the EM Data Review Areas. Figure 5.24 and Figure 5.25 show representative heatmaps in the Atlantic and Gulf of Mexico, respectively, of shortfin mako shark pelagic longline fishery interaction probability from HMS PRiSM output results. In the Atlantic, shortfin mako shark bycatch risk occurs year-round in the Mid-Atlantic Bight, and EM requirements for that area under Alternative F2 are also year-round. In the North Atlantic area, shortfin mako shark interactions occur year-round, although appear (Figure 5.24) more widespread in the first half of the year and more concentrated in the second half of the year. Alternative F2 provides for EM requirements in the second half of the year (June – December). In the South Atlantic area, shortfin mako shark interactions are concentrated in the first half of the year, matching Alternative F2's EM requirements from January - June. In the Gulf of Mexico, shortfin mako shark interactions are more likely to occur in the first half of the year, though there are some high probabilities through September. Alternative F2 provides for EM requirements in the first half of the year (January – June).

While not designed based on shortfin mako interactions, NOAA Fisheries believes that the EM Data Review Areas will have neutral ecological impacts. Requiring EM within the Data Areas will facilitate continued use of EM to verify catch and release with a minimum of harm. If ICCAT authorizes retention of shortfin mako sharks in the future, and EM continues to be a requirement, then NOAA Fisheries may need to consider changes to the EM spatiotemporal requirements.

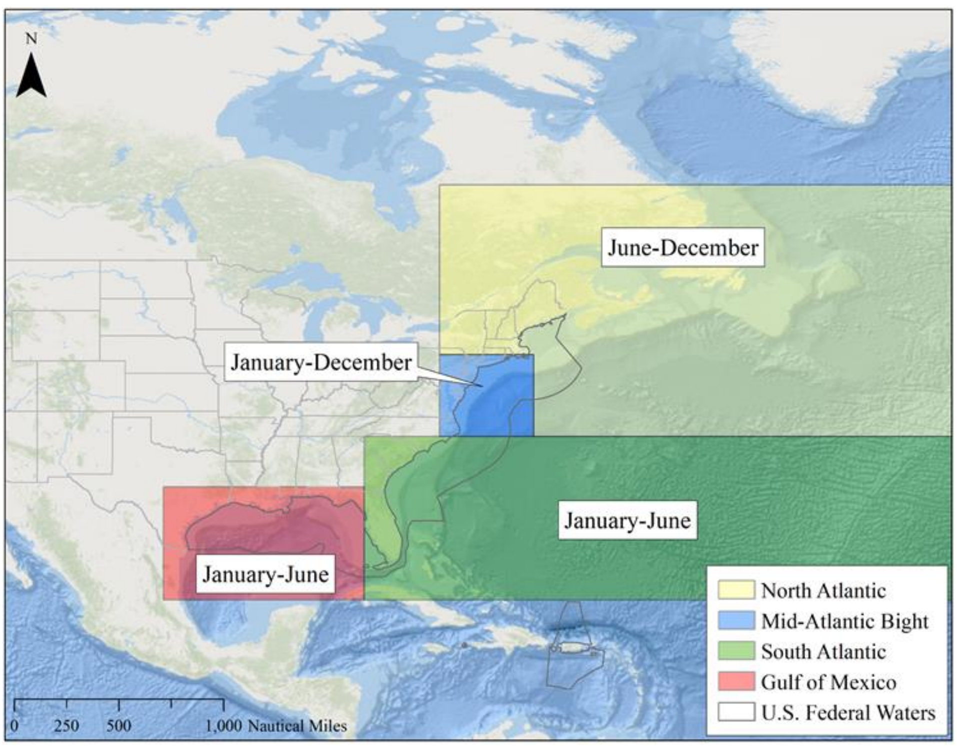

Figure 5.23. EM Data Review Areas

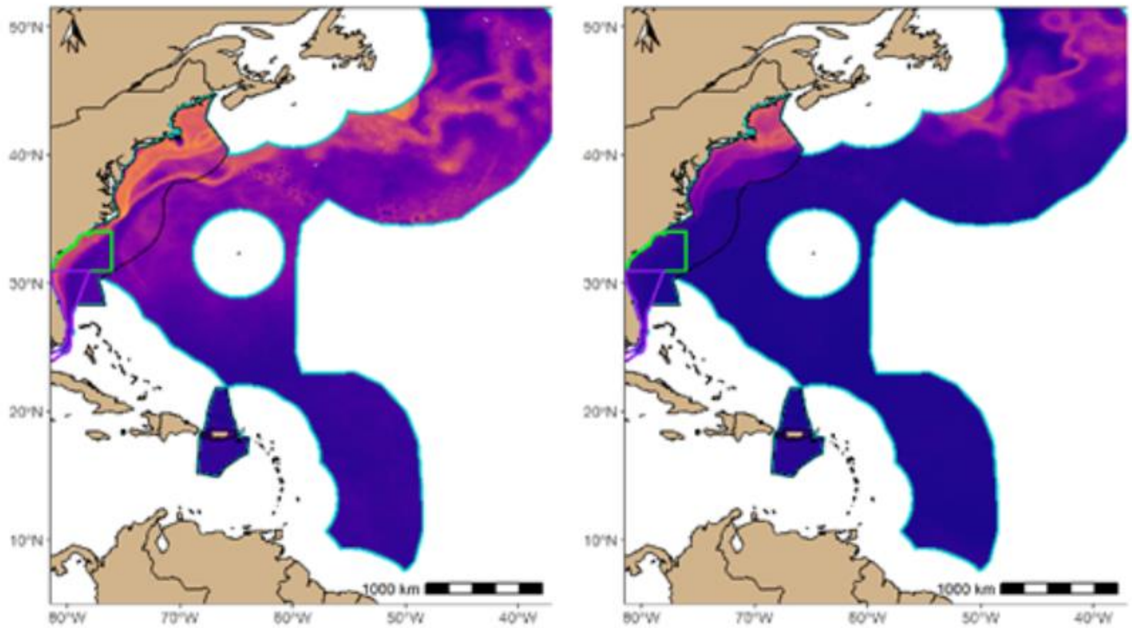

Figure 5.24. Shortfin mako shark probability of interaction in the Atlantic in March and September

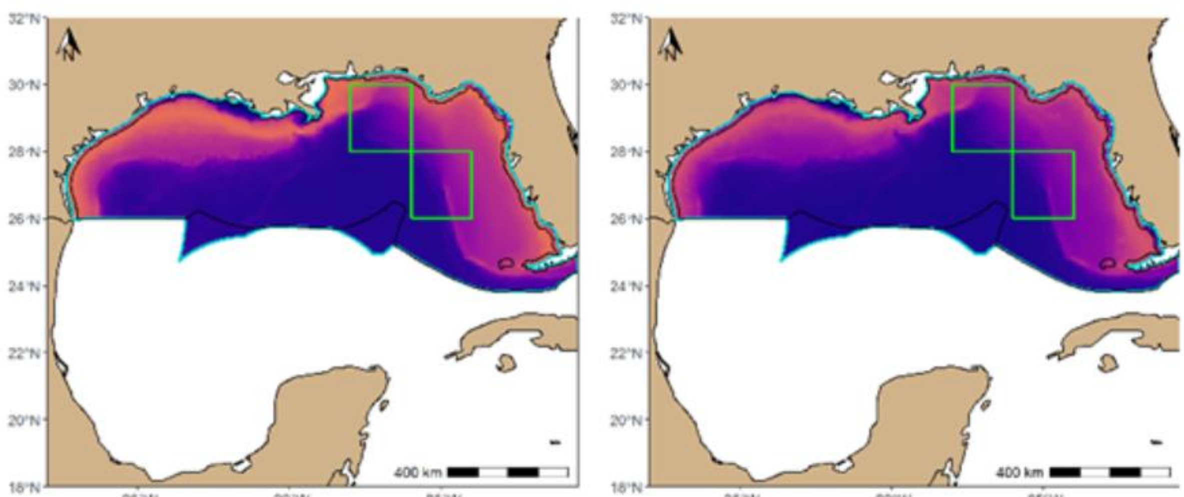

Figure 5.25. Shortfin mako shark probability of interaction in the Gulf of Mexico in March and September

In the short-term, the indirect ecological impacts of Alternative F2 on bycatch species, and other incidentally-caught species is expected to be neutral to minor beneficial due to a likely decrease in pelagic longline fishing effort and the associated reduction in impact to these species. Bycatch and incidentally-caught species in the HMS pelagic longline fishery include leatherback sea turtles, loggerhead sea turtles, shortfin mako sharks, billfish species (blue marlin, white marlin, roundscale spearfish, and sailfish), longfin mako sharks, oceanic whitetip sharks, scalloped hammerhead sharks, dusky sharks, and sandbar sharks. However, in the long-term, if, because of reductions in fishing effort as a result of this alternative, the United States is unable to fully harvest its quotas for the target species, it is possible that ICCAT could reduce the U.S. quota of the target species and correspondingly increase the quotas of other nations, many of which do not have the measures put in place to protect these bycatch species. If that happens, then this alternative could have a minor negative impact on bycatch and other incidentally-caught species.

Social and Economic Impacts

The direct social and economic impacts of Alternative F2 on pelagic longline vessel owners is expected to be moderate to major adverse. The sampling expenses associated with EM programs are large and varied and may represent a meaningful portion of the median revenue per trip and median net revenue per trip. Since costs would be negotiated directly between vessel owners and vendors, estimates of those costs are difficult to calculate. To provide a sense of an upper limit on direct economic impacts of Alternative F2, current EM program costs are described below. Alternative F2's cost mitigation measures can also be incorporated into the analysis to provide qualitative estimates on reductions in cost. Finally, cost estimates in other fisheries using EM could provide context and comparisons for the HMS pelagic longline fishery EM cost estimates.

Cost ceiling estimates

The total cost of the current HMS pelagic longline EM program is publicly available in the 2021 Atlantic Highly Migratory Species Electronic Technologies Implementation Plan. The plan breaks down the cost by task and has been summarized below in Table 5.121. NOAA Fisheries currently has contracts with two companies to provide all the functions and services in the sampling cost category (as defined in Table 3.15 in Section 3.6). Because both of these contracts have been in place since the implementation of the EM program, including development of the underlying infrastructure, they may not reflect the potential costs to the fishery under this alternative. It is possible that the costs under this alternative could be less than under the current program because the methodologies are well established and the restructuring of the EM requirements of the IBQ Program could result in cost savings. Furthermore, equipment repair and replacement costs under the existing contracts may overestimate future costs if cost responsibility is transferred to the industry since there is currently a reduced incentive to take optimal care of equipment. Once industry is responsible for the sampling costs, equipment care and other cost efficiency may result in decreased costs. For these reasons, the combined contract cost can be considered an upper level estimate of the program since other vendors would already have the infrastructure in place to support the program and may be already providing similar services in other fisheries.

Table 5.121. HMS pelagic longline electronic monitoring sampling costs across all vessels (annual)

Task	Cost	Percent of Total Cost
Equipment purchase, leasing, and installation, maintenance, system upgrades, and repairs, training for captain and crew, development of vessel monitoring plans	$570,000	35%
Video review and processing	$259,026	16%
Analyzing data and integrating into monitoring program	$49,411	3%
Video storage and access	$184,000	11%
EM database maintenance	$298,107	18%
EM database enhancements	$258,456	16%
Total	$1,619,000	

It is useful to express the costs of the EM program on a per-set basis in order to explore how the costs change with fishing effort, and analyze a potential means of charging individual vessel owners in an equitable manner. The sampling costs of an EM program reflect in part fishing effort, because the costs associated with recording, transmitting, storage, and review of video and metadata increase with increasing fishing effort. Since equipment is already installed on most vessels, the equipment costs in Table 5.121 reflect repair, maintenance, and replacement, the needs of which are likely a function of use and amount of fishing effort. From 2016 through 2020, an average of 5,778 pelagic longline sets were deployed each year (pelagic logbook data program). The cost per set was therefore approximately $280 ($1,619,000/5,778 sets = $280 per set). Using data from the pelagic longline cost earnings report, Table 5.122 presents pelagic longline earnings for three different trip sizes (by set) for 2018, 2019, and 2020. Trip sizes (by set) of three, six, and ten sets were selected to represent small, medium, and large trips. Figure 5.26 presents percentages of trips by set number based on 2016 through 2020 cost earnings data. A six-set trip is the median size of pelagic longline trips and is used as the medium size trip in the analyses below. Three sets per trip was selected as the smaller trip size and ten sets per trip was selected as the larger trip size based on the distribution in Figure 5.26.

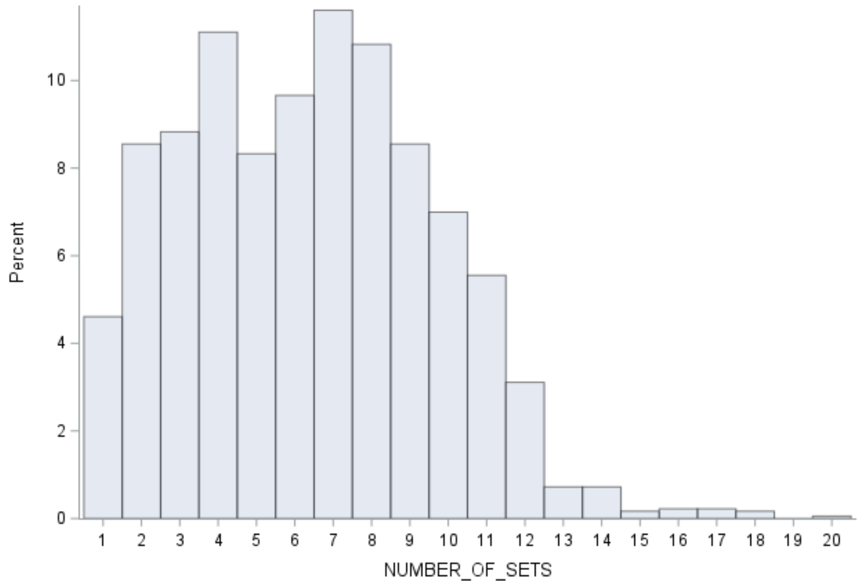

Figure 5.26. Percentages of trips by set number (Source: pelagic longline cost earnings).

Table 5.122. Pelagic longline earnings per trip consisting of three, six, and ten sets, 2018 through 2020 (Source: pelagic logbook cost earning report).

Number of sets/trip		2018	2019	2020	2018-2020 Average
3 sets/trip	Median revenue per trip	$9,291	$12,025	$18,043	$13,120
	Median net earnings/profit per trip (roughly: revenue - cost)	$4,639	$7,555	$15,846	$9,346
6 sets/trip	Median revenue per trip	$20,193	$17,693	$18,050	$18,645
	Median net earnings/profit per trip (roughly: revenue - cost)	$8,858	$9,544	$8,571	$8,991
10 sets/trip	Median revenue per trip	$30,443	$31,809	$23,917	$28,723
	Median net earnings/profit per trip (roughly: revenue - cost)	$20,252	$17,886	$7,561	$15,233

It is difficult to generalize economic impacts across the whole pelagic longline fleet, because the fleet is geographically diverse and composed of a range of vessel sizes, and vessel operators pursue various fishing strategies, including different trip lengths. Table 5.123 estimates the portion of such earnings EM sampling costs would represent on a trip deploying the median number of sets per trip (six sets), a trip with a lower number of sets (three sets), and a trip with a higher number of sets (ten sets) based on 2018 through 2020 average per trip revenue data. Revenue and net earnings information is specific to the size of each trip. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Table 5.123. EM sampling costs per trip as a percentage of earnings.

	3 sets per trip	**6 sets per trip (median number of sets per trip)**	**10 sets per trip**
EM sampling costs ($280 per set)	$840	$1,680	$2,800
Sampling costs as a percent of average median revenue per trip (number of sets*$280)/average revenue/trip (from Table 5.122)	6%	9%	10%
Sampling costs as a percent of average median net earnings per trip (number of sets*$280)/average earnings/trip (from Table 5.122)	9%	19%	18%

<u>Cost mitigation measures</u>

To mitigate the economic impact, Alternative F2 includes five components that could reduce the cost burden. First, the EM cost shift would be phased in over three years to allow the EM vendor market to develop. This phased-in approach has specific percentages that could be applied to any cost estimate. For example, in the first year, vessel owners would only be responsible for 25 percent of the sampling costs. Since those changes are temporary, they are not considered further in this cost mitigation discussion. Second, the vendor approval process encourages multiple vendors to enter the market, decreasing costs through competition and also leveraging the existing infrastructure of vendors currently providing video services. The current program, funded by NOAA Fisheries, pays for the entire program including the sampling infrastructure to receive, review, and store videos and data. Other vendors already providing such services may not require significant funds to develop the sampling infrastructure. Third, EM equipment currently installed on pelagic longline vessels, paid for by NOAA Fisheries, could continue to be used for the remaining life of each component. This feature avoids requirements for each vessel owner to obtain and pay for EM equipment upon implementation of Amendment 15, though they would be responsible for repair and replacement. Fourth, instead of providing exact specifications of equipment and data transfer methods that must be used, Alternative F2 provides vessel owners and vendors with flexibility, provided solutions meet the standards set forth. Innovative and less expensive equipment, data transfer methods, or other solutions could lower costs. Fifth, in order to operationalize the video review sampling design, this alternative would use EM Data Review Areas, under which fishermen may turn off their systems in certain areas and times. This approach would continue to further bluefin tuna reporting compliance goals, and would reduce costs through reduced wear and tear on the equipment, reduced shipping costs, and reduced video storage costs. Additionally, in some instances, fishermen may not need to use EM if target species are available in areas of unlikely bluefin tuna interactions.

Cost reductions due to the introduction of multiple vendors and the flexibility of equipment and process solutions are difficult to quantify but are likely to be realized. Other cost reductions, however, can be estimated. Allowing vessels to continue to use equipment provided by NOAA Fisheries can be quantified as well. Though the equipment would eventually have to be repaired and then replaced and returned to NOAA Fisheries at the vessel owner's expense, the decreased equipment costs are available in the short-term. The cost ceiling estimates in Table 5.123 do not include equipment installation costs since most vessels are already equipped, however, requiring vessels to procure and install their own equipment would increase costs by about $9,000 per vessel which is the average cost of equipment and installation.

The EM Data Review Areas, which provide reductions in the spatiotemporal EM requirements, would also provide quantifiable reductions in cost. By limiting EM requirements to these areas, the Alternative F2 sampling design is simplified, allowing for easier coordination among the Agency and multiple vendors. In contrast, if video from all sets, regardless of location and time, are submitted for review, selection of sets must occur under a stratified sampling plan. Random selection of sets for review without a stratified sampling plan, would more often include sets where bluefin tuna interactions are unlikely and exclude more useful sets where interactions are likely. However, a stratified sampling plan would increase administrative burden and introduce uncertainty in the EM vendor market. A stratified sampling plan would not allow for a vendor to know which sets would be reviewed when vessel operators submit video data. Rather, vendors would be notified after videos are received since sets for review could only be identified once the sampling plan administrator has a complete list of sets deployed during the applicable time period. Cost structure negotiations between vessel owners and vendors would be more complicated since costs would not be known upfront. This uncertainty would lead to video review costs that are higher or lower than expected, based upon a sampling plan unavailable to vessel owners and vendors. Under this alternative, limiting EM requirements to certain areas and times would ensure that all submitted video is of sets that occurred in areas of likely bluefin tuna interactions. Each vendor can then randomly select 10 percent of submitted sets (including at least one set from each vessel), providing useful compliance information without the complexities of a formal stratified sampling plan and without compromising conservation goals, while providing cost certainty to vessel owners and vendors.

Furthermore, if a vessel can operate exclusively in areas and times that do not require EM, that vessel owner's EM costs are reduced to zero. If a vessel operator plans to fish both inside and outside EM Data Review Areas, they would need to continue to maintain operational equipment and coordinate with a vendor. However, they would not need to submit and pay for video review for every set. Table 5.124 shows the regional breakdown of sets that occurred inside and outside the proposed EM Data Review Areas from 2016 through 2020. Note that any effort inside an EM Data Review Area would require submission and review of video data for all sets on that trip, even if some effort occurred outside those areas. A portion of the costs for some fishermen operating in the South Atlantic could be reduced by 31 percent and by 57 percent for some fishermen operating in the Gulf of Mexico.

Table 5.124. Average annual number of sets inside and outside proposed EM Data Review Areas, by region (Source 2016-2020 Pelagic Logbook Data)

Region	Inside EM Data Review Areas (average annual number of sets)	Outside EM Data Review Areas (average annual number of sets)	Percent of sets outside EM Data Review Areas
North Atlantic	1,719	6	0%
Mid-Atlantic Bight	8,963	0	0%
South Atlantic	6,375	2,835	31%
Gulf of Mexico	3,232	4,329	57%

In addition to the cost mitigation measures included in Alternative F2, NOAA Fisheries notes that there may be external funding sources available to help offset some portion of fishers' sampling costs. Outside groups, such as environmental NGOs may be interested in assisting fishers with such costs, if the monitoring program aligns with organizational goals or if fishermen are willing to voluntarily assist with research or reporting programs initiated by the organization. Grant programs could also provide funding. For example, the Atlantic States Marine Fisheries Commission (ASMFC) currently administers a grant that covers funding of the Northeast Groundfish EM program (see "EM programs in other fisheries" section). Additionally, the National Fish and Wildlife Foundation (NFWF) recently requested proposals for a grant program to "systematically integrate technology into fisheries data collection and observations." Though this specific request for proposals has closed, future opportunities could become available. External funding sources are not guaranteed and we are not aware of deliberations by any organization to provide funding at this time. However, the possibility of such opportunities is a consideration when estimating costs that would be incurred by the HMS pelagic longline fishery.

EM programs in other fisheries

NOAA Fisheries has implemented EM programs in various regions and has been working toward industry-funded programs in recent years. Examples include EM programs under the Northeast Groundfish FMP, the Pacific Coast Groundfish FMP, two North Pacific groundfish FMPs, and the Pacific Islands Hawaiian longline FMP. The design and goals of each program differs from the HMS pelagic longline EM program, and none has fully implemented cost allocation to the industry. However, to provide context for considering the costs of Alternative F2, NOAA Fisheries here provides a sense of the range of cost estimates related to other programs. Additional information about all regional electronic technology programs, including EM, is available on the NOAA Fisheries Electronic Technologies Implementation Plans website.

In the northeast groundfish fishery, the industry has been required to fund the at-sea monitoring program, including EM, since 2009 (74 FR 17029; April 13, 2009). However, since that time, NOAA Fisheries has had sufficient funding to pay for the industry's sampling costs and has reimbursed the industry for 100 percent of its at-sea monitoring costs through a grant with the ASMFC. Amendment 23 to the Northeast Multispecies FMP (87 FR 75852; December 9, 2022) implemented, among other things, a fixed monitoring coverage target as a percentage of trips, dependent on federal funding. Cost estimates in Amendment 23 for EM in the northeast groundfish fishery range from $270 to $335/sea day.

For the Pacific groundfish trawl catch share fishery, NOAA Fisheries published a final rule that authorized the use of EM in place of human observers to meet requirements for 100-percent at-sea monitoring for catcher vessels in the fishery (84 FR 3114; June 28, 2019). Although implementation of the EM program has been delayed until at least January 1, 2024, NOAA Fisheries provided some preliminary estimates of EM program costs at the November 2019 Pacific Fishery Management Council meeting. Based on a pilot program developed under an exempted fishing permit (EFP), NOAA Fisheries estimated that industry costs for an EM program would range from $149/sea-day for a whiting trip (without equipment costs) to $489/sea-day for a bottom trawl trip (with equipment costs).

For the Bering Sea and Aleutian Islands and Gulf of Alaska groundfish and halibut fisheries, owners and operators of vessels using non-trawl gear in the partial coverage category of the North Pacific Observer Program may choose to be in a selection pool for using an EM system to monitor catch and bycatch (82 FR 36991; August 8, 2017) (issued under Magnuson-Stevens Act section 313 (North Pacific fisheries research plan)). NOAA Fisheries contracts with one or more EM service providers to install and service EM equipment and to collect and review EM data, and collects fees pursuant to section 313 authority. In 2022, approximately 170 hook-and-line and pot vessels were selected to use EM. Based on the 2021 North Pacific Observer Program Annual Report (in press), the average cost for EM in the partial coverage category of the hook-and-line and pot fisheries was $933/sea-day.

The Pacific Islands Region is currently developing an EM program for the Hawaii-based longline fisheries. Since 2017, the Pacific Islands Fisheries Science Center has conducted a pre-implementation program to compare EM detection rates with observer detection rates in both deep- and shallow-set fisheries. Currently, observers are deployed on 100 percent of shallow-set trips and 20 percent of deep-set trips. Eighteen vessels are participating in the program and EM coverage is approximately 15 percent on deep-set trips and 33 percent on shallow set trips. Across all trips participating in the program, the per-set cost is approximately $108/set spread across all sets, not just those that are reviewed. If costs are only spread across the sets that were reviewed, the per-set cost of the program is approximately $460/set.

Summary of expected EM sampling costs in the industry

A precise estimate of actual costs that would be incurred by the pelagic longline fishery from EM sampling cost allocation is not available. However, using the above information, a directional estimate can be deduced. First, the cost ceiling estimate is $280 per set, which would cost a vessel owner approximately $1,680 for a 6-set trip (median number of sets per trip). The median length of a pelagic longline trip is 10 days (NOAA Fisheries 2021b), resulting in $168 per sea-day. Mitigation measures outlined above, especially the change in spatiotemporal EM requirements (EM Data Review Areas) would likely reduce this cost. In the South Atlantic region, vessel operators would use EM approximately 31 percent less often than under the no action alternative, and in the Gulf of Mexico, approximately 57 percent less often (Table 5.124). While these reductions would not result in reduced costs on trips that are required to use EM, the reductions would be an approximate reduction in total annual cost for the entire pelagic longline fishery operating in those areas. In the North Atlantic and Mid-Atlantic Bight, a reduction in costs is unlikely (Table 5.124). For all regions, multiple vendor options would likely also provide some reduction in costs, though, an estimate on the reduction is not available.

Direct comparison to other national programs is not possible due to differences in program goals and requirements. Unlike other programs which use EM for a large volume of catch or require higher rates of video review for various reasons, the HMS pelagic longline EM program is designed to monitor compliance with bluefin tuna reporting requirements, requiring a lower review rate and a more limited number of required species identification. However, cost estimates related to other programs may provide context and points of comparisons for estimates under Alternative F2. Estimates of cost in other programs range from $149 to $933 per sea-day, which cover the ceiling estimate of $168 per sea-day estimate for the HMS pelagic longline fishery before mitigation measures are included.

Indirect social and economic impact to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be minor adverse. Reductions in fishing effort resulting from increased costs would reduce demand for supplies and would reduce landings of fish for dealers to acquire. Since most dealers do not rely solely on landings from one fishery, adverse social and economic impacts are somewhat reduced relative to direct impacts to the pelagic longline fishery. From 2016 through 2020, 212 dealers purchased swordfish, yellowfin tuna, or bigeye tuna products along the Atlantic, Gulf of Mexico, and U.S. Caribbean coasts.

5.6.3. Alternative F3 - Remove current EM regulations regarding bluefin tuna and shortfin mako sharks

This alternative would remove all the current EM program requirements applicable to pelagic longline vessels. Other IBQ Program requirements would remain to continue individual vessel accountability for bluefin tuna.

The direct ecological impacts of Alternative F2 on target species catch is expected to be neutral. Target species in the pelagic longline fishery are quota managed and this alternative would not affect the overall U.S. quotas for swordfish, yellowfin tuna, or bigeye tuna, which prevent overfishing, are based on the best scientific information available, and are consistent with the ICCAT-recommended TACs and quotas. The removal of EM requirements could provide more flexibility to fishermen and it is possible that this could result in increased effort. However, since effort is generally dictated by market conditions, and change in effort as a result of this alternative is likely to be small with neutral direct ecological impacts.

Ecological Impacts on Bluefin Tuna, Bycatch Species, and Other Incidentally-Caught Species

The indirect ecological impacts of Alternative F3 on bluefin tuna would be neutral to minor negative. Since EM requirements were implemented in 2015, the total fishing effort in the pelagic longline fishery has declined substantially and there has been a relatively low level of bluefin tuna discards. Table 5.125 shows the number of vessels fishing with pelagic longline gear, the number of vessels landing bluefin tuna, and the number of sets, from 2016 through 2020. The IBQ Program has measures that require vessel accountability and may serve as disincentives to interact with bluefin tuna. Even without EM, there are other reporting requirements (VMS, dealer reports, observers and logbooks) that provide data on bluefin tuna and other incidentally-caught or bycatch species.

Data indicate a high level of matching between VMS reports and the results of EM video reviews regarding the presence of bluefin tuna (Figure 6.61, NOAA Fisheries 2019). Dealer landings data could provide an estimate on a large portion of IBQ usage in near real time. This dynamic is shown in Table 5.126 which compares landings to IBQ quota usage. Since implementation of the IBQ program in 2015, landings account for the vast majority of IBQ usage, especially in more recent years. Tracking dealer landings could allow the Agency to cross-check the majority of VMS bluefin tuna reports from fishermen, in near real-time, providing increased confidence in IBQ tracking. However, dealer reports are not a useful source of discard data. Observer information provides information on trends in bluefin tuna interactions and IBQ usage, although the current level of coverage (about 10 percent of trips) would not provide a full cross-check for compliance with IBQ reporting requirements across the entire fishery.

While acknowledging these other data sources, EM is the reporting requirement that has successfully motivated compliance with the IBQ Program since its inception. Without EM, NOAA Fisheries would lose a primary tool for verifying the accuracy of the logbook and VMS reports, and for identifying concerns related to compliance with the IBQ Program and the fishery overall. While fishing strategies that have evolved to adapt to the IBQ Program requirements may continue in the short-term, those strategies are likely to continue to change over the long-term. Without EM, there could be weaker compliance with IBQ Program requirements, resulting in long-term, minor negative impacts to bluefin tuna.

Table 5.125. Number of vessels fishing with pelagic longline gear, the number of vessels landing bluefin tuna, and the number of sets, from 2016 through 2020 (Source: Table 6.9, 2021 SAFE Report)

Year	Number of vessels using pelagic longline gear	Number of vessels landing bluefin tuna	Number of pelagic longline sets
2016	85	55	6,885
2017	89	58	7,305
2018	76	50	5,666
2019	67	44	4,803
2020	72	36	4,229

Table 5.126. Comparison of bluefin tuna landings to IBQ quota usage (Source: 2012 through 2019 from Table 3.19, Amendment 13 FEIS; 2020 from Table 6.9, 2021 SAFE Report)

Year	Landings (mt)	Dead Discards (mt)	IBQ Usage(mt, landings + dead discards)	Percent of IBQ Usage that are Landings
2012	89.6	205.8	295.4	30%
2013	62.9	156.4	219.3	29%
2014	82.5	139.2	221.7	37%
2015	71.4	17.1	88.5	81%
2016	86.2	25.0	111.2	78%
2017	104.1	10.3	114.4	91%
2018	88.0	14.6	102.6	86%

2019	86.3	5.5	91.8	94%
2020	50.0	5.3	55.3	90%

Table 5.126 also demonstrates that the IBQ program implemented in 2015 successfully reduced dead discards largely by converting that catch into landings, thereby reducing regulatory discards. The IBQ system incentivized this transition due to individual accountability, but also by changing the requirements for bluefin tuna retention. Prior to the IBQ program, bluefin tuna retention limits were based on retained target catch amounts. Specifically, one, two, or three bluefin tuna could be retained if 2,000 lb, 6,000 lb, or 30,000 lb of target catch, respectively, was on board. The IBQ system allows fishermen to retain any number of legal-sized bluefin tuna, provided their permit has enough IBQ allocation to cover the landings. Under Alternative F3, bluefin tuna retention requirements would not change and so the successful conversion of dead discards to landings may not be impacted. However, it is also possible that increased high-grading (i.e., prohibited act of discarding retained fish if more valuable catch is boated) could occur if EM is removed as a compliance tool.

Indirect short-term ecological impacts of Alternative F3 on shortfin mako sharks are neutral to minor adverse. There is a zero retention limit for shortfin mako sharks, thus EM is only used to verify that shortfin mako sharks that are live at haulback are released with a minimum of harm. Removing EM requirements could reduce the incentive for fishermen to release live shortfin mako sharks with minimal harm. If, in the future, limited retention of shortfin mako sharks that are dead at haulback is authorized, removal of EM requirements could hamper enforcement of the requirement and NOAA Fisheries may need to consider other ways to implement and enforce limited retention of the species

The indirect ecological impacts of Alternative F3 on other bycatch species and incidentally-caught species would be neutral. The removal of EM requirements could provide more flexibility to fishermen and it is possible that this could result in increased effort. However, since effort is generally dictated by market conditions, any change in effort as a result of this alternative is likely to be small with neutral indirect ecological impacts. Bycatch and incidentally-caught species in the HMS pelagic longline fishery include shortfin mako sharks, leatherback sea turtles, loggerhead sea turtles, billfish species (blue marlin, white marlin, roundscale spearfish, and sailfish), longfin mako sharks, oceanic whitetip sharks, scalloped hammerhead sharks, dusky sharks, and sandbar sharks.

Social and economic impacts

The direct social and economic impacts of Alternative F3 on pelagic longline vessel owners/operators is expected to be neutral to minor beneficial. Vessel owner/operators would no longer be required to pay the costs associated with mailing hard drives (approximately $20 for each shipment); pay for specialized equipment such as EM booms or measuring grids (up to $1,000); or experience any constraints on fishing operations or fish handling that may result from complying with the EM regulations. The additional flexibility could also allow for minor increases in fishing effort, providing additional revenue.

Indirect social and economic impact to supporting businesses such as seafood dealers and bait/tackle suppliers are expected to be neutral. Any effort changes would be small so associated increases in landings would be similarly small. From 2016 through 2020, 212 dealers purchased swordfish, yellowfin tuna, or bigeye tuna products along the Atlantic, Gulf of Mexico, and U.S. Caribbean coasts.

5.6.4 Comparison of Electronic Monitoring Alternatives

The No Action alternative, Alternative F1, would be the least disruptive to fishery operations and IBQ reporting compliance. However, Alternative F1 would not comply with the 2019 NOAA Cost Allocation Policy. Alternative F2, the preferred alternative, would meet the requirements of the policy by shifting the cost burden of the sampling portion of the EM program from the Agency to the industry. Since the core technical aspects of the EM program, including camera requirements and video review, would be maintained, adoption of this alternative should not impact compliance with the IBQ program bluefin tuna retention and reporting requirements. Modification of the spatiotemporal requirements of the EM program (EM Data Review Areas) is not expected to have any impact ecologically to target species, bluefin tuna, shortfin mako sharks, or other species, since the approach was designed based on the existing SEFSC sampling program. While fishers may change their fishing strategy or location in light of the EM Data Review Areas, this is not expected to result in a noticeable change in catch composition. Alternative F2 would, however, lead to a substantial increase in operational costs in the HMS pelagic longline fishery. Costs to the fishery may be between 10 to 20 percent of per-trip profits, though the mitigation measures detailed in Section 5.6.2 would likely decrease those costs. NOAA Fisheries prefers Alternative F2 at this time because it would comply with the 2019 Cost Allocation Policy while maintaining reporting compliance aspects of EM in support of the IBQ program.

Alternative F3 would remove EM requirements in the HMS pelagic longline fishery but would not modify the IBQ program. Adoption of this alternative would comply with the 2019 Cost Allocation Policy since the Agency would no longer fund the EM program and, in contrast to Alternative F2, would not result in increased costs in the fishery. However, the EM program supports compliance with the bluefin tuna IBQ program which has successfully reduced dead and regulatory discards and capped total mortality of bluefin tuna in the pelagic longline fishery. Alternative F3 is not preferred at this time due to uncertain impacts on compliance with IBQ reporting requirements.

5.7 REFERENCES

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Chapter 6 CUMULATIVE IMPACTS, MITIGATION, AND UNAVOIDABLE IMPACTS

6.1 CUMULATIVE IMPACTS

Cumulative impacts are the impacts on the environment that result from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR § 1508.7). A cumulative impact includes the total effect on a natural resource, ecosystem, or human community due to past, present, and reasonably foreseeable future activities or actions of Federal, non–Federal, public, and private entities. Cumulative impacts may also include the effects of natural processes and events, depending on the specific resource in question. Cumulative impacts include the total of all impacts to a particular resource that have occurred, are occurring, and would likely occur as a result of any action or influence, including the direct and reasonably foreseeable indirect impacts of a Federal activity. The goal of this section is to describe the cumulative ecological, economic and social impacts of past, present and reasonably foreseeable future actions with regard to the management measures presented in this document.

Amendment 15 largely focuses on the shark bottom longline and HMS pelagic longline fisheries and Section 6.1 considers cumulative impacts to each fishery separately.

6.1.1 Shark Bottom Longline Fishery

The first Atlantic shark FMP (58 FR 21931; April 26, 1993) was implemented in 1993 and included measures such as a quota, prohibition on shark finning, and the creation of the large coastal, small coastal, and pelagic shark species complexes. The 1999 FMP for Atlantic Tunas, Swordfish, and Sharks (15 CFR 902; May 28, 1999) implemented additional measures in shark fisheries including quota changes, minimum sizes, and limited access permits in commercial shark fisheries. In 2003, Amendment 1 to the 1999 FMP (68 FR 74746; December 24, 2003) removed commercial shark minimum sizes and created regional quotas for some species groups, among other things. Of particular relevance to this action, Amendment 1 to the 1999 FMP also created the Mid-Atlantic shark closed area. Shark fishery regulations were further modified in 2006 through the Consolidated HMS FMP (71 FR 58058; October 2, 2006) which included measures such as mandatory protected species safe handling, release, and identification workshops and certification for HMS pelagic longline, bottom longline, and gillnet fisheries.

Atlantic shark fisheries, including the shark bottom longline fishery, experienced large changes due to publication of Amendment 2 to the 2006 Consolidated HMS FMP (73 FR 40658; July 15, 2008). Amendment 2 implemented large changes in the fisheries based on stock assessments conducted in 2005/2006 for the large coastal shark (LCS) complex, sandbar, blacktip, porbeagle, and dusky sharks. The management measures in Amendment 2 included, among other things:

- Established an annual shark season instead of trimesters.
- Modified the shark stock assessment schedule from every 2-3 years to every 5 years.
- Established a research fishery for sandbar sharks with established base quotas of 116.6 mt dw and a 50 mt dw non-sandbar LCS research quota.
- Implemented commercial quotas of 188.3 mt dw for Atlantic non-sandbar LCS and 439.5 mt dw for Gulf of Mexico non-sandbar LCS.
- Implemented a base commercial quota of 454 mt dw for SCS.
- Implemented commercial quotas of 488 mt dw for pelagic sharks (other than blue and porbeagle sharks), 273 mt dw for blue sharks, and 1.7 mt dw for porbeagle sharks.
- Implemented time/area closures recommended by South Atlantic Fishery Management Council (SAFMC).
- Established a boundary between the Gulf of Mexico region and the Atlantic region, defined as a line beginning on the east coast of Florida at the mainland at 25° 20.4' N. lat, proceeding due east. Any water and land to the south and west of that boundary was considered within the Gulf of Mexico. Any water and land to the north and east of that boundary line was considered within the Atlantic region.
- Established a 33 non-sandbar LCS per trip retention limit for directed permit holders and a 3 non-sandbar LCS per trip retention limit for incidental permit holders.
- Established no trip limit for SCS or pelagic sharks for directed permit holders and 16 SCS and pelagic sharks for incidental permit holders.
- Required that all Atlantic sharks must be offloaded with fins naturally attached.
- Prohibited the retention of sandbar sharks in the commercial fisheries unless participants were part of the shark research fishery.

Amendment 2 resulted in a large reduction in commercial shark fishing effort, particularly for those targeting large coastal sharks due to the retention limit reduction.

A number of more recent FMP amendments to the 2006 Consolidated HMS FMP and actions have affected the commercial shark fisheries as well. Amendment 3 (75 FR 30484; June 1, 2010) established new small coastal shark complexes and quotas, added smoothhound sharks to the HMS management unit, and encouraged live release of shortfin mako sharks, among other things. In response to ICCAT recommendations, NOAA Fisheries prohibited the retention of hammerhead, oceanic whitetip sharks (76 FR 53652; August 28, 2011), and silky sharks (77 FR 60632; October 4, 2012) caught in association with ICCAT fisheries. In 2013, Amendment 5a (78 FR 40318; July 3, 2013) established regional quotas and quota linkages for different large coastal and small coastal shark management groups which were further modified in 2015 through Amendment 6 (80 FR 50074; August 18, 2015). Amendment 6 also modified the commercial retention limit range for large coastal sharks and sandbar sharks caught in the shark research fishery and removed vessel upgrade restrictions for shark limited access permit holders. In 2015, NOAA Fisheries published Amendment 9 (80 FR 73128; November 24, 2015) to modify measures in the smoothhound shark fishery including implementing quotas, requiring net checks, and allowing limited processing of smoothhound shark carcasses at sea. Amendment 5b (82 FR 16478; April 4, 2017) implemented a number of protections for dusky sharks, including a circle hook requirement in the shark bottom longline fishery to decrease mortality of incidentally-caught dusky and other sharks. Amendment 11 (84 FR 5358; February 21, 2019) largely focused on shortfin mako shark protections, but many of those measures were superseded by a final rule (87 FR 39373; July 1, 2022) that set the shortfin mako shark retention limit at zero. Finally, in 2023, Amendment 14 (88 FR 4157; January 24, 2023) established guidance on a number of technical benchmarks including acceptable biological catch, annual catch limits, and underharvest carryovers that could provide the foundation for future changes in Atlantic shark management.

In additional to international fisheries management efforts through ICCAT (see Section 1.1 for further detail), NOAA Fisheries also actively participates in other international bodies that could affect U.S. shark fishermen and the shark industry including the Conference of the Parties (COP) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). CITES is an international agreement that regulates the global trade in plants and wildlife to ensure that international trade does not threaten their survival. Any country that is a Party to CITES may propose amendments to Appendices I and II, and resolutions, decisions, and agenda items for consideration by all the Parties. CITES has three appendices: Appendix I includes species prohibited in international commercial trade, Appendix II includes international trade of regulated species in part through CITES export permits issued by the exporting country, and Appendix III includes species for which a country has requested help with monitoring trade.

Table 6.1 shows shark species currently listed on CITES Appendix II. In 2022, CITES listed *Carcharhinidae* species (requiem sharks) with a 12-month implementation delay. Of the requiem shark species listed, Atlantic sharpnose, blacknose, blacktip, blue, bull, lemon, sandbar, and spinner sharks are managed by the HMS Management Division and can be retained by commercial fishermen. Bignose, Caribbean reef, Caribbean sharpnose, dusky, Galapagos, night, and smalltail sharks are also listed on Appendix II of CITES, but retention of these shark species is prohibited. Bonnethead sharks were listed in Appendix II with the rest of the non-listed hammerhead shark species based on the similarity in appearance of specimens of these species to others in the CITES Appendices. At the time this document was finalized, the impacts of the requiem and bonnethead shark listings are unknown because they have not yet become effective. However, it is expected that they will likely impact the commercial shark fishery similarly as other CITES listings.

Table 6.1. Atlantic HMS managed shark species listed on CITES Appendix II.

Atlantic HMS Species on Appendix II	Conference of Parties (CoP)	Meeting Year
Basking shark	CoP13	2004
Whale shark	CoP13	2004
White shark	CoP13	2004

Atlantic HMS Species on Appendix II	Conference of Parties (CoP)	Meeting Year
Hammerhead shark, great	CoP16	2013
Hammerhead shark, scalloped	CoP16	2013
Hammerhead shark, smooth	CoP16	2013
Oceanic whitetip shark	CoP16	2013
Porbeagle shark	CoP16	2013
Silky shark	CoP17	2016
Thresher shark	CoP17	2016
Longfin mako shark	CoP18	2019
Shortfin mako shark	CoP18	2019
Atlantic sharpnose shark	CoP19	2022
Bignose shark	CoP19	2022
Blacknose shark	CoP19	2022
Blacktip shark	CoP19	2022
Blue shark	CoP19	2022
Bonnethead shark	CoP19	2022
Bull shark	CoP19	2022
Caribbean sharpnose shark	CoP19	2022
Dusky shark	CoP19	2022
Galapagos shark	CoP19	2022
Lemon shark	CoP19	2022
Night shark*=	CoP19	2022
Sandbar shark	CoP19	2022
Smalltail shark*=	CoP19	2022
Spinner shark	CoP19	2022

Ecological and social and economic impacts to the shark bottom longline fishery analyzed in Chapter 5 take into account prior HMS management actions (FMP and amendments and regulations) as impacts are assessed relative to the current state of the fishery.

Reasonably foreseeable actions include annual shark specifications, management action based on any new or updated shark stock assessments, and a follow-up action to Amendment 14. Annual shark specifications would establish opening dates, retention limits, and underharvest carryovers as appropriate in the Atlantic shark fisheries. Future annual specifications are unlikely to deviate from recent annual specifications. A number of domestic and international shark stock assessments are planned and a stock assessment for hammerhead sharks (great, scalloped, smooth, and Carolina hammerhead sharks) is underway through the Southeast Data, Assessment, and Review process. If the hammerhead shark stock assessment or any future stock assessment indicate the need for great protections for some species or if stocks are identified that can handle additional fishing mortality, NOAA Fisheries would take appropriate action. A follow-up action to Amendment 14 is expected to restructure commercial quotas including removing quota linkages, establish recreational quotas, revisit regions, and, to the extent they were established based on existing quotas, modify retention limits in the shark fisheries. Collectively, these actions would ensure that quotas reflect the latest, best scientific information available on sustainable harvest levels, minimizing adverse ecological impacts.

Reasonably foreseeable conditions include changes in shark product markets. Recently, demand for shark products has declined, reducing effort in Atlantic shark fisheries. Future changes in demand, whether up or down, would affect the profitability of the fisheries. NOAA Fisheries notes that a new prohibition on sale of shark fins could affect shark product markets, shipping, and demand. *See* Public Law No. 117-263 § 5946(b) (December 23, 2022) (National Defense Authorization Act for Fiscal Year 2023). In addition, state shark fin prohibitions can also affect shipping channels for the product. Legislative bans on the possession and trade of shark fins exist in Delaware, Maryland, Massachusetts, New York, Texas, Florida, and New Jersey, although some of these states allow limited exemptions for species such as smoothhound sharks and, in the case of Florida, exempt some Federal commercial shark permit holders. Some states on the West Coast of the United States, several U.S. territories, and Illinois have similar restrictions.

6.1.2 HMS Pelagic Longline Fishery

The pelagic longline fishery for Atlantic HMS primarily targets swordfish, yellowfin tuna, and bigeye tuna in various areas and seasons. Pelagic longline gear sometimes attracts and hooks non-target finfish with little or no commercial value as well as species that cannot be retained by commercial fishermen due to regulations. Pelagic longline gear may also interact with protected species such as sea turtles. Any species (or undersized catch of permitted species) that cannot be landed due to fishery regulations are required to be released, regardless of whether the catch is dead or alive.

Regulations for the U.S. Atlantic pelagic longline fishery include minimum sizes for swordfish, yellowfin tuna, bigeye tuna, and bluefin tuna; gear and bait requirements; limited access vessel permits; the IBQ Program to limit incidental catch of bluefin tuna; gear restricted areas; closed areas; observers, protected species incidental take limits; reporting requirements (including logbooks); mandatory workshop requirements; regional quotas for swordfish; and shark landings restrictions. The retention of billfish by commercial vessels, or the sale of billfish from the Atlantic Ocean, is prohibited. As a result, all billfish caught on pelagic longline gear must be released, and are considered bycatch. Many of the management strategies implemented have a spatial component. For example, some gear requirements are designated for certain areas (e.g., weak hooks in the Gulf of Mexico, certain gear and bait combination requirements for the NED). The pelagic longline fishery also must comply with other laws and regulations including the MMPA and ESA.

Recent specific rulemakings that have affected pelagic longline management are listed below:

- On January 1, 2015, NOAA Fisheries implemented Amendment 7 (79 FR 71510; December 2, 2014). The rule dramatically changed pelagic longline fishery management, including: the IBQ Program; the Spring Gulf of Mexico Gear Restricted Area; the Cape Hatteras Gear Restricted Area; closure of the pelagic longline fishery when annual bluefin tuna quota is reached; elimination of target catch requirements associated with retention of incidental bluefin tuna in the pelagic longline fishery; mandatory retention of legal-sized bluefin tuna caught as bycatch; expanded monitoring requirements, including EM via cameras and bluefin tuna catch reporting via VMS; and transiting provisions for pelagic longline and bottom longline vessels.
- On March 3, 2019, NOAA Fisheries implemented Amendment 11 to the 2006 Consolidated HMS FMP (84 FR 5358; February 21, 2019)(Amendment 11). This rule implemented management measures to address overfishing and rebuild the overfished North Atlantic shortfin mako shark stock based on the ICCAT stock assessment that determined that shortfin mako sharks are overfished and experiencing overfishing. Management measures also reflect ICCAT Recommendation 17-08. Commercial measures allowed retention of shortfin mako sharks by HMS permit holders when caught with longline or gillnet gear and only if the shark is dead at haulback. Retention of dead shortfin mako sharks with pelagic longline gear was allowed only if there was a functional EM system on board the vessel. This requirement was superseded in 2022 when the United States began prohibiting all U.S. fishermen, including those on pelagic longline vessels, from retaining any shortfin mako sharks consistent with ICCAT Recommendation 21-09 (87 FR 39373; July 1, 2022).
- The Deepwater Horizon Oceanic Fish Restoration Project (OFRP) was conducted in the Gulf of Mexico region from 2017 – 2022 and solicited pelagic longline vessels to voluntarily participate on an annual basis. These vessels were compensated to refrain from fishing with pelagic longline gear during the first half of each year of participation, a period that coincided with higher bluefin tuna prevalence and spawning in the Gulf of Mexico. To help offset the economic impacts of the project, participating vessels were encouraged to fish with alternative gears (e.g., green-stick, buoy gear, and deep-set rod and reel) for swordfish and yellowfin tuna. While the pelagic longline vessels were not actively fishing longline gear the IBQ allocations to those vessels were locked and could not be used. As a result of vessels participating in this project, the number of vessels actively fishing pelagic longline in the winter and spring in the Gulf of Mexico was reduced.
- On September 15, 2017, the first marine national monument in the Atlantic Ocean, the Northeast Canyons and Seamounts Marine National Monument was created. The total area of the monument is 4,913 square miles of ocean. Commercial fishing and other resource extraction activities have been prohibited within the monument boundaries on a year-round basis. Recreational

fishing is allowed to occur in the monument boundaries. On June 5, 2020, the prohibition on commercial fishing was lifted under the Presidential "Proclamation on Modifying the Northeast Canyons and Seamounts Marine National Monument." More recently, on October 8, 2021, the current administration reinstated the prohibition on commercial fishing in the area, with the exception of American lobster and Atlantic deep-sea red crab taken with fixed gear. The National Monument does not intersect with any areas considered in this action. On December 6, 2022, the HMS Management Division notified the public through a GovDelivery notice that the U.S. Fish and Wildlife Service and NOAA Fisheries have invited public input to help guide the creation of the Northeast Canyons and Seamounts Marine National Monument Joint Management Plan.

- On April 2, 2020, NOAA Fisheries published a final rule (85 FR 18812) that modified certain pelagic longline bluefin tuna area-based and weak hook management measures. This rule eliminated the Cape Hatteras Gear Restricted Area from the regulations. The rule also modified the current year-round weak hook requirement to a seasonal requirement (January-June) when bluefin tuna are abundant in the Gulf of Mexico. The rule also converted a closed area in the Atlantic (Northeastern United States closed area) and a gear restricted area (Spring Gulf of Mexico Gear Restricted Area) to monitoring areas. These areas, which were previously closed to reduce bluefin tuna bycatch on pelagic longline gear, are now open to pelagic longline fishing. Bluefin tuna mortality that occurred in the monitoring areas while they were in effect (April through May for the Spring Gulf of Mexico Monitoring Area and June for the Northeastern United States Monitoring Area) was deducted from a threshold specific to that area. The thresholds were not met. NOAA Fisheries is considering next steps regarding these areas and, in the meantime, the areas remain open.
- Amendment 13 (87 FR 59966; October 3, 2022) addressed bluefin tuna management to respond to recent trends and characteristics of the bluefin tuna fishery. The objectives of this Amendment were: (1) Evaluate and optimize the allocation of U.S. bluefin tuna quota among bluefin tuna quota categories, considering historical allocations and use, and recent fishery characteristics and trends, and provide U.S. fishing vessels with a reasonable opportunity to catch the U.S. quota established by ICCAT; facilitate the ability for active HMS directed permit categories to catch their full bluefin tuna quota allocations, and facilitate directed fishing for species other than bluefin tuna in the pelagic longline fishery while accounting for incidental bluefin tuna catch; (2) Maintain flexibility of the regulations to account for the highly variable nature of the bluefin tuna fisheries, and maintain fairness among permit/quota categories; (3) Continue to manage the Atlantic pelagic longline fishery consistent with the IBQ Program objectives in Amendment 7 and consistent with the conservation and management objectives of the 2006 Consolidated HMS FMP and its amendments, and consistent with all applicable laws; and (4) Modify the management of the pelagic longline fishery in response to the Three-Year Review of the IBQ Program, and in response to important relevant prevailing trends (e.g., declining

fishing effort and revenue for target species). The changes in Amendment 13 became effective on January 1, 2023. Of relevance to this action, Amendment 13 implemented a dynamic system of determining Individual Bluefin Tuna Quota (IBQ) shareholders to provide bluefin tuna quota to only active vessels, and other changes to the IBQ Program. Amendment 13 included changes to the EM requirements, adding provisions regarding the vessel monitoring plans, measuring grids, and additional hardware to support the rail video cameras where necessary to provide optimal views of the location where fish are removed from the water.

Ecological, social, and economic impacts to the HMS pelagic longline fishery analyzed in Chapter 5 take these past actions into account as impacts are assessed relative to the current state of the fishery..

Reasonably foreseeable actions include those in response to updated stock assessment information for target or bycatch species, new ESA Biological Opinion requirements, or future spatial management evaluations that may result from the preferred alternatives in this Amendment. If updated stock assessment information for target or bycatch species indicate that additional protections for either species group is warranted, NOAA Fisheries may explore additional effort controls or gear modifications in the pelagic longline fishery. In the near-term, new ESA Biological Opinion requirements are possible due to the July 2022 request from the Office of Sustainable Fisheries (SF), NOAA Fisheries to reinitiate consultation on the effects of the Atlantic HMS pelagic longline fishery. Reinitiation of consultation on the pelagic longline fishery was requested due to new information on mortality of giant manta rays in the fishery. New Reasonable and Prudent Measures (RPMs) and Terms and Conditions may result from the consultation and, if so, rulemaking would need to be initiated to implement the measures.

Reasonably foreseeable actions could also include rulemakings to further refine modifications and data collection in spatial management areas based on assessments outlined in preferred alternatives C2 and C4. Under Alternative C2, NOAA Fisheries would initiate an assessment once three years of data from the spatial management areas are available. Alternative C4 would similarly provide for an assessment of spatial management areas, however, initiation would be triggered as needed based on preliminary data or information instead of timing. Future assessments could use a combination of catch data, video analyses, and additional HMS PRiSM modeling to further refine boundaries and timing of spatial management areas or could modify data collection programs. Impacts from these actions would likely mirror impacts detailed in this action.

Reasonably foreseeable conditions include changes to domestic and international market conditions and imports. Effort in the pelagic longline fishery is largely driven by market conditions, specifically the price fishermen can obtain for landed product. For products that mostly remain in the U.S. market, such as swordfish, prices are affected by consumer demand and the availability and price of imported swordfish. For products that both remain in the United States and are exported, domestic demand and imports affect price, but international market conditions such as foreign demand and U.S. currency values also affect price. Changes to domestic and international market conditions will impact fishing effort.

6.2 Mitigation and Unavoidable Impacts

Mitigation is an important mechanism that Federal agencies can use to minimize, prevent, or eliminate damage to the human and natural environment associated with their actions. As described in the Center for Environmental Quality regulations, agencies can use mitigation to reduce environmental impact in several ways. Mitigation may include one or more of the following: avoiding the impact by not taking a certain action or parts of an action; minimizing impacts by limiting the degree or magnitude of the action and its implementation; rectifying the impact by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and compensating for the impact by replacing or providing substitute resources or environments. The mitigation measures discussed in an EIS must cover the range of impacts of the proposal and must be considered even for impacts that by themselves would not be considered "significant." If a proposed action is considered as a whole to have significant effects, all of its specific effects on the environment must be considered, and mitigation measures must be developed where it is feasible to do so. NOAA Fisheries may consider mitigation provided that the mitigation efforts do not circumvent the goals and objectives of the rulemaking or the mandate to rebuild fisheries under the Magnuson-Stevens Act.

The preferred alternatives are explained in detail in Chapters 3, 5, 6. Alternatives and methods that mitigate adverse impacts on the human environment are discussed below.

6.2.1 Mitigation Measures

The preferred alternatives in Amendment 15 were designed and selected to minimize and mitigate adverse impacts. Preferred alternatives to modify, collect data, and evaluate spatial management areas (A, B, C, and E Alternatives) generally have neutral and beneficial ecological, social, and economic impacts.

Preferred modifications to spatial management areas were also designed to mitigate gear conflicts between recreational fishermen and commercial data collection efforts. Because recreational fishermen are more likely to fish nearshore than offshore, modifications were designed, consistent with HMS PRiSM results, to ensure that nearshore areas had the most precautionary data collection alternative, usually cooperative research EFPs.

The preferred alternatives to shift sampling costs for the pelagic longline EM program from the Agency to the industry ("F" alternatives) would result in adverse economic impacts, as detailed in Chapter 5. To mitigate the economic impact, the preferred alternative includes three components that could reduce the cost burden. First, the EM cost shift would be phased in over three years to allow the EM vendor market to develop. For example, in the first year, vessel owners would only be responsible for 25 percent of the sampling costs. Second, the design of the cost transfer encourages multiple vendors to enter the market, decreasing costs through competition and also leveraging the existing infrastructure of vendors currently providing video services. The current program, funded by NOAA Fisheries, pays for the entire program including the sampling infrastructure to receive, review, and store videos and data. Other vendors already providing such services may not require significant funds to develop the sampling infrastructure. Third, EM equipment currently installed on pelagic longline vessels, paid for by NOAA Fisheries, could continue to be used for the remaining life of each component. This feature avoids requirements for each vessel owner to obtain and pay for EM equipment upon implementation of Amendment 15, although they would be responsible for repair and replacement. Fourth, instead of providing exact specifications of equipment and data transfer methods that must be used, Alternative F2 provides vessel owners and vendors with flexibility, provided solutions meet the standards set forth. Innovative and less expensive equipment, data transfer methods, or other solutions could lower costs. Fifth, the preferred alternative would reduce spatiotemporal EM requirements and allow fishermen to turn off their systems in certain areas and times. Limiting the EM requirements in this way does not jeopardize bluefin tuna reporting compliance goals, but does reduce costs through reduced wear and tear on the equipment, reduced shipping costs, and reduced video storage costs. Additionally, in some instances, fishermen may not need to use EM if target species are available in areas of unlikely bluefin tuna interactions.

In addition to the cost mitigation measures included in Alternative F2, NOAA Fisheries notes that there may be external funding sources available to help offset some portion of fishers' sampling costs. Outside groups, such as environmental NGOs may be interested in assisting fishers with such costs, if the monitoring program aligns with organizational goals or if fishermen are willing to voluntarily assist with research or reporting programs initiated by the organization. Grant programs could also provide funding. For example, the Atlantic States Marine Fisheries Commission (ASMFC) currently administers a grant that covers funding of the Northeast Groundfish EM program (see "EM programs in other fisheries" section). Additionally, the National Fish and Wildlife Foundation (NFWF) recently requested proposals for a grant program to "systematically integrate technology into fisheries data collection and observations." Though this specific request for proposals has closed, future opportunities could become available. External funding sources are not guaranteed and we are not aware of deliberations by any organization to provide funding at this time. However, the possibility of such opportunities is a consideration when estimating costs that would be incurred by the HMS pelagic longline fishery.

6.2.2 Unavoidable Adverse Impacts

There are no unavoidable adverse ecological impacts expected that would result from the preferred alternatives to modify, collect data, and evaluate spatial management areas (A, B, C, and E Alternatives). NOAA Fisheries would continue to monitor the impact of the management measures in the preferred alternatives and would propose additional management measures, as necessary, to avoid any unanticipated adverse impacts..

The preferred alternatives to shift sampling costs for the pelagic longline EM program from the Agency to the industry ("F" alternatives) would result in adverse economic impacts, as detailed in Chapter 5. Although the adverse economic impacts have been somewhat mitigated, as described in section 6.2.1, NOAA Fisheries recognizes that most pelagic longline vessel owners would be adversely impacted. However, shifting the cost burden of the sampling portions of the EM program to the industry is unavoidable due to the requirement to comply with NOAA Fisheries Policy 04-115-02 (*Cost Allocation in Electronic Monitoring Programs for Federally Managed U.S. Fisheries*).

6.2.3 Irreversible and Irretrievable Commitment of Resources

The management measures in the preferred alternatives would not result in any irreversible and irretrievable commitment of resources. As explained in Chapter 5, target species are quota managed, and the preferred spatial management area packages provide protections for bycatch and incidental catch species. Fishery management regulations can be revisited if/when new information comes to light and/or changing circumstances.

Chapter 7 REGULATORY IMPACT REVIEW

Rulemakings must comply with Executive Order (EO) 12866 and the Regulatory Flexibility Act (RFA). NOAA Fisheries undertakes a regulatory impact review (RIR) for all regulatory actions of public interest. The RIR provides analyses of the economic benefits and costs of each alternative to the nation and the fishery as a whole. The information contained in Chapter 7, taken together with the data and analysis incorporated by reference, comprise the complete RIR.

The requirements for all regulatory actions specified in E.O. 12866 are summarized in the following statement from the order:

> *In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider. Further, in choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.*

E.O. 12866 further requires the Office of Management and Budget to review proposed regulations that are considered to be "significant." A significant regulatory action means any regulatory action that is likely to result in a rule that may:

- Have an annual effect on the economy of $200 million or more (adjusted every 3 years by the Administrator of OIRA for changes in gross domestic product); or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, territorial, or tribal governments or communities.
- Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency.
- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof.
- Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this Executive Order.

7.1 DESCRIPTION OF THE MANAGEMENT OBJECTIVES

Please see Chapter 1 for a description of the objectives of this rulemaking.

This rulemaking considers the modification, data collection, and assessment of longline spatial management measures in the Atlantic and Gulf of Mexico. Additionally, this rulemaking considers changes to the administration and funding of the HMS pelagic longline EM program.

The objectives of this rulemaking, consistent with the objectives of the 2006 Consolidated HMS FMP and its amendments, are to:

1) Using spatial management tools, minimize bycatch and bycatch mortality, to the extent practicable, while also optimizing fishing opportunities for U.S. fishing vessels.
2) Develop methods of collecting target and non-target species occurrence and catch rate data from HMS spatial management areas for the purpose of assessing spatial management area performance.
3) Broaden the considerations for the use of spatial management areas as a fishery management tool, including to provide flexibility to account for the highly variable nature of HMS and their fisheries, manage user conflicts, facilitate collection of information, address the need for regular evaluation and performance review, plan for climate resilience, and address environmental justice.
4) Evaluate the effectiveness of existing HMS spatial management areas, and if warranted, modify them to achieve an optimal balance of ecological and social and economic benefits and costs.
5) Modify the HMS EM program as necessary to augment spatial management and address the requirements of relevant NOAA Fisheries policies regarding EM.

7.2 Description of the Fishery

Please see Chapter 3 for a description of the fisheries that could be affected by these management actions.

7.3 Statement of the Problem

Please see Chapter 1 for a description of the problem and need for this rulemaking.

7.4 Description of Each Alternative

Please see Chapter 3 for a summary of each alternative and Chapter 5 for a complete description of each alternative and its expected ecological, social, and economic impacts. Chapters 4 and 8 provide additional information related to the economic impacts of the alternatives.

7.5 Economic Analysis of the Expected Effects of Each Alternative Relative to the Baseline

Table 7.1 summarizes the net economic benefits and cost of each of the alternatives analyzed in this EIS. Additional details and more complete analyses are provided in Chapter 5.

Table 7.1. Net economic benefits and costs of each alternative.

Alternative	Economic Benefits	Economic Costs
"A" Alternatives: Evaluation and Modification of Spatial Management Areas		
Alternative Suite A1: Mid-Atlantic Shark Spatial Management Areas		
Sub-Alternative A1a: No Action	No change in economic benefits.	No change in economic costs.
Sub-Alternative A1b	Bottom longline effort in the area is low and changes to the spatial and temporal extent of the area under this alternative are small. Thus, effort and landings in the fishery would be unlikely to change. No change in economic benefits would be expected.	Bottom longline effort in the area is low and changes to the spatial and temporal extent of the area under this alternative are small. Thus, effort and landings in the fishery would be unlikely to change. No change in economic costs would be expected.
Sub-Alternative A1c	Same as Sub-Alternative A1b.	Same as Sub-Alternative A1b.
Sub-Alternative A1d	Same as Sub-Alternative A1b.	Same as Sub-Alternative A1b.
Alternative Suite A2: Charleston Bump Spatial Management Areas		
Sub-Alternative A2a: No Action	No change in economic benefits.	No change in economic costs.
Sub-Alternative A2b	Changes in the spatial and temporal extent of the spatial management area could provide increased access for pelagic longline effort in portions of the area for data collection.	Calculated changes to net revenue from target catch landings (swordfish, yellowfin tuna, and bigeye tuna) would be -$205,237 across the entire pelagic longline fishery operating in the area. However, fishermen are unlikely to fish in areas with lower target catch rates, so reductions in net revenue are unlikely to be realized. No change in economic costs would be expected.
Sub-Alternative A2c	Changes in the spatial and temporal extent of the spatial	Expanded access to fishing areas for data collection would

	management area could provide increased access for pelagic longline effort in portions of the area for data collection. Calculated changes to net revenue from target catch landings (swordfish, yellowfin tuna, and bigeye tuna) would be $235,863 across the entire pelagic longline fishery operating in the area. This increase in net revenue and reduced costs due to access to areas that are closer to port would lead to economic benefits.	include additional requirements that may have an economic cost, as detailed below in the Data Collection (B Alternatives) and the D Preferred Alternative Packages sections. However, this sub-alternative would not independently result in changes to economic costs.
Sub-Alternative A2d	Same as Sub-Alternative A2c, but calculated changes to net revenue from target catch landings would be $$390,532 across the entire pelagic longline fishery operating in the area	Same as Sub-Alternative A2c.
Sub-Alternative A2e	Same as Sub-Alternative A2c, but calculated changes to net revenue from target catch landings would be $83,590 across the entire pelagic longline fishery operating in the area.	Same as Sub-Alternative A2c.
Alternative Suite A3: East Florida Coast Spatial Management Areas		
Sub-Alternative A3a: No Action	No change in economic benefits.	No change in economic costs.
Sub-Alternative A3b	Changes in the spatial and temporal extent of the spatial management area could provide increased access for pelagic longline effort in portions of the area for data collection.	Calculated changes to net revenue from target catch landings (swordfish, yellowfin tuna, and bigeye tuna) would be -$75,453 across the entire pelagic longline fishery operating in the area. However, fishermen are unlikely to fish in areas with lower target catch rates, so reductions in net revenue are unlikely to be realized. No change in economic costs would be expected.

Sub-Alternative A3c	Changes in the spatial and temporal extent of the spatial management area could provide increased access for pelagic longline effort in portions of the area for data collection. Calculated changes to net revenue from target catch landings (swordfish, yellowfin tuna, and bigeye tuna) would be $15,145 across the entire pelagic longline fishery operating in the area. This increase in net revenue and reduced costs due to access to areas that are closer to port would lead to economic benefits.	Expanded access to fishing areas for data collection would include additional requirements that may have an economic cost, as detailed below in the Data Collection (B Alternatives) and D Preferred Alternative Packages sections. However, this sub-alternative would not independently result in changes to economic costs.
Sub-Alternative A3d	Same as Sub-Alternative A3c, but calculated changes to net revenue from target catch landings would be $37,845 across the entire pelagic longline fishery operating in the area.	Same as Sub-Alternative A3c.
Sub-Alternative A3e	Changes in the spatial and temporal extent of the spatial management area could provide increased access for pelagic longline effort in portions of the area for data collection.	Calculated changes to net revenue from target catch landings (swordfish, yellowfin tuna, and bigeye tuna) would be -$8,762 across the entire pelagic longline fishery operating in the area. However, fishermen are unlikely to fish in areas with lower target catch rates, so reductions in net revenue are unlikely to be realized. No change in economic costs would be expected.
<u>Alternative Suite A4: DeSoto Canyon Spatial Management Areas</u>		
Sub-Alternative A4a: No Action	No change in economic benefits.	No change in economic costs.
Sub-Alternative A4b	Changes in the spatial and temporal extent of the spatial management area could provide increased access for pelagic	Expanded access to fishing areas for data collection would include additional requirements that may have

	longline effort in portions of the area for data collection. Calculated changes to net revenue from target catch landings (swordfish, yellowfin tuna, and bigeye tuna) would be $38,188 across the entire pelagic longline fishery operating in the area. This increase in net revenue and reduced costs due to access to areas that are closer to port would lead to economic benefits.	an economic cost, as detailed below in the Data Collection (B Alternatives) and the D Preferred Alternative Packages sections. However, this sub-alternative would not independently result in changes to economic costs.
Sub-Alternative A4c	Same as Sub-Alternative A4b, but calculated changes to net revenue from target catch landings would be $38,188 across the entire pelagic longline fishery operating in the area.	Same as Sub-Alternative A4b.
Sub-Alternative A4d	Changes in the spatial and temporal extent of the spatial management area could provide increased access for pelagic longline effort in portions of the area for data collection.	Calculated changes to net revenue from target catch landings (swordfish, yellowfin tuna, and bigeye tuna) would be -$224,295 across the entire pelagic longline fishery operating in the area. However, fishermen are unlikely to fish in areas with lower target catch rates, so reductions in net revenue are unlikely to be realized. No change in economic costs would be expected.
“B” Alternatives: Commercial Data Collection		
Alternative B1: No Action	No change in economic benefits.	No change in economic costs.
Alternative B2: Spatial management area research fishery	This program would be limited in scope, however, increased access to productive fishing grounds could result in small economic benefits due to more efficient fishing and potentially shorter transit times from port.	Compliance with the research plan requirements would include measures that could reduce fishing CPUE, however, the program is voluntary so fishermen can choose to avoid economic costs.
Alternative B3: Monitoring	Data collection in monitoring	Data collection by commercial

area	areas by commercial longline vessels would be limited in scope, however, increased access to productive fishing grounds could result in small economic benefits due to more efficient fishing and potentially shorter transit times from port.	longline fishermen in monitoring areas would be subject to a number of requirements, considered as sub-alternatives under Alternative B3. Each of the sub-alternatives consider ways to limit effort and/or bycatch and to ensure accurate reporting in support of data collection. Effort caps are unlikely to result in changes to economic cost, however, increased EM data review and reporting requirements would increase costs. Expanded EM review of sets that occur in the monitoring area would cost approximately $280 for a full video review (a typical ten day trip consisting of six sets would cost $1,680). Increased reporting requirements after each set would result in extra work, adding costs as well. However, fishing in the monitoring area is voluntary and fishermen are unlikely to do so if expected economic benefits do not outweigh expected costs. Thus, no change to economic costs would be expected.
Alternative B4: Cooperative research via an EFP	Fishermen participating in research under an EFP are likely to be compensated through some combination of commercial target catch sales and research funds, although target catch rates under the research plan may not be the same as those under normal commercial fishing. Thus, no change in economic benefits are expected.	Data collection under an EFP would likely include some sort of compensation, although fishing CPUE may be reduced due to additional research requirements. However, participating in a research project is voluntary so fishermen can choose to avoid economic costs.
"C" Alternatives: Evaluation Timing of Spatial Management Areas		
Alternative C1: No Action	No change in economic benefits.	No change in economic costs.

		However, lack of a periodic review schedule and review factors creates process uncertainty.
Alternative C2: Evaluate once three years of data are available (or since most recent evaluation)	This alternative is administrative in nature and would not result in a change to economic benefits.	This alternative is administrative in nature and would not result in a change to economic costs to industry participants. However, periodic reviews could lead to some uncertainty in the fishery about future management measures. This alternative would increase administrative costs for the Agency as a result of the periodic evaluations.
Alternative C3: Evaluate once five years of data are available (or since most recent evaluation)	This alternative is administrative in nature and would not result in a change to economic benefits.	Same as Sub-Alternative C2, but less administrative costs for the Agency due to the longer period between reviews.
Alternative C4: Triggered Evaluation	This alternative is administrative in nature and would not result in a change to economic benefits.	Same as Sub-Alternative C2, but less administrative costs for the Agency as reviews would not happen on a regular schedule.
Alternative C5: Sunset Provision	This alternative would eliminate spatial management areas after a set number of years. This could provide additional flexibility for fishermen and associated economic benefits.	Eliminating spatial management areas would likely result in additional management measures to reduce impacts on bycatch to comply with statutory requirements. Such measures would reduce fishing CPUE and result in economic costs.
"D": Preferred Alternative Packages		
Preferred Mid-Atlantic Spatial Management Area Package	Same as the economic benefits for the following preferred alternatives: Sub-Alternative A1d Alternative B1	Same as the economic costs for the following preferred alternatives: Sub-Alternative A1d Alternative B1

	Alternative C2 Alternative C4	Alternative C2 Alternative C4
Preferred Charleston Bump Spatial Management Area Package	Same as the economic benefits for the following preferred alternatives: Sub-Alternative A2c Alternative B3 Alternative B4 Alternative C2 Alternative C4	Same as the economic costs for the following preferred alternatives: Sub-Alternative A2c Alternative B3 Alternative B4 Alternative C2 Alternative C4
Preferred East Florida Coast Spatial Management Area Package	Same as the economic benefits for the following preferred alternatives: Sub-Alternative A3d Alternative B3 Alternative B4 Alternative C2 Alternative C4	Same as the economic costs for the following preferred alternatives: Sub-Alternative A3d Alternative B3 Alternative B4 Alternative C2 Alternative C4
Preferred DeSoto Canyon Spatial Management Area Package	Same as the economic benefits for the following preferred alternatives: Sub-Alternative A4d Alternative B1 Alternative B4 Alternative C2 Alternative C4	Same as the economic costs for the following preferred alternatives: Sub-Alternative A4d Alternative B1 Alternative B4 Alternative C2 Alternative C4
“E” Alternatives: Spatial Management Area Regulatory Provisions		
Alternative E1: Spatial Management Area Regulatory Provisions - No action	No change in economic benefits.	No change in economic costs.
Alternative E2: Spatial Management Area Regulatory Provisions - Reorganize and Revise - Preferred Alternative	This alternative is administrative in nature and would not result in a change to economic benefits.	This alternative is administrative in nature and would not result in a change to economic costs.
“F” Alternatives: Electronic Monitoring Program		
Alternative F1: - Maintain Current Electronic Monitoring Agency	No change in economic benefits.	No change in economic costs.

Funding - No action		
Alternative F2: Transfer Electronic Monitoring Sampling Costs to Industry (Phased-In) - Preferred Alternative	No change in economic benefits.	The transfer of EM sampling costs from the Agency to industry would likely lead to a substantial increase in economic costs for vessel owners. The cost to industry is estimated to be approximately $280 per set before mitigation measures (e.g., multiple vendors, changes to EM spatiotemporal requirements) are factored in. On a median length trip of 10 days with 6 sets, the cost would be $1,680/trip or $168/sea-day. This cost estimate equates to approximately 19% of net revenue on a median trip.
Alternative F3: Remove current EM regulations regarding bluefin tuna and shortfin mako sharks	Since the Agency funds nearly 100% of the EM program, removing EM requirements would not have a large economic impact on the fishery. However, the fishery would no longer incur costs associated with activities such as shipping hard drives and coordinating equipment repair and replacement. Thus, small economic benefits would be likely.	Since the Agency funds nearly 100% of the EM program, removing EM requirements would not have a large economic impact on the fishery and no new economic costs would be expected.

7.6 Conclusions

As noted above, under E.O. 12866, a regulation is a “significant regulatory action” if it is likely to: (1) have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities; (2) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; (3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or (4) raise novel legal or policy issues arising out of legal mandates, the President’s priorities, or the principles set forth in this Executive Order. Pursuant to the procedures established to implement section 6 of E.O. 12866, the Office of Management and Budget has determined that this action is not significant. A summary of the expected net economic benefits and costs of each alternative, which are based on supporting text in Chapter 5, can be found in Table 7.1.

Chapter 8 INITIAL REGULATORY FLEXIBILITY ANALYSIS

The Initial Regulatory Flexibility Analysis (IRFA) is conducted to comply with the Regulatory Flexibility Act (5 U.S.C. §§ 601 et seq.) (RFA). The goal of the RFA is to minimize the economic burden of Federal regulations on small entities. To that end, the RFA directs Federal agencies to assess whether a proposed regulation is likely to result in significant economic impacts to a substantial number of small entities, and identify and analyze any significant alternatives to the proposed rule that accomplishes the objectives of applicable statutes and minimize any significant effects on small entities. Certain data and analyses required in an IRFA are also included in other Chapters of this document. Therefore, this IRFA incorporates by reference the economic data in Chapter 4 and economic analyses and impacts in Chapter 5 of this document.

8.1 STATEMENT OF THE NEED FOR AND OBJECTIVES OF THIS PROPOSED RULE

Please see Chapter 1 for a description of the reasons why this action is being considered for the proposed action.

8.2 STATEMENT OF OBJECTIVES OF, AND LEGAL BASIS FOR, THE PROPOSED RULE

Section 603(b)(2) of the RFA requires Agencies to state the objective of, and legal basis for the proposed action. Please see Chapter 1 for a full description of the objectives of this action.

The objectives of this action are listed in Chapter 1. NOAA Fisheries developed the draft management objectives based upon comments received during the Amendment 15 scoping process and the detailed suggestions and concerns expressed by the HMS Advisory Panel, fishery participants, and the public regarding management of spatial management areas over the last several years. Additionally, the EM funding alternatives were developed to comply with the 2019 NOAA Fisheries Policy 04-115-02 "*Cost Allocation in Electronic Monitoring Programs for Federally Managed Fisheries*." These specific objectives are within the context of the current 2006 Consolidated HMS FMP and its amendments, including the overarching objectives of ending overfishing, and meeting other legal obligations and conservation and management goals and requirements.

8.3 DESCRIPTION AND ESTIMATE OF THE NUMBER OF SMALL ENTITIES TO WHICH THE PROPOSED RULE WOULD APPLY

Section 603(b)(3) of the Regulatory Flexibility Act requires Agencies to provide an estimate of the number of small entities to which the rule would apply. The Small Business

Administration (SBA) authorizes an agency to develop its own industry-specific size standards after consultation with the SBA Office of Advocacy and an opportunity for public comment (see 13 CFR 121.903(c)). Pursuant to this process, NOAA Fisheries issued a final rule that established a small business size standard of $11 million in annual gross receipts for all businesses in the commercial fishing industry (NAICS 11411) for RFA compliance purposes (80 FR 81194; December 29, 2015; effective on July 1, 2016). SBA has established size standards for all other major industry sectors in the U.S., including the scenic and sightseeing transportation (water) sector (North American Industry Classification System (NAICS) code 487210, for-hire), which includes charter/party boat entities. SBA has defined a small charter/party boat entity as one with average annual receipts (revenue) of less than $8.0 million.

NOAA Fisheries considers all HMS permit holders to be small entities because they had average annual receipts of less than $11 million for commercial fishing. Regarding those entities that would be directly affected by the proposed measures, the average annual revenue per active pelagic longline vessel is estimated to be $222,000, based on approximately 82 active vessels that produced an estimated $18.2 million in revenue in 2020, well below the NOAA Fisheries small business size standard for commercial fishing businesses of $11 million. No single pelagic longline vessel has exceeded $11 million in revenue in recent years. HMS bottom longline commercial fishing vessels typically earn less revenue than pelagic longline vessels and, thus, would also be considered small entities.

NOAA Fisheries has determined that the preferred alternatives would not likely directly affect any small organizations or small government jurisdictions defined under RFA, nor would there be disproportionate economic impacts between large and small entities.

More information regarding the description of the fisheries affected, can be found in Chapter 5.

8.4 Description of the Projected Reporting, Record-Keeping, and Other Compliance Requirements of the Proposed Rule, Including an Estimate of the Classes of Small Entities Which Would be Subject to the Requirements of the Report or Record

Section 603(b)(4) of the RFA requires Agencies to describe any new reporting, record-keeping and other compliance requirements. Some preferred alternatives in Draft Amendment 15 would result in reporting, record-keeping, and compliance requirements that require a new or modified Paperwork Reduction Act filing.

Under Preferred Alternative Packages D2 and D3, NOAA Fisheries would implement Alternative B3 to create two monitoring areas within the current footprints of the Charleston Bump and East Florida Coast closed areas. To control effort and ensure accurate reporting under Alternative B3, NOAA Fisheries prefers implementation of Sub-Alternative B3a (effort caps) and Sub-Alternative B3e (expanded EM review). Sub-Alternative B3a includes two expanded reporting requirements for HMS pelagic longline fishermen operating in the monitoring areas. First, vessel operators that intend to fish in a monitoring area would need to declare that intention via VMS before embarking on a trip or during the in-trip hail-out. Second, vessel operators would need to report fishing effort (date and area of set and number of hooks) through VMS within 12 hours after the completion of each longline set. Third, in addition to the current bluefin tuna reporting requirements, vessel owners and/or operators would be required to report through VMS within 12 hours after completion of each longline set, the actual length of the following species that are retained and the approximate length of species that are discarded dead or alive: blue marlin, white marlin, roundscale spearfish, sailfish, leatherback sea turtles, loggerhead sea turtles, and shortfin mako sharks. Vessels would be allowed to fish inside and outside of a monitoring area on the same trip, but any fishing effort would be considered to have occurred from within the monitoring area. Neither requirement is wholly new since pelagic longline vessel operators currently need to hail-out via VMS before embarking on a trip and bluefin tuna catch must be reported with 12 hours after the end of a longline set. Rather, the proposed measures are expanded requirements with an additional hail-out declaration requirement and species reporting requirements. These requirements would impact a sub-set of the 82 active HMS pelagic longline vessels that choose to fish within the monitoring areas.

Under Preferred Alternative F2, HMS pelagic longline vessel owners would be required to cover sampling costs associated with the EM program to support compliance with catch reporting requirements during pelagic longline fishing activity, including incidentally caught bluefin tuna. The alternative would also open up the HMS pelagic longline EM program to additional vendors, and establishes application and reporting standards for potential EM vendors. All pelagic longline vessel owners (82 active vessels) would need to coordinate with a NOAA Fisheries-approved vendor to provide support for EM requirements including equipment maintenance and replacement and review of video data. NOAA Fisheries would solicit vendors to perform the tasks in support of the EM program, consistent with performance design standards. NOAA Fisheries, or a NOAA Fisheries-designated entity, would certify vendors that meet certain requirements, including meeting the technical performance standards and publish a list of certified vendors in the Federal Register, which would be made available to vessel operators. Certification of EM vendors would require submittal of information by vendors including demonstration of technical ability, a data integrity and storage plan, and conflict of interest information. NOAA Fisheries anticipates receiving applications from up to four vendors and approval of three.

The expanded requirements under both these alternatives are within the scope of an existing approved Paperwork Reduction Act (OMB Control No. 0648-0372 “Electronic Monitoring Systems for Atlantic Highly Migratory Species”). However, due to the existence of concurrent actions for that collection, which will come up for renewal before the final rule for this action is anticipated to be published, the collection-of-information requirements in this proposed rule will be assigned a temporary Control Number that will later be merged into Control Number 0648-0372.. A revised Paperwork Reduction Act submission and approval is pending.

8.5 IDENTIFICATION OF ALL RELEVANT FEDERAL RULES WHICH MAY DUPLICATE, OVERLAP, OR CONFLICT WITH THE PROPOSED RULE

Under section 603(b)(5) of the RFA, Agencies must identify, to the extent practicable, relevant Federal rules which duplicate, overlap, or conflict with the proposed action. Fishermen, dealers, and managers in these fisheries must comply with a number of international agreements, domestic laws, and other fishery management measures. These include, but are not limited to, the Magnuson-Stevens Act, the Atlantic Tunas Convention Act, the High Seas Fishing Compliance Act, the Marine Mammal Protection Act, the Endangered Species Act, the National Environmental Policy Act, the Paperwork Reduction Act, and the Coastal Zone Management Act. This proposed action has been determined not to duplicate, overlap, or conflict with any Federal rules.

8.6 DESCRIPTION OF ANY SIGNIFICANT ALTERNATIVES TO THE PROPOSED RULE THAT ACCOMPLISH THE STATED OBJECTIVES OF THE APPLICABLE STATUTES AND THAT MINIMIZE ANY SIGNIFICANT ECONOMIC IMPACT OF THE PROPOSED RULE ON SMALL ENTITIES

One of the requirements of an IRFA is to describe any significant alternatives to the proposed rule which accomplish the stated objectives of applicable statutes and which minimize any significant economic impact of the proposed rule on small entities. The analysis shall discuss significant alternatives such as:

1. Establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities;
2. Clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities;
3. Use of performance rather than design standards; and
4. Exemptions from coverage of the rule, or any part thereof, for small entities.

5 U.S.C. § 603 (c)(1)-(4).

Regarding the first and fourth categories, NOAA Fisheries cannot establish differing compliance or reporting requirements for small entities or exempt small entities from coverage of the rule or parts of it. All of the businesses impacted by this action are considered small entities, and thus the requirements are already designed for small entities. Moreover, the objectives for this action (*see* Section 1.4) center around the modification, data collection, and assessment of spatial management areas and funding and administration of the HMS pelagic longline EM program. NOAA Fisheries thus analyzed a broad range of alternatives to meet those objectives: Alternatives A-E consider modification, data collection, and assessment of spatial management areas and the F Alternatives consider funding and administration of the HMS pelagic longline EM program. Consistent application of management measures is important for effective management of spatial management areas and the EM program. Thus, no differing requirements or exemptions would be appropriate.

Regarding the second category, NOAA Fisheries designed alternatives that would simplify compliance or reporting requirements while still meeting the objectives of the amendment. Preferred A Alternatives to modify spatial management areas used design elements that would ease communication and enforcement including straight lines and points near ports or existing spatial management areas. Preferred B Alternatives to create data collection programs largely built upon current reporting and other requirements to avoid creating overly-complicated measures. Preferred Alternative F2 does introduce new complexities into the HMS pelagic longline EM program, including new requirements to independently contract with EM vendors. However, these complexities may be necessary in order to mitigate adverse economic impacts.

Regarding the third category, performance standards are built into the preferred B Alternatives to collect data through monitoring areas and cooperative EFP research. Each of these components include a total cap on effort to ensure conservation goals are met. Once effort caps are reached, the area is closed to data collection.

8.6.1 Alternative A: Evaluation and modification of closed areas

8.6.1.1 Alternative Suite A1: Mid-Atlantic Shark Spatial Management Areas

Sub-Alternative A1a, the no action sub-alternative, would maintain the current Mid-Atlantic shark closed area in effect with respect to its spatial and temporal extent. This sub-alternative would likely maintain the recent catch levels and revenues, because the spatial and the temporal extents would remain unchanged and social and economic impacts are expected to be neutral. Median earnings across the shark research fishery and non-shark research fishery per trip (taking into account operating costs) ranged between $609 and $1,192 from 2017 through 2020 in nominal dollars ($614 in 2020). Estimated total ex-vessel revenue from sharks in 2020 is $2,311,319 (2021 real dollars). Based on permit and target species, some fishermen direct effort on sharks while others only retain incidentally caught sharks. In 2020, there were 13 active vessels (vessels that had trips where 75 percent of the landings by weight were sharks) targeting sharks in the Atlantic.

Sub-Alternative A1b would maintain the current Mid-Atlantic shark closed area in effect with respect to its spatial extent, and shift the temporal extent to November 1 through May 31 from January 1 through July 31 (i.e., same seven-month duration, but shifted two months earlier). The social and economic impacts of Sub-Alternative A1b are expected to be neutral. There is relatively little bottom longline fishing effort in the Mid-Atlantic region during open time periods, including and adjacent to the area defined by this spatial management area. Effort is low enough that totals for the area, even during open time periods, that the data cannot be provided due to confidentiality concerns. This sub-alternative would maintain the recent catch levels and revenues, and there would likely be low levels of data collection from within the spatial management area. Overall revenues from shark research fishery trips are likely to continue in the range noted in Sub-Alternative A1a. Based on permit and target species, some fishermen direct effort on sharks while others only retain incidentally caught sharks. In 2020, there were 13 active vessels (vessels that had trips where 75 percent of the landings by weight were sharks) targeting sharks in the Atlantic.

Sub-Alternative A1c would modify both the spatial and temporal extent of the current Mid-Atlantic shark closed area. Specifically, this sub-alternative would extend the eastern boundary of the current Mid-Atlantic shark closed area eastward to the 350-m shelf break and shift the north boundary south to Cape Hatteras (35° 13' 12" N. lat.). The temporal extent would shift to November 1 through May 31 from January 1 through July 31. The social and economic impacts of Sub-Alternative A1c are expected to be neutral. There is relatively little bottom longline fishing effort in the Mid-Atlantic region during open time periods, including and adjacent to the area defined by this spatial management area. Effort is low enough that totals for the area, even during open time periods, that the data cannot be provided due to confidentiality concerns. This sub-alternative would maintain the recent catch levels and revenues, and there would likely be low levels of data collection from within the spatial management area. Overall revenues from shark research fishery trips are likely to continue in the range noted in Sub-Alternative A1a. Based on permit and target species, some fishermen direct effort on sharks while others only retain incidentally caught sharks. In 2020, there were 13 active vessels (vessels that had trips where 75 percent of the landings by weight were sharks) targeting sharks in the Atlantic.

Sub-Alternative A1d would modify both the spatial and temporal extent of the current Mid-Atlantic shark closed area. Specifically, this sub-alternative would extend the eastern boundary of the current Mid-Atlantic shark closed area eastward to the 350-m shelf break. The temporal extent would shift to November 1 through May 31 from January 1 through July 31. The social and economic impacts of Sub-Alternative A1d are expected to be neutral. There is relatively little bottom longline fishing effort in the Mid-Atlantic region during open time periods, including and adjacent to the area defined by this spatial management area. Effort is low enough that totals for the area, even during open time periods, that the data cannot be provided due to confidentiality concerns. This sub-alternative would maintain the recent catch levels and revenues, and there would likely be low levels of data collection from within the spatial management area. Overall revenues from shark research fishery trips are likely to continue in the range noted in Sub-Alternative A1a. Based on permit and target species, some fishermen direct effort on sharks while others only retain incidentally caught sharks. In 2020, there were 13 active vessels (vessels that had trips where 75 percent of the landings by weight were sharks) targeting sharks in the Atlantic.

8.6.1.2 Alternative Suite A2: Charleston Bump Spatial Management Areas

Sub-Alternative A2a, the no action sub-alternative, would maintain the current Charleston Bump closed area in effect with respect to its spatial and temporal extent. NOAA Fisheries used the target species catch estimates and ex-vessel prices for swordfish, yellowfin tuna, and bigeye tuna to estimate the effect of the sub-alternative on commercial pelagic longline revenue. The estimated combined target species revenue is $4,419,261 (2021 real dollars). This sub-alternative would maintain the recent fishing effort, catch levels, and revenues, resulting in direct neutral social and economic impacts on pelagic longline fishermen. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Sub-Alternative A2b would maintain the current Charleston Bump closed area in effect with respect to its spatial extent, and would shift the temporal scope from December 1 through March 31 from February 1 through April 30 (i.e., starting two months earlier and ending one months earlier; change from a three-month closure to a four-month closure). NOAA Fisheries used the target species catch estimates and ex-vessel prices for swordfish, yellowfin tuna, and bigeye tuna to estimate the effect of the sub-alternative on commercial pelagic longline revenue. This sub-alternative would generate less revenue from swordfish and bigeye tuna, but more from yellowfin tuna than the No Action sub-alternative. When combined, the total revenue difference between this sub-alternative and the No Action sub-alternative is -$205,237. However, fishermen are unlikely to fish in areas with lower catch rates, so reductions in revenue may not be realized. Sub-Alternative A2b would likely result in minor adverse social and economic impacts. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery, though, not all vessels are active in the area so economic impacts would not be equally shared among all active vessels.

Sub-Alternative A2c would modify both the spatial and temporal extent of the current Charleston Bump closed area. This sub-alternative would move the eastern boundary of the current Charleston Bump closed area westward. Specifically, the eastern boundary of this sub-alternative would be formed by the line connecting the northeast corner of the current Charleston Bump closed area (34° 00’ N. lat., 76° 00’ W. long.) to a point on the current southern border of Charleston Bump closed area (31° 00’ N. lat., 79° 32’ 46” W. long.). The western boundary of this management area would remain the same as the current western boundary of Charleston Bump closed area. The temporal extent of the high-bycatch-risk area would increase from February 1 to April 30 to include the entire year. The remainder of the current closed area footprint would only be designated low-bycatch-risk area from February 1 through April 30. Outside those months, that area would be open to normal pelagic longline fishing. NOAA Fisheries used the target species catch estimates and ex-vessel prices for swordfish, yellowfin tuna, and bigeye tuna to estimate the effect of the sub-alternative on commercial pelagic longline revenue. This sub-alternative would generate more revenue from swordfish, but less from yellowfin and bigeye tuna relative to the No Action sub-alternative. When combined the total revenue difference between this sub-alternative and the No Action sub-alternative is $235,863 resulting in moderate positive direct economic impacts in the short- and long-term, which would also lead to positive direct social impacts. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery, though, not all vessels are active in the area so economic impacts would not be equally shared among all active vessels.

Sub-Alternative A2d would modify both the spatial and temporal extent of the current Charleston Bump closed area. Specifically, this sub-alternative would shift the eastern boundary westward 40 nm from the coastline; retain the current northern and southern boundaries of the current Charleston Bump closed area; and retain the current western boundary of Charleston Bump closed area. The temporal extent of the high-bycatch-risk area would be extended from February 1 through April 30 to October 1 through May 31. The remainder of the current closed area footprint would only be designated low-bycatch-risk area from February 1 through April 30. Outside those months, that area would be open to normal pelagic longline fishing. NOAA Fisheries used the target species catch estimates and ex-vessel prices for swordfish, yellowfin tuna, and bigeye tuna to estimate the effect of the sub-alternative on commercial pelagic longline revenue. This sub-alternative would generate more revenue from swordfish, but less from yellowfin and bigeye tuna relative to the No Action sub-alternative. When combined, the total revenue difference between this sub-alternative and the No Action sub-alternative is $390,532 resulting in moderate positive direct economic impacts in the short- and long-term, which would also lead to positive direct social impacts. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery, though, not all vessels are active in the area so economic impacts would not be equally shared among all active vessels.

Sub-Alternative A2e would modify both the spatial and temporal extent of the current Charleston Bump closed area. Specifically, this sub-alternative would reduce the spatial extent by moving the northern boundary of the current Charleston Bump closed area southward to 33° 12’ 39” N. lat. and the shifting the eastern boundary westward to 78° 00’ W. long. The western boundary would be consistent with the current western boundary of Charleston Bump closed area. The temporal extent of the high-bycatch-risk area would be eight months (from October 1 through May 31) instead of three months (February 1 through April 30). The remainder of the current closed area footprint would only be designated low-bycatch-risk area from February 1 through April 30. Outside those months, that area would be open to normal pelagic longline fishing. NOAA Fisheries used the target species catch estimates and ex-vessel prices for swordfish, yellowfin tuna, and bigeye tuna to estimate the effect of the sub-alternative on commercial pelagic longline revenue. This sub-alternative would generate more revenue from swordfish and yellowfin tuna, but less from bigeye tuna relative to the No Action sub-alternative. When combined, the total revenue difference between this sub-alternative and the No Action sub-alternative is $83,590 resulting in minor positive direct economic impacts in the short- and long-term, which would also lead to positive direct social impacts. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery, though, not all vessels are active in the area so economic impacts would not be equally shared among all active vessels.

8.6.1.3 Alternative Suite A3: East Florida Coast Spatial Management Areas

Sub-Alternative A3a, the no action sub-alternative, would maintain the current East Florida Coast closed area in effect with respect to its spatial and temporal extent. NOAA Fisheries used the target species catch estimates and ex-vessel prices for swordfish, yellowfin tuna, and bigeye tuna to estimate the effect of the sub-alternative on commercial pelagic longline revenue. The estimated annual revenue for each target species and the combined target species revenue is $4,196,431 (2021 real dollars). This sub-alternative would maintain the recent fishing effort, catch levels, and revenues, resulting in direct neutral social and economic impacts on pelagic longline fishermen. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Sub-Alternative A3b would modify both the spatial and temporal extent of the current East Florida Coast closed area. Specifically, this sub-alternative consists of two different spatial configurations associated with two temporal periods. From May 1 through November 30 the spatial extent would be the same as the No Action alternative. From December 1 through April 30 the spatial extent would shift the eastern boundary to 40 nm from the coastline within the northern and southern boundaries of the current East Florida Coast closed area. The remainder of the current closed area footprint would be designated a low-bycatch-risk area from May 1 through November 30. NOAA Fisheries used the target species catch estimates and ex-vessel prices for swordfish, yellowfin tuna, and bigeye tuna to estimate the effect of the sub-alternative on commercial pelagic longline revenue. This sub-alternative would generate slightly more revenue from swordfish, but less from yellowfin tuna and bigeye tuna relative to the No Action sub-alternative. When combined the total revenue difference between this sub-alternative and the No Action sub-alternative is -$75,453 resulting in minor negative direct economic impacts in the short- and long-term, which could also lead to negative social impacts. However, fishermen are unlikely to fish in areas with lower catch rates, so reductions in revenue may not be realized. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery, though, not all vessels are active in the area so economic impacts would not be equally shared among all active vessels.

Sub-Alternative A3c would modify only the spatial extent of the current East Florida Coast closed area. Specifically, this sub-alternative would reduce the spatial extent by shifting the eastern boundary of the current closed area to 40 nm from the coastline in areas north of the U.S. – Bahamas EEZ boundary at approximately 28° 17’ 24” N. lat. All areas south of that boundary within the current closed area would remain the same relative to the No Action alternative. The temporal extent would remain unchanged relative to the No Action alternative. The remainder of the current closed area footprint would be designated a low-bycatch-risk area for the entire year. NOAA Fisheries used the target species catch estimates and ex-vessel prices for swordfish, yellowfin tuna, and bigeye tuna to estimate the effect of the sub-alternative on commercial pelagic longline revenue. This sub-alternative would generate more revenue from swordfish, but less from yellowfin and bigeye tuna relative to the No Action sub-alternative. When combined, the total revenue difference between this sub-alternative and the No Action sub-alternative is $15,145 resulting in minor positive direct economic impacts in the short- and long-term, which would also lead to positive direct social impacts. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery, though, not all vessels are active in the area so economic impacts would not be equally shared among all active vessels.

Sub-Alternative A3d would modify only the spatial extent of the current East Florida Coast closed area. Specifically, this sub-alternative would reduce the spatial extent by including areas east of the line connecting two points at 31° 00’ N. lat., 79° 32’ 46” W. long. and 27° 52’ 55” N. lat., 79° 28’ 34” W. long. at the northern and southern boundaries, respectively, of the current closed area. All areas south of 27° 52’ 55” N. lat. within the current closed area would remain the same relative to the No Action alternative. The temporal extent would remain unchanged relative to the No Action alternative. The remainder of the current closed area footprint would be designated a low-bycatch-risk area for the entire year. NOAA Fisheries used the target species catch estimates and ex-vessel prices for swordfish, yellowfin tuna, and bigeye tuna to estimate the effect of the sub-alternative on commercial pelagic longline revenue. This sub-alternative would generate more revenue from swordfish, but less from yellowfin and bigeye tuna relative to the No Action sub-alternative. When combined, the total revenue difference between this sub-alternative and the No Action sub-alternative is $37,845 resulting in minor positive direct economic impacts in the short- and long-term, which would also lead to positive direct social impacts. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery, though, not all vessels are active in the area so economic impacts would not be equally shared among all active vessels.

Sub-Alternative A3e would modify both the spatial and temporal extent of the current East Florida Coast closed area. Specifically, this sub-alternative consists of two different spatial configurations associated with two temporal periods. From June 1 through September 30 the spatial extent would consist of the area within 40 nm of the coastline within the northern and southern boundaries of the current East Florida Coast closed area. During this time period, the remainder of the current closed area footprint would be designated a low-bycatch-risk area. From October 1 through May 31 and the spatial extent would include the area east of the Florida coast to a line connecting two points at 31° 00’ N. lat., 79° 32’ 46” W. long. and 27° 52’ 55” N. lat., 79° 28’ 34” W. long. at the northern and southern boundaries, respectively, of the current closed area. As with the June to September area, from October to May, the remainder of the current closed area footprint would be designated a low-bycatch-risk area. NOAA Fisheries used the target species catch estimates and ex-vessel prices for swordfish, yellowfin tuna, and bigeye tuna to estimate the effect of the sub-alternative on commercial pelagic longline revenue. This sub-alternative would generate slightly more revenue from swordfish, but less from yellowfin tuna and bigeye tuna relative to the No Action sub-alternative. When combined the total revenue difference between this sub-alternative and the No Action sub-alternative is -$8,762 resulting in minor negative direct economic impacts in the short- and long-term, which could also lead to negative social impacts. However, fishermen are unlikely to fish in areas with lower catch rates, so reductions in revenue may not be realized. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery, though, not all vessels are active in the area so economic impacts would not be equally shared among all active vessels.

8.6.1.4 Alternative Suite A4: DeSoto Canyon Spatial Management Areas

Sub-Alternative A4a, the no action sub-alternative, would maintain the current DeSoto Canyon closed area in effect with respect to its spatial and temporal extent. NOAA Fisheries used the target species catch estimates and ex-vessel prices for swordfish, yellowfin tuna, and bigeye tuna to estimate the effect of the sub-alternative on commercial pelagic longline revenue. The estimated annual revenue for each target species and the combined target species revenue is $4,618,912 (2021 real dollars). This sub-alternative would maintain the recent fishing effort, catch levels, and revenues, resulting in direct neutral social and economic impacts on pelagic longline fishermen. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Sub-Alternative A4b would modify both the spatial and temporal extent of the current DeSoto Canyon closed area. Specifically, the sub-alternative would maintain the current spatial extent of the DeSoto Canyon spatial management area while changing the timing of the closed areas. Both boxes would remain closed from April 1 to October 31 instead of all year. Additionally, from November to March, the top northwest box would be closed while the bottom southeast box would be designated a low-bycatch-risk area. NOAA Fisheries used the target species catch estimates and ex-vessel prices for swordfish, yellowfin tuna, and bigeye tuna to estimate the effect of the sub-alternative on commercial pelagic longline revenue. This sub-alternative would generate more revenue from swordfish, but less from yellowfin tuna and similar from bigeye tuna relative to the No Action sub-alternative. When combined the total revenue difference between this sub-alternative and the No Action sub-alternative is $38,188 resulting in minor positive direct economic impacts in the short- and long-term, which would also lead to positive direct social impacts. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery, though, not all vessels are active in the area so economic impacts would not be equally shared among all active vessels.

Sub-Alternative A4c would only modify the spatial extent of the current DeSoto Canyon closed area. Specifically, this sub-alternative would reduce the spatial extent by including areas within the current spatial extent that occurs north of 27° 00’ N. lat. The temporal extent would remain unchanged relative to the No Action alternative. The remainder of the current closed area footprint would be designated a low-bycatch-risk area throughout the year. NOAA Fisheries used the target species catch estimates and ex-vessel prices for swordfish, yellowfin tuna, and bigeye tuna to estimate the effect of the sub-alternative on commercial pelagic longline revenue. This sub-alternative would generate more revenue from swordfish and yellowfin tuna, but less from bigeye tuna relative to the No Action sub-alternative. When combined, the total revenue difference between this sub-alternative and the No Action sub-alternative is $278,627 resulting in moderate positive direct and indirect economic impacts in the short- and long-term, which would also lead to positive direct social impacts. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery, though, not all vessels are active in the area so economic impacts would not be equally shared among all active vessels.

Sub-Alternative A4d would modify the spatial extent of the current DeSoto Canyon closed area; the temporal extent would remain unchanged (i.e., area would remain closed year-round). Specifically, this sub-alternative would shift the spatial extent putting a parallelogram through the current area. The parallelogram connects southern points; 27° 00’ N. lat., 86° 30’ W. long. and 27° 00’ N. lat., 83° 48’ W. long., while the northern boundary would be defined by the state water boundary between 88° 24’ 58” W. long. and 85° 22’ 34” W. long. The areas outside this parallelogram that are currently closed would reopen to normal fishing. NOAA Fisheries used the target species catch estimates and ex-vessel prices for swordfish, yellowfin tuna, and bigeye tuna to estimate the effect of the sub-alternative on commercial pelagic longline revenue. This sub-alternative would generate less revenue from all three target species relative to the No Action sub-alternative. When combined, the total revenue difference between this sub-alternative and the No Action sub-alternative is -$224,295 resulting in moderate negative direct and indirect economic impacts in the short- and long-term, which could also lead to negative social impacts. However, fishermen are unlikely to fish in areas with lower catch rates, so reductions in revenue may not be realized. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery, though, not all vessels are active in the area so economic impacts would not be equally shared among all active vessels.

8.6.2 Alternative B: Commercial Data Collection

Alternative B1, the no action alternative, would not implement any new closed area data collection approaches to support HMS spatial management. Because Alternative B1 would not implement any new data collection programs, direct social and economic impacts to fishermen would be neutral in the short-term. In the long-term, as described above, because there would not be any way to collect data from the spatial management areas and modify them accordingly, the impacts to the species, and therefore the impacts to the fishermen and the economy, would be unknown. If the spatial management areas are appropriate and the species and their habitat are protected, fishermen and related industries might experience an increase in revenue as species become more abundant. However, if the spatial management areas are inappropriate and do not protect the species and their habitat, fishermen and related industries might experience a decrease in revenue as the species abundance declines. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Alternative B2 would create a new research fishery, similar to the existing bottom longline shark research fishery, where permitted commercial longline fishing vessels may apply, and a small number would be selected for participation in the spatial management area research fishery. The selected vessels would conduct fishing operations guided by a research plan developed by NOAA Fisheries, and be subject to conditions. Alternative B2 would be a voluntary program and fishermen would continue to decide whether to fish based on market conditions, fish availability, and the restrictions and conditions of the research fishery. Because of the limited nature of the research fishery, large beneficial social or economic impacts to fishermen are not expected. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Alternative B3 would implement monitoring areas to allow fishermen into previously-closed areas to collect data while following strict effort restrictions and monitoring and reporting requirements. Under this alternative a specific geographic area would be designated a “monitoring area” and commercial longline vessels would be permitted to fish inside the monitoring area subject to certain conditions and other applicable regulations. In conjunction with Alternative B3, two sub-alternatives are preferred as well: Sub-Alternative B3a (effort caps) and Sub-Alternative B3e (electronic monitoring). Under Sub-

Alternative B3a, NOAA Fisheries would monitor the number of longline sets occurring in the monitoring area, and when the number of sets reaches the effort “cap”, would prohibit fishing with the relevant gear type in the monitoring area as described above. Additionally, vessel operators that intend to fish in a monitoring area would need to 1) declare that intention via VMS before embarking on a trip and 2) would be required to report the catch of the following species, in addition to current bluefin tuna reporting requirements, through VMS within 12 hours after the end of a longline set: blue marlin, white marlin, roundscale spearfish, sailfish, leatherback sea turtles, loggerhead sea turtles, and shortfin mako sharks. Sub-Alternative B3e would require that longline vessels fishing for all, or a part of a trip in a monitoring area have 100 percent of the EM data reviewed for that trip, and paid for by the owner/operator of the vessel.

Fishing effort in the monitoring area(s) would rely on commercial fishermen’s willingness to fish in the area based on market conditions, fish availability, and the restrictions of the monitoring area. Although it is difficult to predict the amount of fishing effort and fish availability that would occur in the monitoring areas, the socio-economic impact is likely to be either neutral or minor and beneficial. Access to previously closed areas would provide the flexibility to fish in locations previously closed to fishing. If access to fishing in monitoring areas decreases the amount of steaming time required to reach the fishing locations, operating costs may be reduced, and a shorter trip duration would facilitate participation in the fishery. Shorter transit times would also result in reduced fuel consumption. Owners of fishing vessels can often have difficulty finding and hiring crew willing to work on vessels, in part due to the duration of fishing trips, and the impact of fishing trips on crew members' lives. The increased revenue and flexibility associated with monitoring areas would be limited by the restrictions and costs associated with the monitoring areas such as effort caps or the cost of electronic monitoring. Expanding the use of electronic monitoring to 100-percent video review of all sets that occur within the monitoring area would require owners or operators of fishing vessels to pay for the additional review. Each set would cost approximately $280 for a full video review, thus, a typical ten day trip consisting of six sets would cost $1,680. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery, though, not all vessels would choose to fish in monitoring areas so economic impacts would not be equally shared among all active vessels.

Under Alternative B4, data would be collected from within a spatial management area, which would otherwise be closed, through the issuance of an EFP. This EFP would be issued to fishing vessels participating in specific research. The EFP would exempt participating vessels from certain regulatory requirements for specific research during a limited timeframe. Consideration of an application for gear-specific research in closed areas would require incorporation of elements to ensure research activities do not jeopardize conservation goals or result in excessive gear conflicts with other user groups. Fishermen participating in research under an EFP are likely to be compensated through some combination of commercial target catch sales and research funds. Since the fishermen are likely to operate in areas of unknown target catch rates, researchers may partially or fully fund fishing activities to ensure trips do not have negative profits. As such, fishermen operating under the EFP are unlikely to experience adverse economic impacts nor are they expected to realize larger profits than regular commercial fishing. Thus, Alternative B4 would have neutral social and economic impacts. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

8.6.3 Alternative C: Evaluation Timing of Spatial Management Areas

Under Alternative C1, the no action alternative, NOAA Fisheries would not commit to a schedule to evaluate the spatial management modifications using data collected under the data programs ("B" Alternatives) analyzed by this DEIS. Evaluations of spatial management areas are administrative in nature and would not have any short-term social and economic impacts on fishermen or indirect impacts on supporting businesses. In the long-term, evaluation of spatial management areas could result in minor beneficial social and economic impacts due to the achievement of a better balance between the ecological and socioeconomic impacts of spatial management areas. This No Action Alternative has no time period for reviews or factors to consider when reviewing areas, and thus has less clarity process-wise than Alternatives C2, C3 and C4. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Under Alternative C2 NOAA Fisheries would evaluate the four spatial management areas once three years of catch and effort data is finalized and available. Subsequent reviews would occur after three full years of data are available after the conclusion of the previous evaluation. Evaluations of spatial management areas are administrative in nature and would not have any short-term social or economic impacts on fishermen or indirect impacts on supporting businesses. In the long-term, evaluation of spatial management areas could result in minor beneficial social and economic impacts due to the achievement of a better balance among the ecological, social, and economic impacts of spatial management areas. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Under Alternative C3 NOAA Fisheries would evaluate the four spatial management areas once five years of catch and effort data is finalized and available. Subsequent reviews would occur after five full years of data are available after the conclusion of the previous evaluation. Evaluations of spatial management areas are administrative in nature and would not have any short-term social or economic impacts on fishermen or indirect impacts on supporting businesses. In the long-term, evaluation of spatial management areas could result in minor beneficial social and economic impacts due to the achievement of a better balance among the ecological, social, and economic impacts of spatial management areas. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Under Alternative C4, NOAA Fisheries would monitor data collection activities and begin an evaluation if conditions warrant it instead of, or in addition to, scheduled regular evaluation. Evaluations of spatial management areas are administrative in nature and would not have any short-term social or economic impacts on fishermen or indirect impacts on supporting businesses. In the long-term, evaluation of spatial management areas could result in minor beneficial social economic impacts due to the achievement of a better balance among the ecological, social, and economic impacts of spatial management areas. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Under Alternative C5, NOAA Fisheries would set a default end date for a spatial management area and the area and associated restrictions would be removed unless action is taken to maintain or modify the area. Eliminating spatial management areas after a set number of years would provide additional flexibility for fishermen to fish in areas that were previously closed to fishing, and therefore increase the total amount of area to pursue target species. Further, the newly open area may include locations with potential advantages such as higher catch rates or lower trips costs. Thus, Alternative C5 would likely result in minor beneficial social and economic impacts. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

8.6.4 "D" Preferred Alternative Packages

The D1 Mid-Atlantic Spatial Management Area Preferred Alternative Package would include implementation of four alternatives and sub-alternatives analyzed among the "A," "B," and "C" alternatives. Thus, economic impacts to small entities resulting from implementation of the D1 Preferred Alternative Package would be the combination of the impacts of the following alternatives and sub-alternatives described above: Sub-Alternative A1d (spatial and temporal modification to the area), Alternative B1 (no action data collection), Alternative C2 (three year evaluation), and Alternative C4 (triggered evaluation). Impacts of each of the alternatives are not repeated here. In 2020, there were 13 active vessels (vessels that had trips where 75 percent of the landings by weight were sharks) targeting sharks in the Atlantic.

The D2 Charleston Bump Spatial Management Area Preferred Alternative Package would include implementation of four alternatives and sub-alternatives analyzed among the "A," "B," and "C" alternatives. Thus, economic impacts to small entities resulting from implementation of the D2 Preferred Alternative Package would be the combination of the impacts of the following alternatives and sub-alternatives described above: Sub-Alternative A2c (spatial and temporal modification to the area), Alternative B3 (monitoring area), Alternative B4 (cooperative research EFP), Alternative C2 (three year evaluation), and Alternative C4 (triggered evaluation). Impacts of each of the alternatives are not repeated here. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery, though, not all vessels are active in the area so economic impacts would not be equally shared among all active vessels.

The D3 East Florida Coast Spatial Management Area Preferred Alternative Package would include implementation of four alternatives and sub-alternatives analyzed among the "A," "B," and "C" alternatives. Thus, economic impacts to small entities resulting from implementation of the D3 Preferred Alternative Package would be the combination of the impacts of the following alternatives and sub-alternatives described above: Sub-Alternative A3d (spatial modification to the area), Alternative B3 (monitoring area), Alternative B4 (cooperative research EFP), Alternative C2 (three year evaluation), and Alternative C4 (triggered evaluation). Impacts of each of the alternatives are not repeated here. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery, though, not all vessels are active in the area so economic impacts would not be equally shared among all active vessels.

The D4 Preferred DeSoto Canyon Spatial Management Area Preferred Alternative Package would include implementation of four alternatives and sub-alternatives analyzed among the "A," "B," and "C" alternatives. Thus, economic impacts to small entities resulting from implementation of the D3 Preferred Alternative Package would be the combination of the impacts of the following alternatives and sub-alternatives described above: Sub-Alternative A4d (spatial modification to the area), Alternative B1 (no action data collection), Alternative B4 (cooperative research EFP), Alternative C2 (three year evaluation), and Alternative C4 (triggered evaluation). Impacts of each of the alternatives are not repeated here. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery, though, not all vessels are active in the area so economic impacts would not be equally shared among all active vessels.

8.6.5 Alternative E: Spatial Management Area Regulatory Provisions

Alternative E1, the no action alternative, would make no changes to the framework adjustment regulations at 50 CFR 635.34(d), which have considerations for regulatory action. Consideration of high-level spatial management design elements or factors are administrative in nature and would not have any short-term or long-term social or economic impacts on fishermen. Thus, all social and economic impacts would be neutral. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Alternative E2 would revise the HMS regulations at 50 CFR 635.35(e) to add considerations for review of spatial management areas, including the high-level design of specific objectives, timing of evaluation, data collection and access within spatial management areas. Adding these considerations is administrative in nature and would not have any short-term or long-term social or economic impacts on fishermen. Thus, all social and economic impacts would be neutral. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

8.6.6 Alternative F: Electronic Monitoring

Under Alternative F1, NOAA Fisheries would not transfer sampling costs to the industry and would continue to fund the EM Program (both administrative and sampling costs) and utilize contracts with one or more vendors to conduct EM system installation, maintenance, and repair, as well as data storage, video review, and analyses. Since this alternative would not implement any changes, direct social and economic impacts on pelagic longline fishermen are expected to be neutral. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Alternative F2 would transfer 100 percent of HMS pelagic longline EM sampling costs to the industry, over a three-year period (phased-in) and would include components designed to create a standardized EM program that may be implemented by NOAA certified vendors. In conjunction with the phase-in of sampling costs, this alternative would include four distinct components: 1) vendor requirements; 2) vessel requirements; 3) vessel monitoring plan requirements; and 4) modification of current IBQ Program's EM spatial/temporal requirements. The transfer of EM sampling costs from the Agency to industry would likely lead to a substantial increase in economic costs for vessel owners. The cost to industry is estimated to be approximately $280 per set before mitigation measures (e.g., multiple vendors, changes to EM spatiotemporal requirements) are factored in. On a median length trip of 10 days with 6 sets, the cost would be $1,680/trip or $168/sea-day. This cost estimate equates to approximately 19% of net revenue on a median trip. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Alternative F3 would remove all of the current EM program requirements applicable to pelagic longline vessels. Bluefin tuna interactions with pelagic longline gear would be monitored using a combination of VMS data, logbook data, observer reports, and landings data from dealers. Since the Agency funds nearly 100% of the EM program, removing EM requirements would not have a large economic impact on the fishery. However, the fishery would no longer incur costs associated with activities such as shipping hard drives and coordinating equipment repair and replacement. Thus, small economic benefits would be likely. From 2018 through 2020, there were 82 active pelagic longline vessels in the fishery.

Chapter 9 Applicable Laws, Policies, and Executive Orders

9.1 Magnuson-Stevens Fishery Conservation and Management Act

9.1.1 Consistency with the National Standards

Fishery management measures must be consistent with ten national standards contained in the Magnuson-Stevens Act (sec. 301). This section describes how the preferred alternatives in this action are consistent with the National Standards and guidelines set forth in 50 CFR part 600.

National Standard 1

National Standard 1 requires NOAA Fisheries to prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery. NOAA Fisheries has existing conservation and management measures that prevent overfishing and rebuild overfished stocks in the HMS fisheries. *See* Amendments 2, 3, 5a, 5b, 6, 7, 9, 11, 13 and 14 to the 2006 HMS Consolidated FMP. The preferred alternatives in this Amendment would not affect those measures. As explained below, the preferred alternatives would help achieve, on a continuing basis, the optimum yield for directed HMS pelagic and bottom longline fisheries.

Section 5.4 describes the preferred "A" (area modifications), "B" (data collection), and "C" (timing for review) alternatives for each of the four spatial management areas addressed in this amendment. For each area, NOAA Fisheries prefers Alternatives C2 (evaluating the areas when three years of catch and effort data is finalized and available) and C4 (evaluating areas as warranted based on review factors mentioned in the introduction to Section 5.3). The preferred "A" and "B" Alternatives for each area are:

- Mid-Atlantic Spatial Management Area: Alternatives A1d and B1 (No Action)
- Charleston Bump Spatial Management Area: Alternatives A2c; B4 (cooperative research via EFP in high-bycatch risk area); and B3, B3a, B3e and B4 (monitoring area with effort caps and EM and cooperative research via EFP in low-bycatch risk area)
- East Florida Coast Spatial Management Area: Alternative A3d; same "B" Alternatives as Charleston Bump
- DeSoto Canyon Spatial Management Area: Alternatives A4d; B4 (cooperative research via EFP in high-bycatch risk area); B1 (no action in low-bycatch risk area)

The preferred alternatives to modify, collect data, and assess spatial management areas are designed to more efficiently protect bycatch species in pelagic and bottom longline fisheries by more closely aligning boundaries and timing with the distribution of those species. A secondary effect, though, of more efficient spatial management areas is improved access to pelagic and bottom longline target species in areas with lower bycatch-risk. This would help achieve optimum yield without jeopardizing sustainability. Target species in the HMS pelagic longline fishery include swordfish, yellowfin tuna, and bigeye tuna. Swordfish and yellowfin tuna are not overfished and overfishing is not occurring. Bigeye tuna are overfished with overfishing occurring, however, the stock is actively managed through ICCAT and the United States is a small contributor to overall fishing mortality. Target species in the HMS bottom longline fishery, including the shark research fishery, are sandbar sharks, blacktip sharks, and tiger sharks. Sandbar sharks are overfished but overfishing is not occurring. Blacktip and tiger sharks are not overfished and overfishing is not occurring. Landings of each of these target species have been well below scientifically-derived quotas in recent years.

The preferred alternative (F2) to modify the administration and funding of the HMS pelagic longline EM program would not affect preventing overfishing or achieving, on a continuous basis, optimum yield. Social and economic impacts of transferring sampling costs to industry are expected to be moderate to major adverse, and could result in fishermen deciding to make fewer or shorter trips, thereby reducing effort in the fishery. In addition, fishermen may choose to alter their fishing strategy or location in order to avoid fishing in areas where EM is required and the associated costs are higher. However, EM is needed to manage incidental catch of bluefin tuna under the IBQ Program, and NOAA Fisheries policy is to transfer EM sampling costs to industry. Notwithstanding potential changes in fishing effort, NOAA Fisheries believes that the preferred alternative will not affect achieving OY on a continuing basis. It is unlikely that the preferred alternative would have a noticeable effect on catch composition of target, bycatch, or incidentally-caught species for the reasons explained in Section 5.6.2. Moreover, the preferred alternative provides for a three-year phase in of costs to allow the fishery time to adapt to this change as well as other mitigation measures. *See Cost Mitigation Measures* discussion in Section 5.6.2,

National Standard 2

National Standard 2 requires that conservation and management measures be based on the best scientific information available. The best scientific information available, consistent with the HMS Regional BSIA Framework, was used to develop alternatives and analyses for the spatial management alternatives Primary scientific literature was researched and referenced (*See* References section in each chapter), and recent fishery observer reports and logbook data were considered. HMS PRiSM was developed to support this Amendment and includes recent fishery observer catch data with environmental data such as sea surface temperature, bathymetry, and chlorophyll-A concentrations. Model results from HMS PRiSM represent the latest, best available scientific information on fishery interaction predictions. To ensure that the approach is sound, NOAA Fisheries formally consulted with outside experts at two points in the process, each providing valuable insight and assurances. First, the HMS PRiSM methodology was submitted for peer-review and publication in the scientific journal Marine Biology, as described above. Second, as detailed below, portions of the DEIS were submitted to the Center of Independent Experts (CIE) for review. To ensure that NOAA Fisheries is using the best available scientific information for management considerations, CIE was established in 1998 to routinely provide external, independent and expert reviews of the Agency's science used for policy and management decisions. The CIE process satisfies peer-review standards as specified in the Magnuson-Stevens Act provision National Standard 2 guidelines. These guidelines specify that peer review is an important factor in the determination of best scientific information available, and the selection of reviewers must adhere to peer-review standards such as high qualifications, independence, and strict conflict of interest standards.

For the preferred alternative to modify the administration and funding of the HMS pelagic longline EM program, NOAA Fisheries has provided its best available cost estimates.

National Standard 3

National Standard 3 requires that, to the extent practicable, an individual stock of fish be managed as a unit throughout its range and interrelated stocks of fish be managed as a unit or in close coordination. The preferred alternatives to modify, collect data, and assess spatial management areas are consistent with National Standard 3 because the model and resulting impact analyses explicitly consider the range and distribution of individual stocks and consider where fishery interactions overlap for multiple interrelated stocks, including non-target species. One of the objectives of Amendment 15 is to use HMS PRiSM modeling results, logbooks, and observer data, to more closely match spatial management areas to locations and times of high fishery interaction probability. Doing so allows the Agency to consider the most efficient protections for modeled species across their range. Amendment 15 also considers stocks that are interrelated due to fishery interaction in bottom or pelagic longline gear. Instead of optimizing spatial management areas for one species, this amendment considers a host of species for each area. Non-target and bycatch species such as billfish and sea turtles are considered in pelagic longline spatial management areas and sea turtles and dusky sharks are considered in bottom longline areas. Additional non-target species such as bluefin tuna were also considered in the development of alternatives. Finally, impacts of the alternatives were analyzed using target catch data of species such as swordfish and yellowfin tuna in pelagic longline areas and sandbar sharks in bottom longline areas.

The preferred alternative to modify the administration and funding of the HMS pelagic longline EM program does not affect how stocks are managed throughout their range or how interrelated stocks are managed.

National Standard 4

National Standard 4 requires that conservation and management measures do not discriminate between residents of different states. Furthermore, if it becomes necessary to allocate or assign fishing privileges among various U.S. fishermen, such allocation should be fair and equitable to all fishermen; be reasonably calculated to promote conservation; and should be carried out in such a manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges. None of the preferred alternatives allocate or assign fishing privileges. The preferred alternatives would not differentiate among U.S. citizens, nationals, resident aliens, or corporations on the basis of their state of residence nor would they incorporate or rely on a state statute or regulation that discriminates against residents of another state.

The preferred spatial management area alternatives focus on the U.S. South Atlantic and Gulf of Mexico regions because, as explained in Chapter 1, current spatial management areas have not been assessed and may not be meeting current conservation goals most effectively. Opportunities to participate in data collection would be open to all permitted vessels regardless of state residency. In other words, the preferred alternatives would be applied equally to all permit holders, regardless of home port. Permit holders may fish for managed HMS in any HMS jurisdictional waters where they are found, regardless of the state where they or their business reside or their vessel's principal or home port state. The preferred alternative to modify the administration and funding of the HMS pelagic longline EM program would also apply to all permitted longline vessels regardless of state residency.

Some of the preferred alternatives to modify, collect data, and assess spatial management areas would have different social and economic impacts on different fishery participants, depending upon historical fishing behavior and catch, dependence upon the fishery, fishing location, and social attributes such as dependence upon fishing and social vulnerability. However, the spatial management areas do not have any discriminatory intent; they are conservation measures that address bycatch and incidental catch. See Sections 1.1. (overview of closed areas), 4.1.1 (background of closed areas), and 5.1 (analysis of ecological and other impacts of area alternatives) and Chapter 2 (PRiSM analyses for area alternatives). The preferred alternatives consider the fact that HMS fisheries are widely distributed and highly variable due to the diversity of participants (location, gear types, commercial, recreational), and because HMS migrate over thousands of miles. Vessels fishing in any geographic area in the Atlantic or Gulf of Mexico are likely to have only limited access to the HMS they are targeting unless they travel long distances within the migratory range of that species. The ports and communities that provide the goods and services to support the HMS fisheries may vary as well, as vessels travel over large distances to pursue their target species.

National Standard 5

National Standard 5 requires that conservation and management measures should, where practicable, consider efficiency in the utilization of fishery resources with the exception that no such measure shall have economic allocation as its sole purpose. The preferred alternatives do not make economic allocations of fishery resources.

The preferred alternatives to modify, collect data, and assess spatial management areas would more efficiently protect bycatch species potentially allowing additional access for fishermen to target species in areas with lower bycatch risk. The more efficient design of spatial management areas would increase the efficiency in utilization of fishery resources.

The preferred alternative to modify the administration and funding of the HMS pelagic longline EM program considers efficiency through the use of EM Data Review Areas, which are based on the current SEFSC sampling plan. Vessels would be required to activate EM and submit video only when operating in locations and times of EM Data Review Areas during all or a portion of a trip. This approach reduces complexity in the video review process, provides additional flexibility to vessel owners, and reduces industry sampling costs.

National Standard 6

National Standard 6 states that conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches. Consistent with National Standard 6, the spatial management area preferred alternatives in Amendment 15 expressly address variations and contingencies in fisheries, fishery resources, and catches. This amendment considers alternatives to more efficiently design spatial management areas around bycatch protection particularly in the context of changing species distribution and fishery conditions that have occurred since the areas were first implemented 15 to 20 years ago. Further, the preferred alternatives consider ways to collect data in spatial management areas to continually assess their performance in meeting conservation and management goals. These activities would provide information to continue to account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches. Finally, Preferred Alternatives C2 and C4 would provide for regular review, and review as otherwise warranted, of spatial management areas based on regulatory factors and considerations (Preferred Alternative E2).

As explained under National Standard 5, EM Data Review Areas provide flexibility to vessel owners. In addition, phased-in implementation of the alternative was included, recognizing the need for a transition period in light of potential changes in fisheries.

National Standard 7

National Standard 7 states that conservation and management measures shall, where practicable, minimize costs, and avoid unnecessary duplication. The preferred alternatives to modify, collect data, and assess spatial management areas would minimize costs in the longline fisheries by providing some additional access in areas with lower bycatch risk that may be closer to ports, reducing transit times. Furthermore, the preferred alternatives remove unnecessary regulation as they update spatial management area location and timing using best scientific information available on bycatch and other species interactions. Since implementation of the spatial management areas considered in this action 15 to 20 years ago, circle hook requirements were implemented in the pelagic longline and bottom longline fisheries in order to minimize bycatch and bycatch mortality to the extent practicable for sea turtles and dusky sharks, respectively. And the IBQ Program and EM were implemented in the pelagic longline fishery to provide for individual vessel accountability in the incidental catch of bluefin tuna.

The preferred alternative to modify the administration and funding of the HMS pelagic longline EM program would transfer sampling costs to the industry. While the transfer could reduce the overall cost of the program through additional efficiencies and redesign of the sampling program, the EM preferred alternative would increase costs for vessel owners. However, this action is necessary to meet the conservation and management goals of this Amendment and to comply with NOAA Fisheries Policy 04-115-02 (Cost Allocation in Electronic Monitoring Programs for Federally Managed U.S. Fisheries). *See* Section 9.6 for more information on the policy. The preferred alternative minimizes costs in several ways. For example, the EM Data Review Areas, which provide reductions in the spatiotemporal EM requirements, would provide quantifiable reductions in cost. In addition, the vendor certification process encourages multiple vendors to enter the market, decreasing costs through competition and also leveraging the existing infrastructure of vendors. *See Cost mitigation measures* in Section 5.6.2 for further discussion.

National Standard 8

National Standard 8 states that conservation and management measures shall, consistent with the conservation requirements of the Magnuson-Stevens Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to provide for the sustained participation of such communities, and to the extent practicable, minimize adverse economic impacts on such communities. Section 4.2 provides an assessment of 25 "Atlantic HMS communities" (i.e., greater than average number of Atlantic HMS permits associated with them) using social indicator variables that could assess a community's vulnerability or resilience to potential economic disruptions. The preferred alternatives to modify, collect data, and assess spatial management areas are consistent with National Standard 8 because they could increase access for commercial fishermen in areas with lower bycatch risk, providing sustained participation for fishing communities closer to home ports. Providing additional access and reduced transit times could reduce costs, increase profitability, minimize adverse economic impacts, and help sustain participation in longline fisheries. In designing these alternatives, NOAA Fisheries also considered sustained participation in recreational fisheries (*See* Sections 5.4.6 and 4.9). The preferred alternatives are consistent because the modified design of the spatial management areas took into account recreational fishing locations and targeted data collection activities in areas where recreational fishermen are unlikely to operate to reduce potential gear conflict.

As explained under the National Standard 7 discussion, the preferred alternative that transfers EM sampling costs to the industry would likely result in moderate to major adverse social and economic impacts. The preferred alternative minimizes costs in several ways. *See Cost Mitigation Measures* in Section 5.6.2 for further discussion.

National Standard 9

National Standard 9 states that conservation and management measures shall, to the extent practicable, minimize bycatch, and to the extent that bycatch cannot be avoided, minimize the mortality of such bycatch. NOAA Fisheries has existing measures that minimize bycatch and bycatch mortality in the HMS fisheries. See Amendments 2, 3, 5a, 5b, 6, 7, 8, 9, 11, and 13 to the 2006 HMS Consolidated FMP and Section 4.10 of this DEIS (summarizing bycatch reduction measures). However, four measures – closed areas – had not been evaluated since they were first implemented 15 to 20 years ago. Given changing species distribution and fishery conditions, updating the areas is important to ensure effective bycatch protection. Thus, the first objective of Amendment 15 is to use spatial management tools to minimize bycatch and bycatch mortality, to the extent practicable, in the pelagic and bottom longline fisheries, while also optimizing fishing opportunities. This amendment considers alternatives to more efficiently design spatial management areas using the best scientific information available. Further, the preferred alternatives consider ways to collect data in spatial management areas to continually assess their performance in meeting conservation and management goals, including bycatch reductions.

As explained under the National Standard 1 discussion, the preferred alternative that transfers EM sampling costs to industry may result in some reduced effort. The alternative may also result in changes in fishing strategy or location; however, it is unlikely that this would have a noticeable effect on catch composition of target, bycatch, or incidentally-caught species for the reasons explained in Section 5.6.2..

National Standard 10

National Standard 10 states that conservation and management measures shall, to the extent practicable, promote the safety of human life at sea. The preferred alternatives to modify, collect data, and assess spatial management areas could increase access for fishermen in areas with lower bycatch risk, providing sustained participation for fishing communities closer to home ports. Providing additional access and reduced transit times could reduce the amount of time on the water traveling to and from fishing grounds and provide fishermen with more flexibility to fish in areas and at times when ocean conditions are safer.

The preferred alternative that transfers EM sampling costs does not affect safety at sea. However, as noted above, the alternative may result in some reduced effort or fishermen choosing to alter their fishing strategy or location.

9.1.2 Consistency with Section 303(b)(2)(C) - Fishery Closure Discretionary Provisions

Section 303(b)(2)(C) of the Magnuson-Stevens Act addresses closures that prohibit *all* fishing. Although not specifically applicable to the four spatial management areas considered in Amendment 15 since each area only applies to a single gear type and does not prohibit all fishing. NOAA Fisheries thought it helpful to consider the elements in section 303(b)(2)(C), namely that a closure:

i. is based on the best scientific information available;

ii. includes criteria to assess the conservation benefit of the closed area;
iii. establishes a timetable for review of the closed area's performance that is consistent with the purposes of the closed area; and
iv. is based on an assessment of the benefits and impacts of the closure, including its size, in relation to other management measures (either alone or in combination with such measures), including the benefits and impacts of limiting access to: users of the area, overall fishing activity, fishery science, and fishery and marine conservation.

The preferred spatial management area alternatives are based on the best scientific information available. *See* National Standard 2 discussion above. With regard to the second element, the conservation benefit of each area was determined through HMS PRiSM, and included a metric scoring system to qualitatively measure and rank closed areas options based on conservation benefit (Section 2.5). Consistent with the third criterion, in the preferred alternative packages for each spatial management area, a timetable is included to assess the performance in meeting conservation and management goals. Assessment would occur once three years of data are available or sooner if conditions warrant an earlier analysis (Section 3.3). Finally, with regard to the fourth element, tradeoffs among conservation benefits, fishery resource access, fishing effort, and other management measures were extensively considered in the impacts analyses in Chapter 5, particularly in the context of ecological (target and non-target catch), social, and economic impacts. Section 4.2 details community profiles and analyzes impacts to fishing communities. Additional impacts analyses in Chapter 5 consider impacts to recreational fisheries and Section 9.4 considers impacts to minority and low-income populations.

9.2 PAPERWORK REDUCTION ACT

The purpose of the PRA is to reduce the total amount of paperwork burden the Federal government imposes on private businesses and citizens. The Paperwork Reduction Act imposes procedural requirements on agencies that wish to collect information from the public. One of the preferred data collection alternatives, Alternative B3, would implement expanded reporting requirements subject to the Paperwork Reduction Act. Vessel operators would be required to fund additional review of video data collected in monitoring areas and VMS catch reporting requirements would be expanded to include additional species. Additionally, preferred Alternative F2 would transition the EM program cost burden from the Agency to industry and introduce new reporting requirements to ensure that vessel operators are complying with the redesigned EM program. The expanded requirements under both these alternatives are within the scope of an existing approved Paperwork Reduction Act (OMB Control No. 0648-0372 "Electronic Monitoring Systems for Atlantic Highly Migratory Species"). However, due to the existence of concurrent actions for that collection, which will come up for renewal before the final rule for this action is anticipated to be published, the collection-of-information requirements in this proposed rule will be assigned a temporary Control Number that will later be merged into Control Number 0648-0372. A revised Paperwork Reduction Act submission and approval is pending.

9.3 Coastal Zone Management Act

NOAA Fisheries has determined that this action is consistent to the maximum extent practicable with the enforceable policies of the approved coastal management program of each state along the Atlantic coast, Gulf of Mexico, and the Caribbean Sea. This determination will be submitted for review by the responsible state agencies under section 307 of the Coastal Zone Management Act (CZMA).

9.4 Executive Order 12898 - Environmental Justice

Executive Order 12898 requires agencies to identify and address disproportionately high and adverse environmental effects of its regulations on minority and low-income populations. The Executive Order also requires Federal agencies to conduct their programs, policies, and activities in a manner to ensure individuals or populations are not excluded from participation in, or denied the benefits of, or subjected to discrimination because of their race, color, or national origin. This Executive Order is generally referred to as environmental justice. To determine whether environmental justice concerns exist, the demographics of the affected area should be examined to ascertain whether minority populations and low-income populations are present. If so, a determination must be made as to whether implementation of the alternatives may cause disproportionately high and adverse human health or environmental effects on these populations.

Commercial fishermen and associated industries could be impacted by the proposed actions. However, information on the race and income status for groups at the different participation levels is not available. Although information is available concerning a community's overall status with regard to minorities and poverty (e.g., census data), such information is not available specific to fishermen and those involved in the industries and activities themselves. Using a social vulnerability index, Section 4.2 identifies 25 communities that would likely experience greater difficulty recovering from economic hardships caused by job losses in the commercial fishing sector. *See* Section 4.2 at Table 4.2. Communities that scored high or medium high on four indices include New Bedford, Massachusetts; Fort Pierce, Florida; and Freeport, Texas. Three other Atlantic HMS communities scored high or medium high on three social vulnerability indices: Pompano Beach, Florida; Dulac, Louisiana; and Grand Isle, Louisiana. With the exception of New Bedford, Massachusetts and Freeport, Texas, all of these communities are within close proximity to spatial management areas considered in this action.

Since these communities are in close proximity to considered spatial management areas, any increase in flexibility with regard to fishing effort or increased access closer to a community's home port could provide benefits to the communities. While the purpose of the spatial management portions of Amendment 15 are to collect data to assess closed areas, data collection activities have the ancillary benefit of providing increased access to fishing grounds in a controlled and monitored fashion. Furthermore, Amendment 15 considers evaluating spatial management areas once three years of data are available or sooner if conditions warrant. Those evaluations would provide an opportunity to further analyze impacts to minority and low-income populations.

Amendment 15's preferred alternative to transfer sampling costs of the pelagic longline EM program from the Agency to industry would likely result in moderate to major adverse social and economic impacts. However, the impacts would be spread across the fishery based on effort and would not disproportionately impact minority and low-income populations.

9.5 EXECUTIVE ORDER 14008 - TACKLING THE CLIMATE CRISIS AT HOME AND ABROAD: "AMERICA THE BEAUTIFUL"

On January 27, 2021, President Biden signed Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad*, which detailed a two-part approach to address climate change policy. The first part, Part I – Putting the Climate Crises at the Center of United States Foreign Policy and National Security, focuses on how the Administration should consider climate change in the context of United States foreign policy and national security and is less relevant to this Amendment. The second part, Part II – Taking a Government-Wide Approach to the Climate Crisis, focuses on domestic policy and is more relevant to Amendment 15. Part II includes the goal of conserving, connecting, and restoring at least 30 percent of U.S. lands and waters by 2030 and directs the Department of Interior (DOI), in consultation with the Department of Commerce (vis-a-vis NOAA), the Department of Agriculture, the White House Council on Environmental Quality, and other agencies, to submit a report to the White House National Climate Task Force that recommends an inclusive and collaborative conservation vision.

In response to that directive, a May 2021 preliminary report, "Conserving and Restoring America the Beautiful," was published. The report described eight principles by which the nation should pursue the initiative through a collaborative, locally-led, and inclusive approach that benefits all Americans, while providing economic benefits and honoring tribal sovereignty and private property rights. The report also outlined six areas of focus that elected officials, Tribal leaders, and stakeholders see as early opportunities for successful collaboration as part of the initiative: creating more parks in underserved communities; supporting Tribally led conservation and restoration priorities; expanding collaborative conservation of fish and wildlife habitats and corridors; increasing access for outdoor recreation; rewarding voluntary conservation efforts of fishers, ranchers, farmers, and forest owners; and creating jobs by investing in restoration and resilience. Details of NOAA's actions under the initiative and how they fit into the six focus areas can be found on the website *Conserving and Restoring America the Beautiful Areas of Focus*. The first annual progress report on the America the Beautiful initiative was published in December 2021, and highlights steps the Administration has taken over the past year to support locally led and voluntary efforts in support of the initiative, which would help sustain the health of U.S. communities and bolster local economies.

Additionally, NOAA co-chairs an interagency subcommittee that is working to develop the new *American Conservation and Stewardship Atlas*, which will establish a baseline of, and track progress on, conservation and restoration of U.S. lands and waters. In January 2022, the Department of the Interior, in coordination with the Departments of Agriculture and Commerce (through NOAA) and the White House Council on Environmental Quality invited the public to provide comments (January 4, 2022; 87 FR 235) on the development of the Atlas, and how it can best reflect a continuum of conservation actions across the United States. Informed by these comments and other input, the agencies are expected to release a beta version of the Atlas in the coming months.

Amendment 15 is responsive to Administration priorities in the America the Beautiful Executive Order including those identified by the multi-Agency task force and NOAA, as detailed above. Amendment 15 specifically assesses the effectiveness of current closed areas in meeting conservation goals and considers more efficient design of those areas to balance multiple conservation and management goals. Spatial management area assessment and modification needs are driven, in part, by changes to the fisheries and species interactions locations and times due to climate change and the resulting change to ocean conditions. Regular assessment of spatial management areas is critical in the context of changing ocean conditions and marine species' distribution. HMS and other pelagic species such as sea turtles often prefer a narrow range of ocean conditions such as specific temperature and salinity levels. They may also follow prey species that prefer those ocean conditions or other conditions associated with high primary productivity such as high chlorophyll concentrations. Due to changing ocean conditions and species' distribution, static spatial management areas that may have been appropriately placed many years ago may not be protecting the right species in the right places at the right time.

9.6 NOAA Fisheries Policy 04-115-02 (Cost Allocation in Electronic Monitoring Programs for Federally Managed U.S. Fisheries)

On May 7, 2019, NOAA Fisheries issued Procedure 04-115-02 "Cost Allocation in Electronic Monitoring Programs for Federally Managed Fisheries." This cost allocation policy document (policy) outlines guidance and directives for EM cost allocation framework between fishery participants and the Agency. The policy outlines the potential for EM to provide cost-effective fishery-dependent data and monitoring, but notes that all appropriated funds designated for implementing systems to monitor fishing vessel activity and catch at sea are fully dedicated. As such, the policy directs NOAA Fisheries to build funding solutions into new EM programs and, relevant to the HMS pelagic longline EM program, find ways for existing programs to achieve cost-effective approaches including industry funding. Amendment 15's EM Cost Allocation alternatives consider ways to comply with this directive.

The policy provides three areas of specific guidance: *Cost Responsibilities and Categories*, *Implementation Timelines*, and *Measuring Effectiveness*. *Cost Responsibilities and Categories* identifies two categories of costs associated with EM programs: sampling costs and administrative costs. Details on the delineation of program components into the two categories are provided in the policy. Alternative F2 delineates the HMS pelagic longline EM program-specific costs into the two categories, consistent with the policy guidance (Section 3.6). Generally, the policy directs administrative costs to be paid for the Agency and sampling costs to be paid for by industry. As explained in Section 3.6, administrative costs for the EM program are subject to cost recovery provisions for limited access privilege programs.

Implementation Timelines outlines timing flexibility while transferring sampling costs to industry. In the case of existing programs that have been funded by the Agency, the policy allows for up to a three-year transition. Consistent with that, Preferred Alternative F2 proposes a three-year phase-in of the sampling cost transfer.

Measuring Effectiveness directs NOAA Fisheries to track the number of EM programs that include cost allocation strategies through updates on Regional Electronic Technology Implementation Plans provided to the Regulatory and Science Boards. Progress with the HMS pelagic longline EM program cost allocation strategy would be provided to the appropriate contacts to update the plans for communication to the Regulatory and Science Boards.

The preferred alternative (Alternative F2) for EM cost allocation is consistent with the broad goals of the policy and the three specific areas of guidance, as detailed above.

Chapter 10 LIST OF PREPARERS

The development of this Amendment involved input from many people within NOAA Fisheries, NOAA Fisheries contractors, and input from public, constituent groups, and the HMS Advisory Panel. Staff and contractors from the HMS Management Division, in alphabetical order, who worked on this document include:

Randy Blankinship, Division Chief
Karyl Brewster-Geisz, Branch Chief
Lisa Crawford, Knauss Fellow
Dan Crear, Marine Spatial Ecologist
Peter Cooper, Branch Chief
Tobey Curtis, Fishery Management Specialist
Guý DuBeck, Fishery Management Specialist
Benjamin Duffin, Statistician
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Erianna Hammond, Fishery Management Specialist
Cliff Hutt, Fishery Management Specialist
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Brad McHale, Branch Chief
Ian Miller, Fishery Management Specialist
Larry Redd, Fishery Management Specialist
George Silva, Fishery Economist
Tom Warren, Fishery Management Specialist

10.1 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS CONSULTED

Under 304(g)(1)(A) of the Magnuson-Stevens Act, NOAA Fisheries is required to consult and consider the comments and views of affected Fishery Management Councils, ICCAT Commissioners and advisory groups, and advisory panels established under 302(g) regarding amendments to an Atlantic HMS FMP. NOAA Fisheries provided documents and consulted with the Atlantic, Gulf, and Caribbean Fishery Management Councils, Gulf and Atlantic States Marine Fisheries Commissions, and the HMS Advisory Panel at various stages throughout the process. Hard copies were also provided to anyone who requested copies.

The development of this document also involved considerable input from other staff members and Offices throughout NOAA including, but not limited to:

- Other Divisions within the Office of Sustainable Fisheries
- The Southeast Fisheries Science Center
- The Southwest Fisheries Science Center
- NOAA General Counsel

- NOAA Fisheries NEPA
- NOAA Fisheries Office of Science and Technology

Comments on the proposed rule and the draft amendment/Environmental Impact Statement will be accepted for at least 60 days from the date of publication of the proposed rule in the Federal Register. An HMS Advisory Panel meeting and numerous public hearings will be held along the Atlantic Coast, including the Gulf of Mexico, and through an online webinar(s). Additionally, NOAA Fisheries will request the opportunity to present the proposed rule and Draft Amendment 15 to the 2006 Consolidated HMS FMP to the five Atlantic and Gulf Regional Fishery Management Councils and two Interstate Marine Fisheries Commissions.

APPENDIX 1. OBSERVED SPECIES OCCURRENCE

This appendix provides tables showing the percent occurrence of species in bottom and pelagic longline fishery observer datasets. Because of the location of the current time/area closures, the bottom longline observer data only focuses on the Atlantic region, while the pelagic longline observer data has separate tables for the Atlantic and Gulf of Mexico regions. Under the overfished or overfishing column a "-" indicates the status is unknown. Bolded species are the bycatch species selected for HMS PRiSM modeling. This information supports the discussion of "Step 1" (Section 2.3).

Bottom Longline - Atlantic Region

Species (2005-2019)	% Occurrence	Status is overfished or overfishing?	Listed under ESA or MMPA?
Sandbar shark	**78**	**Overfished/No**	**No**
Tiger shark	67	-	No
Atlantic sharpnose shark	49	No/No	No
Blacktip shark	35	No/No	No
Bull shark	31	-	No
Scalloped hammerhead shark	**29**	**Overfished/overfishing**	**No**
Nurse shark	25	-	No
Great hammerhead shark	24	-	No
Dusky shark	**23**	**Overfished/overfishing**	**No**
Blacknose shark	17	Overfished/overfishing	No
Lemon shark	12	-	No
Sand tiger shark	11	-	No
Spinner shark	10	-	No
Silky shark	8	-	No
Loggerhead sea turtle	4	-	Threatened
Southern stingray	3	-	No
Bonnethead shark	2	-	No
White shark	2	-	No
Finetooth shark	2	No/No	No
Reef shark	1	-	No
Night shark	1	-	No
Shortfin mako shark	1	Overfished/overfishing	No
Dolphinfish	1	-	No
Cownose ray	1	-	No
Spotted eagle ray	<0.5	-	No
Smooth hammerhead shark	<0.5	-	No
Atlantic stingray	<0.5	-	No

Common thresher	<0.5	-	No
Atlantic angel shark	<0.5	-	No
Bullnose ray	<0.5	-	No
Leatherback sea turtle	<0.5	-	Endangered
Yellowfin tuna	<0.5	No/No	No
Manta ray	<0.5	-	No
Longfin mako shark	0.0	-	No
Kemp ridley sea turtle	0.0	-	Endangered
Blue shark	0.0	No/No	No
Blackfin tuna	0.0	-	No

Pelagic Longline - Atlantic Region

Species (1997-2018)	% Occurrences	Status is overfished or overfishing?	Listed under ESA or MMPA?
Swordfish	88	No/No	No
Blue shark	63	No/No	No
Yellowfin tuna	49	No/No	No
Dolphinfish	48	-	No
Bigeye tuna	47	Overfished/overfishing	No
Billfish species	**40**	**See individual species below**	**No**
Albacore tuna	34	No/No	No
Shortfin mako shark	**27**	**Overfished/overfishing**	**No**
White marlin/roundscale spearfish	25	Overfished/No	No
Tiger shark	23	-	No
Pelagic stingray	23	-	No
Silky shark	16	-	No
Blue marlin	14	Overfished/Overfishing	No
Bluefin tuna	11	- /No	No
Atlantic sailfish	9	No/No	No
Manta Ray	8	-	Threatened
Blackfin tuna	8	-	No
Loggerhead sea turtle	**7**	**-**	**Threatened**
Wahoo	7	-	No
Leatherback sea turtle	**6**	**-**	**Endangered**
Porbeagle shark	6	Overfished/No	No
Night shark	5	-	No
Oceanic whitetip shark	5	-	Threatened
Bigeye thresher shark	5	-	No

Scalloped hammerhead	5	Overfished/overfishing	No
Dusky shark	4	Overfished/overfishing	No
Longfin mako shark	3	-	No
Skipjack tuna	3	No/No	No
Atlantic sharpnose shark	2	No/No	No
Sandbar shark	2	Overfished/No	No
Common thresher shark	1	-	No
Longbill spearfish	1	-	No
Great hammerhead shark	1	-	No
Smooth hammerhead shark	<0.5	-	No
Blacktip shark	<0.5	No/No	No
Bull shark	<0.5	-	No
Spinner shark	<0.5	-	No
Smooth dogfish	<0.5	No/No	No
Spiny dogfish	<0.5	-	No
Bottlenose dolphin	<0.5	-	MMPA
Bignose shark	<0.5	-	No
Shortfin pilot whale	<0.5	-	MMPA
Common dolphin	<0.5	-	MMPA
Beaked whale	<0.5	-	MMPA
Cobia	<0.5	No/No	No
Blacknose shark	<0.5	Overfished/overfishing	No
Sandtiger shark	<0.5	-	No
Greenland shark	<0.5	-	No
Green sea turtle	<0.5	-	Threatened
Longfin pilot whale	<0.5	-	MMPA
Pygmy sperm whale	<0.5	-	MMPA
Finetooth shark	<0.5	No/No	No
Collared dogfish	<0.5	-	No
Hawksbill sea turtle	<0.5	-	Endangered
Kemp's Ridley sea turtle	<0.5	-	Endangered
Northern bottlenose whale	<0.5	-	MMPA

Pelagic Longline - Gulf of Mexico Region

Species (1997-2019)	% Occurrences	Status is overfished or overfishing?	Listed under ESA or MMPA?
Yellowfin tuna	83	No/No	No
Swordfish	74	No/No	No

Billfish species	**44**	**See individual species below**	**No**
Dolphinfish	38	-	No
Blackfin tuna	33	-	No
Pelagic stingray	30	-	No
Wahoo	27	-	No
Skipjack tuna	24	No/No	No
White marlin/roundscale spearfish	22	Overfished/No	No
Blue marlin	17	Overfished/Overfishing	No
Bluefin tuna	14	No/No	No
Sailfish	13	No/No	No
Tiger shark	13	-	No
Silky shark	13	-	No
Shortfin mako shark	**9**	**Overfished/overfishing**	**No**
Bigeye tuna	7	Overfished/overfishing	No
Bigeye thresher shark	5	-	No
Albacore tuna	5	No/No	No
Leatherback sea turtle	**5**	**-**	**Threatened**
Scalloped hammerhead	3	Overfished/overfishing	No
Sandbar shark	2	Overfished/No	No
Longfin mako shark	2	-	No
Dusky shark	2	Overfished/overfishing	No
Manta Ray	2	-	Threatened
Oceanic whitetip shark	2	-	Threatened
Night shark	1	-	No
Blue shark	1	No/No	No
Loggerhead sea turtle	1	-	Threatened
Longbill spearfish	<0.5	-	No
Blacktip shark	<0.5	No/No	No
Spinner shark	<0.5	-	No
Bull shark	<0.5	-	No
Atlantic sharpnose shark	<0.5	No/No	No
Collared dogfish	<0.5	-	No
Bottlenose dolphin	<0.5	-	MMPA
Common thresher shark	<0.5	-	No
Cobia	<0.5	No/Overfishing	No
Bignose shark	<0.5	-	No
Spiny dogfish	<0.5	-	No
Pygmy sperm whale	<0.5	-	MMPA
Great hammerhead	<0.5	-	No
Smooth hammerhead	<0.5	-	No
Smooth dogfish	<0.5	No/No	No

Beaked whale	<0.5	-	MMPA
Blacknose shark	0	-	No
Finetooth shark	0	No/No	No
Green sea turtle	0	-	Threatened
Hawksbill sea turtle	0	-	Endangered
Kemp's Ridley sea turtle	0	-	Endangered
Shortfin pilot whale	0	-	MMPA
Longfin pilot whale	0	-	MMPA
Common dolphin	0	-	MMPA

APPENDIX 2. PRISM MODEL RESULTS AND VALIDATIONS

Table 2. Information about the observed occurrence rate of each bycatch species modeled for the bottom longline in the Atlantic Region, as well as the best model covariates (with the exception of temporal covariates, e.g. year), deviance explained from the best model, and predictive performance metrics (e.g., area under the receiver operating curve [AUC] and true skill statistic [TSS]) from the three validation approaches for each species. Deviance explained is the amount of variation in the data that the model can account for, meaning the higher the value the better. AUC values range from 0 to 1 where a value of 0.5 indicates the prediction is no different than random, whereas a value closer to 1 indicates perfect model prediction. TSS ranges from -1 to 1, where a value of 0 means the model performed no better than random and a value of 1 indicates perfect model performance.

Species	Fishery	Region	Occurrence (% of sets)	Best model covariates	Deviance Explained (%)	Validation Approach	AUC	TSS
Sandbar shark	Bottom Longline	Atlantic	78	bat, bt, bs, sst, ssh, chla, btsd, sstsd	47.8	Random	0.88	0.68
						Spatial	0.84	0.58
						Temporal	0.95	0.88
Dusky shark	Bottom Longline	Atlantic	23	bat, bt, sss, ssh, chla, btsd, sstsd, set hour	34.0	Random	0.79	0.52
						Spatial	0.76	0.43
						Temporal	0.8	0.58
Scalloped hammerhead shark	Bottom Longline	Atlantic	29	bat, bt, sst, bs, ssh, chla, btsd, sstsd, bait, set hour	41.5	Random	0.77	0.47
						Spatial	0.76	0.41
						Temporal	0.74	0.41

The actual covariate names are as follows: *bat* bathymetry; *rug* rugosity; *sst* sea surface temperature; *chla* chlorophyll a; *ssh* sea surface height; *sss* sea surface salinity; *sstsd* sea surface temperature standard deviation; *bt* bottom temperature; *bs* bottom salinity; *btsd* bottom temperature standard deviation; *bait* type; *set hour* the set began

Table 3. Information about the observed occurrence rate of each bycatch species modeled for the pelagic longline in the Atlantic Region, as well as the best model covariates (with the exception of temporal covariates, e.g. year), deviance explained from the best model, and predictive performance metrics (e.g., area under the receiver operating curve [AUC] and true skill statistic [TSS]) from the three validation approaches for each species. Deviance explained is the amount of variation in the data that the model can account for, meaning the higher the value the better. AUC values range from 0 to 1 where a value of 0.5 indicates the prediction is no different than random, whereas a value closer to 1 indicates perfect model prediction. TSS ranges from -1 to 1, where a value of 0 means the model performed no better than random and a value of 1 indicates perfect model performance. This information supports the discussion of "Step 2" (Section 2.4).

Species	**Fishery**	**Region**	**Occurrence (% of sets)**	**Best model covariates**	**Deviance Explained (%)**	**Validation Approach**	**AUC**	**TSS**
Billfish group	Pelagic Longline	Atlantic	41	sst, ssh, chla, mld, vo, uo, sstsd, hook, bait, set hour	33.7	Random	0.85	0.56
						Spatial	0.81	0.52
						Temporal	0.79	0.46
Shortfin mako shark	Pelagic Longline	Atlantic	27	lunar, bat, rug, sst, ssh, chla, mld, vo, sstsd, bait, set hour	20.2	Random	0.8	0.48
						Spatial	0.73	0.36
						Temporal	0.77	0.45
Leatherback sea turtle	Pelagic Longline	Atlantic	6	bat, rug, sst, ssh, chla, mld, vo, uo, set hour	14.0	Random	0.77	0.44
						Spatial	0.71	0.33
						Temporal	0.67	0.41
Loggerhead sea turtle	Pelagic Longline	Atlantic	7	bat, rug, sst, ssh, chla, mld, vo, uo, bait, hook	12.2	Random	0.76	0.42
						Spatial	0.71	0.33
						Temporal	0.56	0.31
Bluefin tuna	Pelagic Longline	Atlantic	11	lun, bat, rug, sst, ssh, chla, vo, sstsd, bait, hook	22.1	Random	0.84	0.54
						Spatial	0.79	0.45
						Temporal	0.82	0.56

The actual covariate names are as follows: *lunar* illumination; *bat* bathymetry; *rug* rugosity; *sst* sea surface temperature; *chla* chlorophyll a; *ssh* sea surface height; *mld* mixed layer depth; *vo* vertical (northward) current velocity; *uo* horizontal (eastward) current velocity; *sstsd* sea surface temperature standard deviation; *bt* bottom temperature; *bs* bottom salinity; *btsd* bottom temperature standard deviation; *hook* configuration; *bait* bait type; *set hour* hour the set began. In addition, during variable and model selection we used a threshold of 0.6 or greater to indicate if two covariates were collinear. When two variables were collinear one was removed from the model.

Table 4. Information about the observed occurrence rate of each bycatch species modeled for the pelagic longline in the Gulf of Mexico Region, as well as the best model covariates (with the exception of temporal covariates, e.g. year), deviance explained from the best model, and predictive performance metrics (e.g., area under the receiver operating curve [AUC] and true skill statistic [TSS]) from the three validation approaches for each species. Deviance explained is the amount of variation in the data that the model can account for, meaning the higher the value the better. AUC values range from 0 to 1 where a value of 0.5 indicates the prediction is no different than random, whereas a value closer to 1 indicates perfect model prediction. TSS ranges from -1 to 1, where a value of 0 means the model performed no better than random and a value of 1 indicates perfect model performance.

Species	**Fishery**	**Region**	**Occurrence (% of sets)**	**Best model covariates**	**Deviance Explained (%)**	**Validation Approach**	**AUC**	**TSS**
Billfish group	Pelagic Longline	GOM	44	lun, bat, rug, sst, ssh, chla, sstsd, bait, hook, hook depth, set hour	20.6	Random	0.78	0.44
						Spatial	0.78	0.43
						Temporal	0.73	0.43
Shortfin mako shark	Pelagic Longline	GOM	9	lunar, bat, rug, sst, ssh, ssh, chla, sstsd, bait, hook	15.3	Random	0.72	0.38
						Spatial	0.71	0.35
						Temporal	0.67	0.31
Leatherback sea turtle	Pelagic Longline	GOM	5	lun, bat, rug, sst, ssh, chla, sstsd, hook, set hour	8.7	Random	0.7	0.33
						Spatial	0.69	0.3
						Temporal	0.66	0.46
Bluefin tuna	Pelagic Longline	GOM	14	lun, bat, rug, sst, ssh, chla, sstsd, bait, hook depth, set hour	23.6	Random	0.83	0.54
						Spatial	0.82	0.51
						Temporal	0.8	0.57

The actual covariate names are as follows: *lunar* lunar illumination; *bat* bathymetry; *rug* rugosity; *sst* sea surface temperature; *chla* chlorophyll a; *ssh* sea surface height; *sstsd* sea surface temperature standard deviation; *hook* hook configuration; *bait* bait type; *set hour* hour the set began; *hook depth* maximum hook depth.

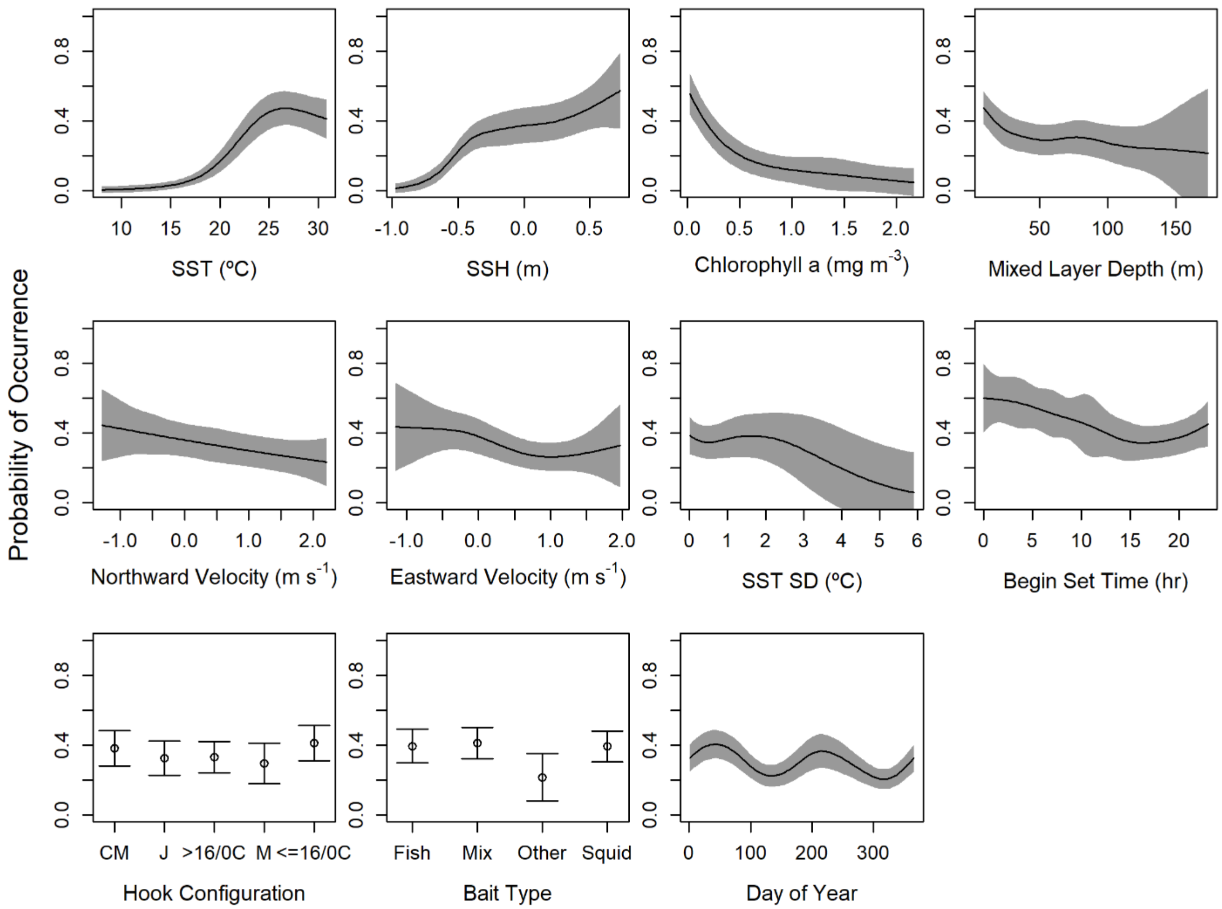


Figure 27. Marginal mean predictions of probability of occurrence (relationships between species and variables) for the billfish species group in the Atlantic region pelagic longline at each covariate in the best model. The black line shows the actual marginal means for each covariate, while the grey area (and error bars for Hook Configuration and Bait Type) represents the 95% confidence intervals generated through bootstrapping. Hook configurations abbreviations are circle hook mixed (CM), J hook (J), larger than 16/0 circle hook (> 16/0C), mixed of circle and J hooks (M), and smaller than or equal to 16/0 circle hook (< = 16/0C). Abbreviated covariates are SST—sea surface temperature; SST SD—sea surface standard deviation; SSH—sea surface height.

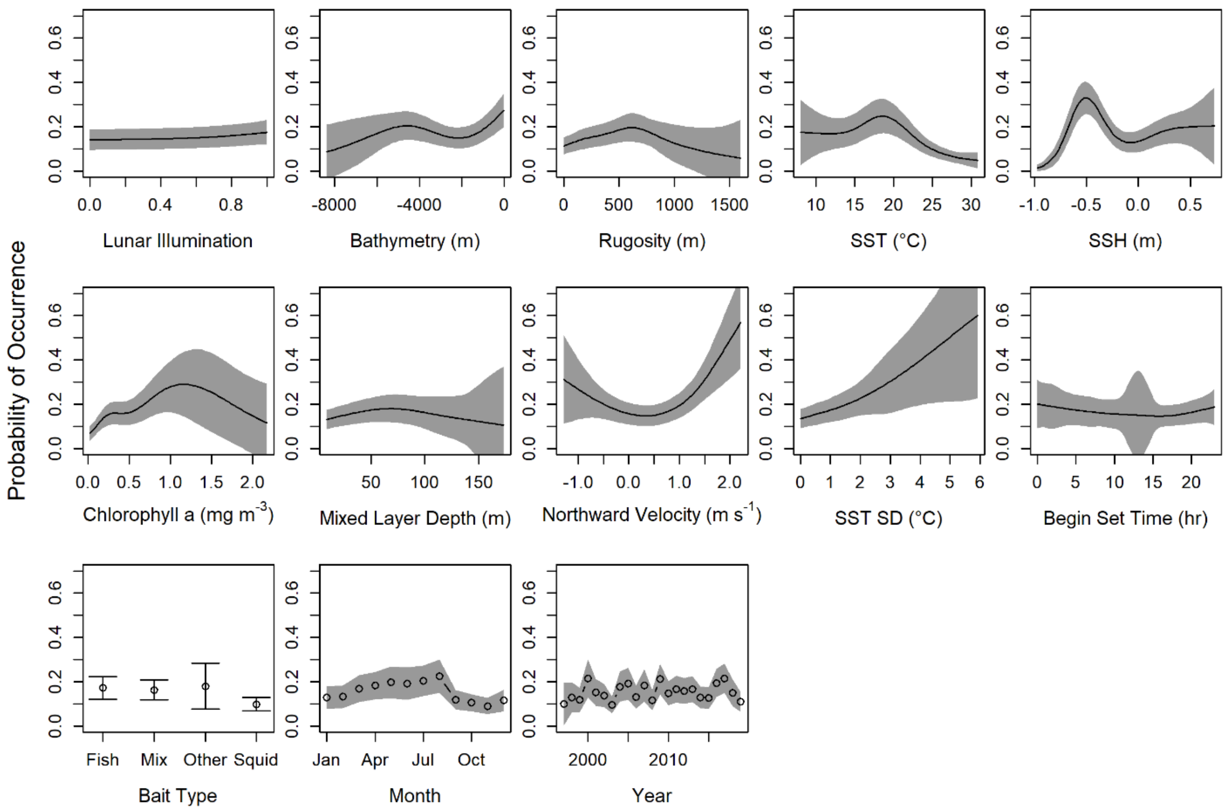


Figure 28. Marginal mean predictions of probability of occurrence (relationships between species and variables) for the shortfin mako shark in the Atlantic region pelagic longline at each covariate in the best model. The black line shows the actual marginal means for each covariate, while the grey area (and error bars for Hook Configuration and Bait Type) represents the 95% confidence intervals generated through bootstrapping. Hook configurations abbreviations are circle hook mixed (CM), J hook (J), larger than 16/0 circle hook (> 16/0C), mixed of circle and J hooks (M), and smaller than or equal to 16/0 circle hook (< = 16/0C). Abbreviated covariates are SST—sea surface temperature; SST SD—sea surface standard deviation; SSH—sea surface height.

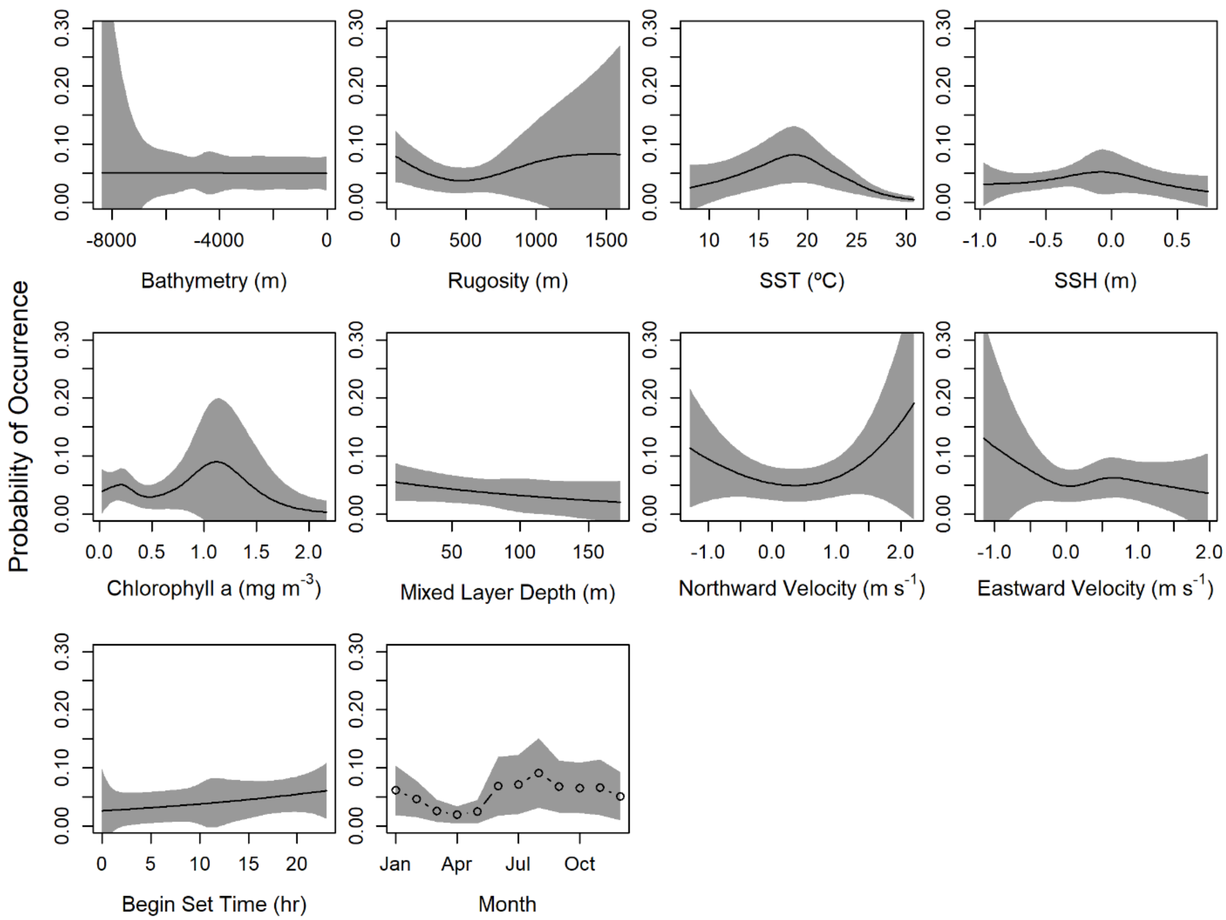


Figure 29. Marginal mean predictions of probability of occurrence (relationships between species and variables) for the leatherback sea turtle in the Atlantic region pelagic longline at each covariate in the best model. The black line shows the actual marginal means for each covariate, while the grey area (and error bars for Hook Configuration and Bait Type) represents the 95% confidence intervals generated through bootstrapping. Hook configurations abbreviations are circle hook mixed (CM), J hook (J), larger than 16/0 circle hook (> 16/0C), mixed of circle and J hooks (M), and smaller than or equal to 16/0 circle hook (< = 16/0C). Abbreviated covariates are SST—sea surface temperature; SST SD—sea surface standard deviation; SSH—sea surface height.

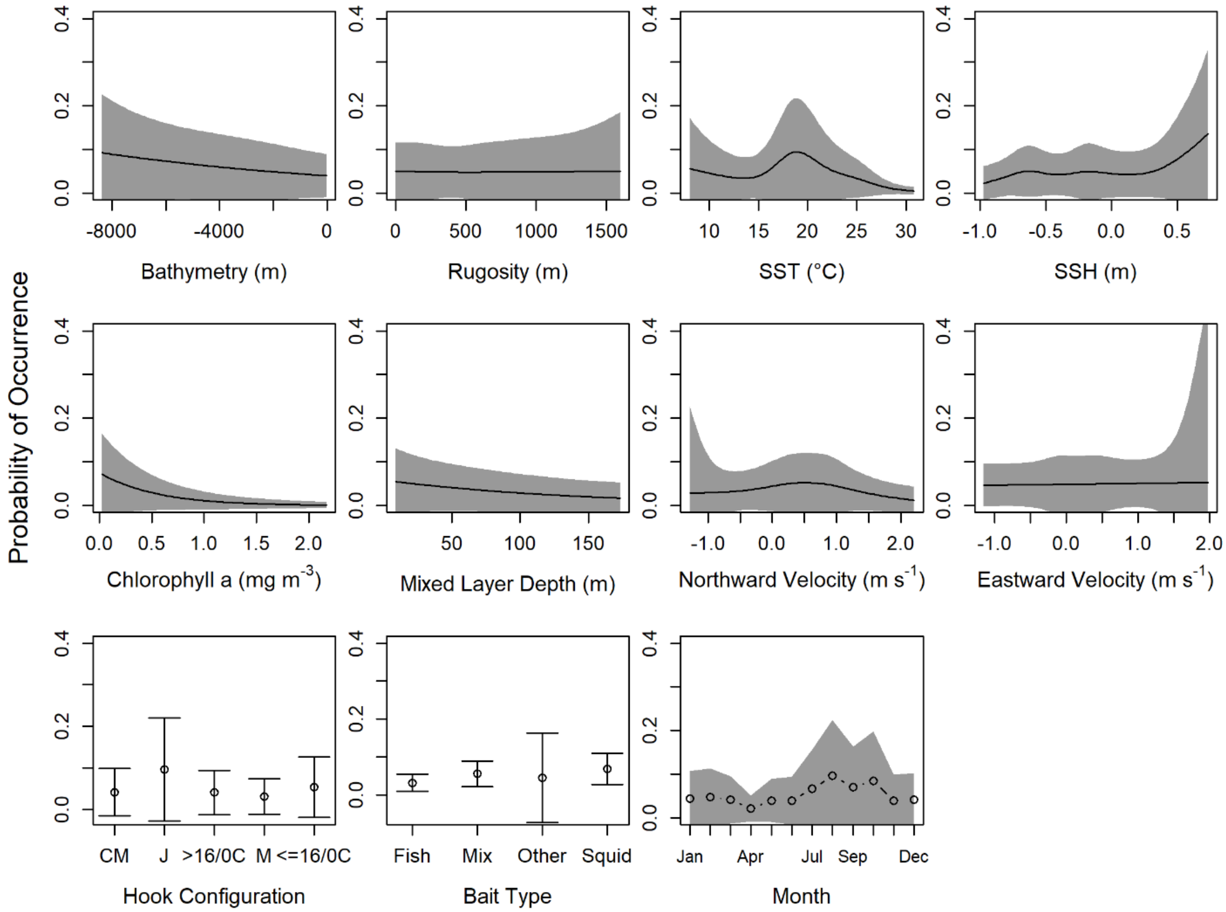


Figure 30. Marginal mean predictions of probability of occurrence (relationships between species and variables) for the loggerhead sea turtle in the Atlantic region pelagic longline at each covariate in the best model. The black line shows the actual marginal means for each covariate, while the grey area (and error bars for Hook Configuration and Bait Type) represents the 95% confidence intervals generated through bootstrapping. Hook configurations abbreviations are circle hook mixed (CM), J hook (J), larger than 16/0 circle hook (> 16/0C), mixed of circle and J hooks (M), and smaller than or equal to 16/0 circle hook (< = 16/0C). Abbreviated covariates are SST—sea surface temperature; SST SD—sea surface standard deviation; SSH—sea surface height.

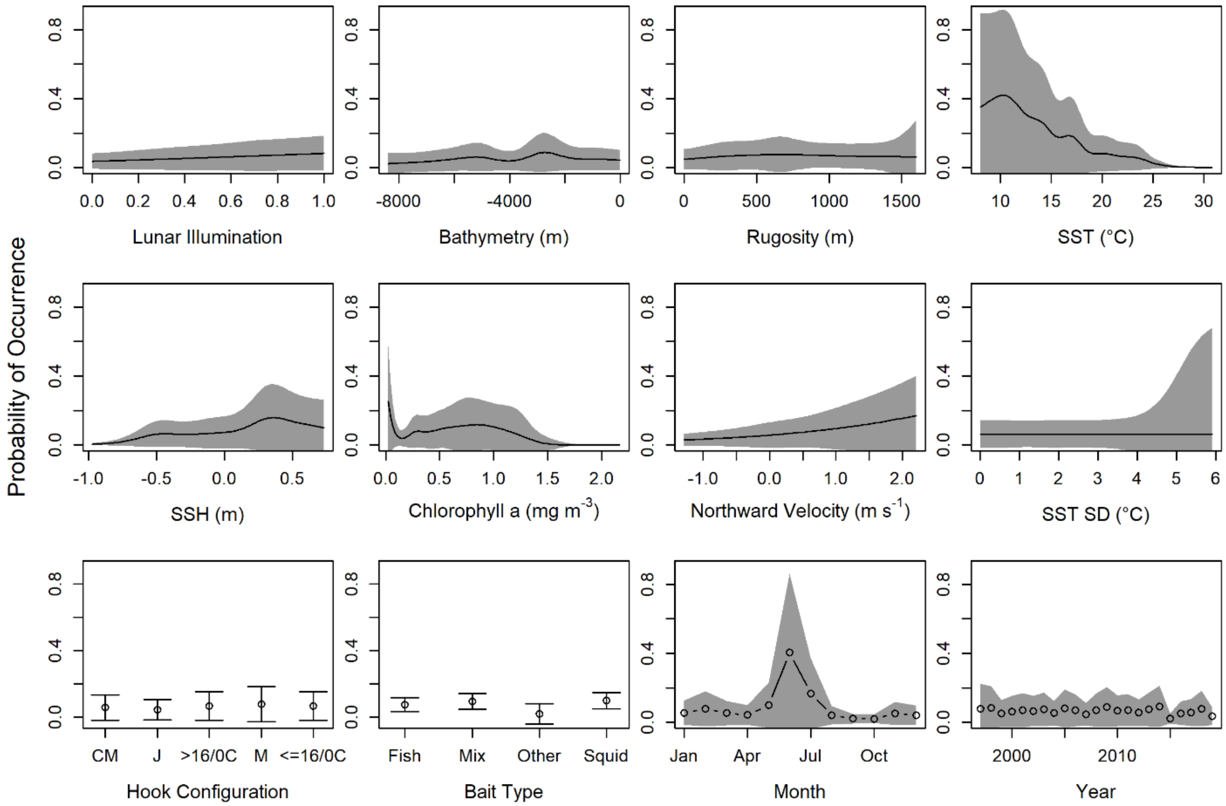


Figure 31. Marginal mean predictions of probability of occurrence (relationships between species and variables) for bluefin tuna in the Atlantic region pelagic longline at each covariate in the best model. The black line shows the actual marginal means for each covariate, while the grey area (and error bars for Hook Configuration and Bait Type) represents the 95% confidence intervals generated through bootstrapping. Hook configurations abbreviations are circle hook mixed (CM), J hook (J), larger than 16/0 circle hook (> 16/0C), mixed of circle and J hooks (M), and smaller than or equal to 16/0 circle hook (< = 16/0C). Abbreviated covariates are SST—sea surface temperature; SST SD—sea surface standard deviation; SSH—sea surface height.

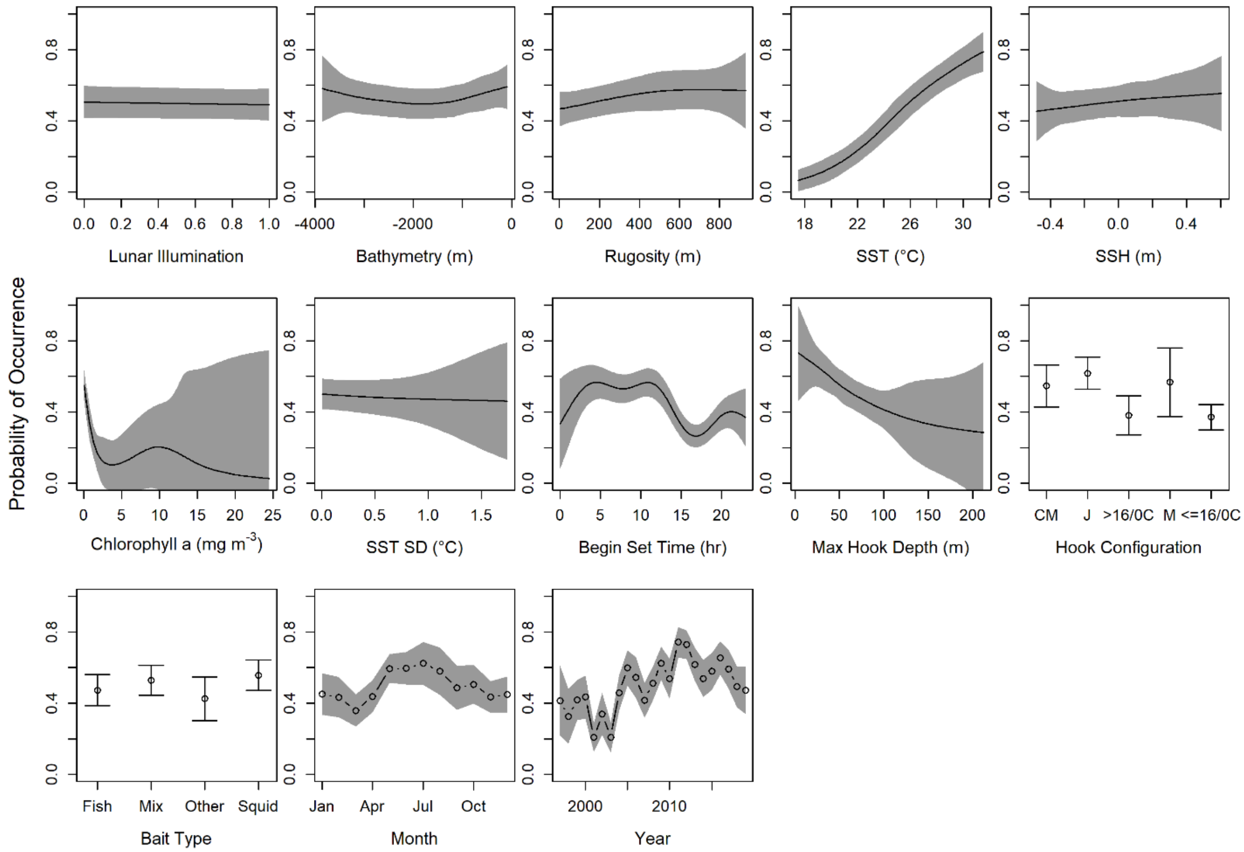


Figure 32. Marginal mean predictions of probability of occurrence (relationships between species and variables) for the billfish species group in the Gulf of Mexico region pelagic longline at each covariate in the best model. The black line shows the actual marginal means for each covariate, while the grey area (and error bars for Hook Configuration and Bait Type) represents the 95% confidence intervals generated through bootstrapping. Hook configurations abbreviations are circle hook mixed (CM), J hook (J), larger than 16/0 circle hook (> 16/0C), mixed of circle and J hooks (M), and smaller than or equal to 16/0 circle hook (< = 16/0C). Abbreviated covariates are SST—sea surface temperature; SST SD—sea surface standard deviation; SSH—sea surface height.

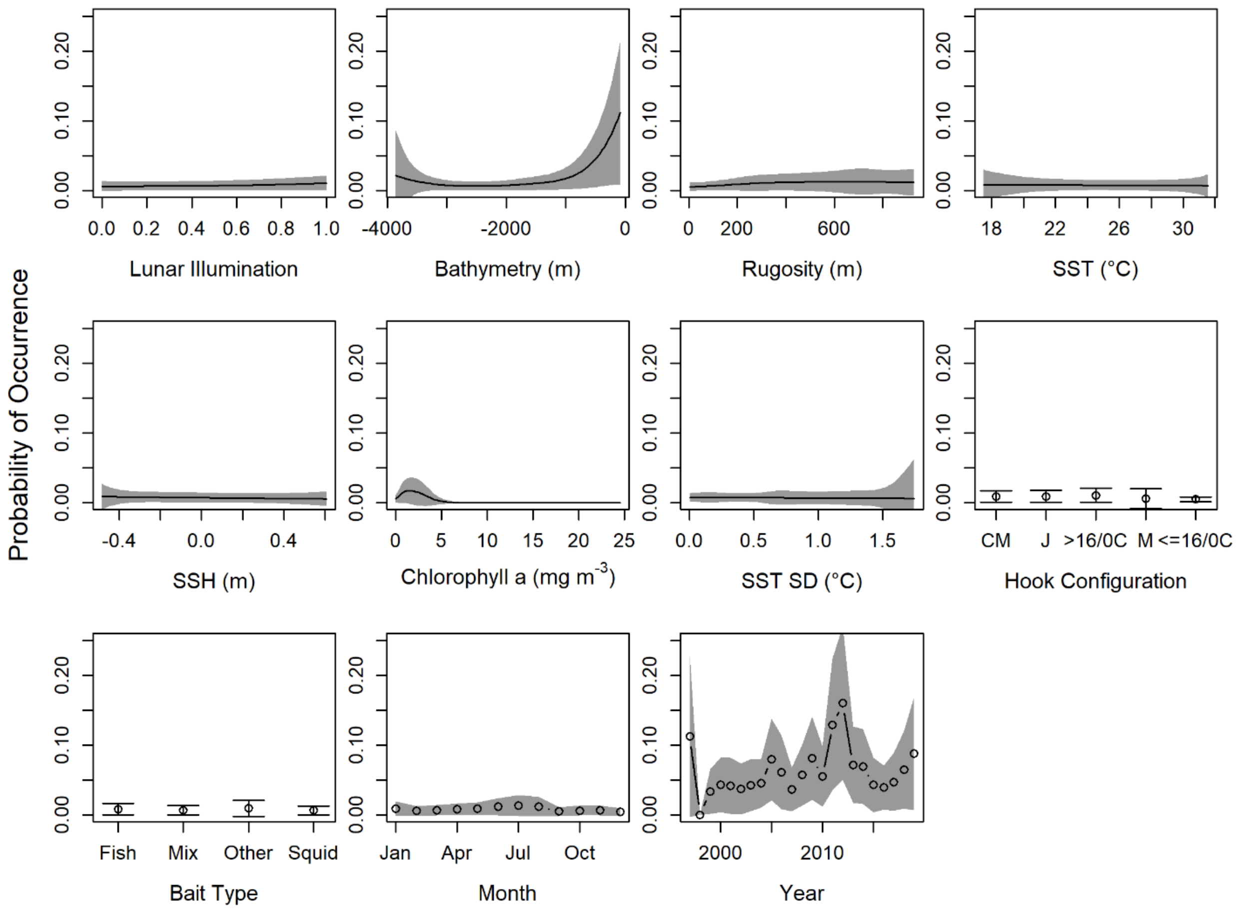


Figure 33. Marginal mean predictions of probability of occurrence (relationships between species and variables) for the shortfin mako shark in the Gulf of Mexico region pelagic longline at each covariate in the best model. The black line shows the actual marginal means for each covariate, while the grey area (and error bars for Hook Configuration and Bait Type) represents the 95% confidence intervals generated through bootstrapping. Hook configurations abbreviations are circle hook mixed (CM), J hook (J), larger than 16/0 circle hook (> 16/0C), mixed of circle and J hooks (M), and smaller than or equal to 16/0 circle hook (< = 16/0C). Abbreviated covariates are SST—sea surface temperature; SST SD—sea surface standard deviation; SSH—sea surface height.

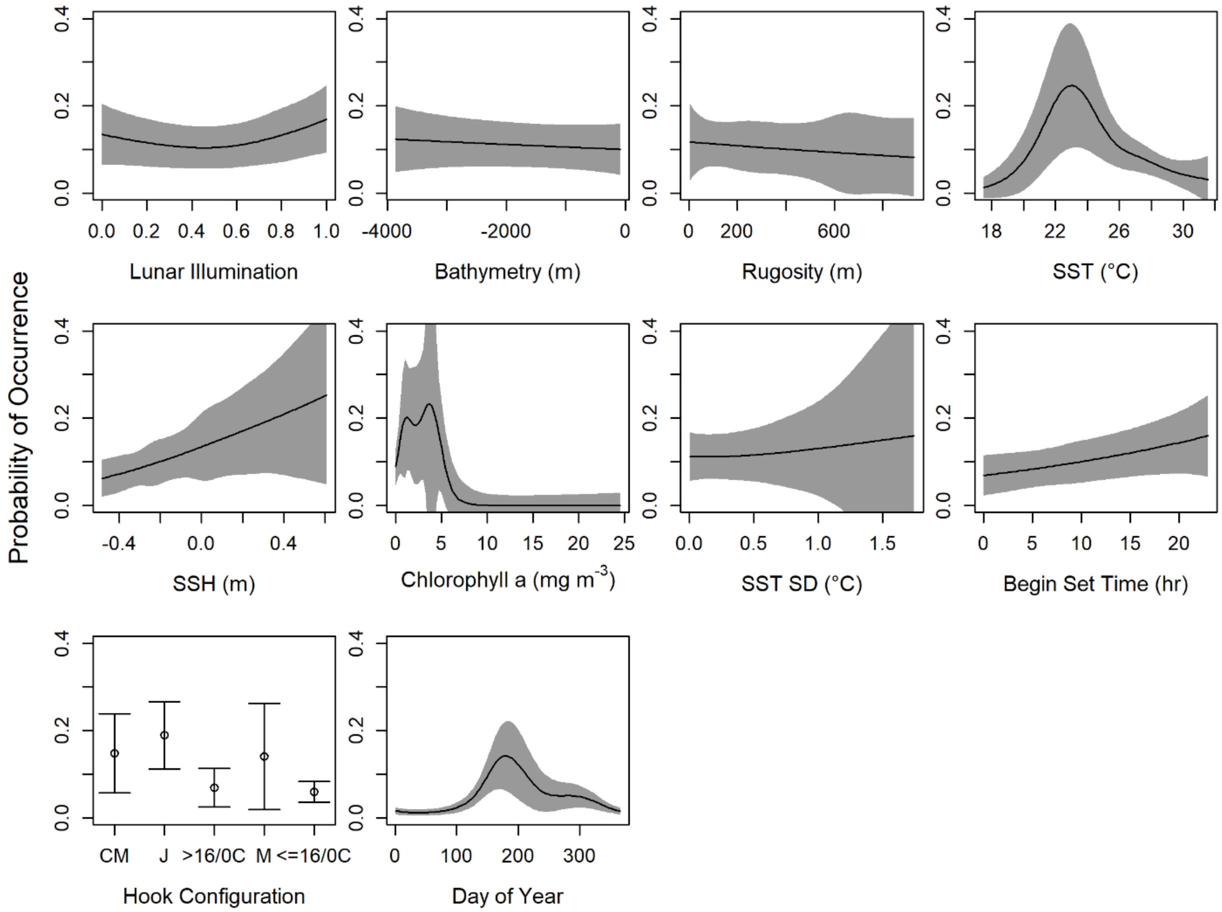


Figure 34. Marginal mean predictions of probability of occurrence for (relationships between species and variables) the leatherback sea turtle in the Gulf of Mexico region pelagic longline at each covariate in the best model. The black line shows the actual marginal means for each covariate, while the grey area (and error bars for Hook Configuration and Bait Type) represents the 95% confidence intervals generated through bootstrapping. Hook configurations abbreviations are circle hook mixed (CM), J hook (J), larger than 16/0 circle hook (> 16/0C), mixed of circle and J hooks (M), and smaller than or equal to 16/0 circle hook (< = 16/0C). Abbreviated covariates are SST—sea surface temperature; SST SD—sea surface standard deviation; SSH—sea surface height.

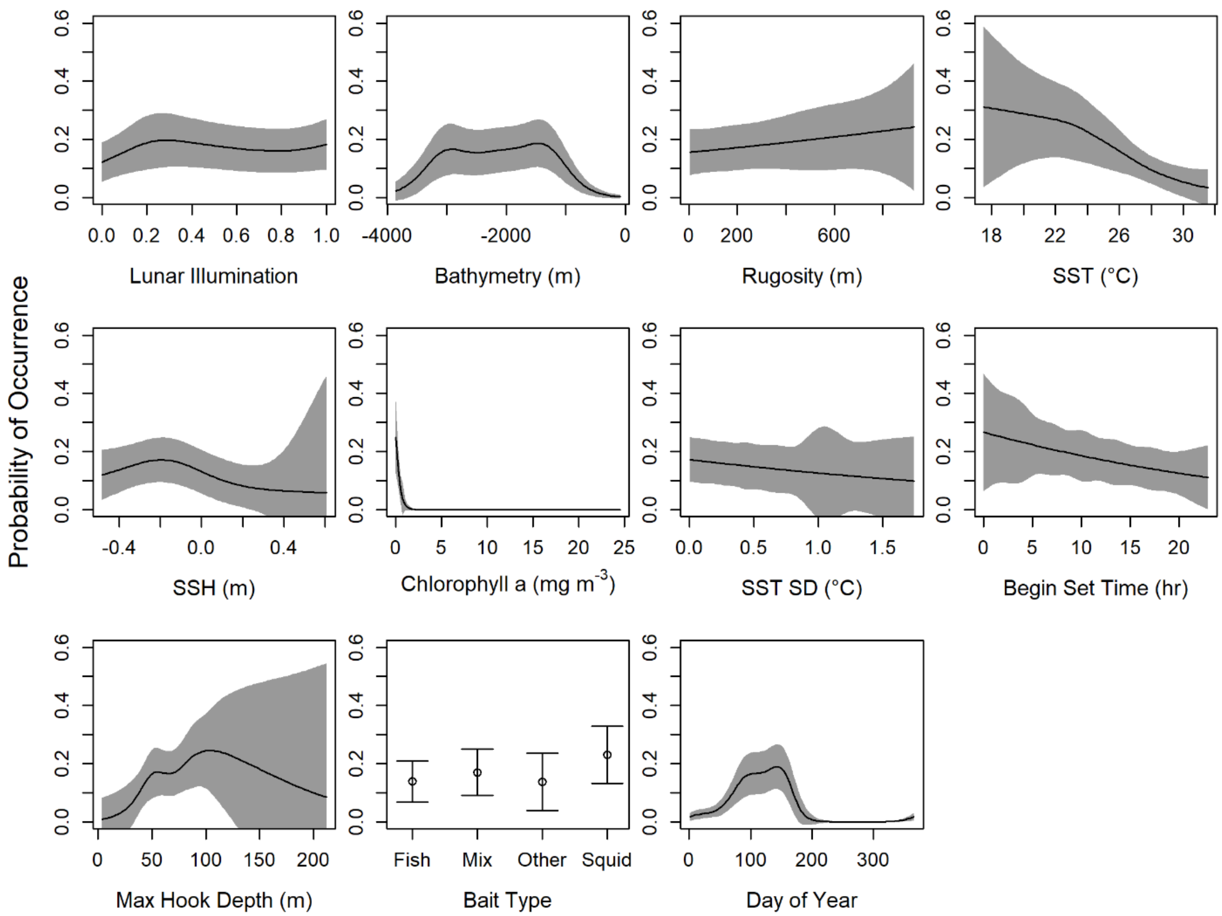


Figure 35. Marginal mean predictions of probability of occurrence (relationships between species and variables) for bluefin tuna in the Gulf of Mexico region pelagic longline at each covariate in the best model. The black line shows the actual marginal means for each covariate, while the grey area (and error bars for Hook Configuration and Bait Type) represents the 95% confidence intervals generated through bootstrapping. Hook configurations abbreviations are circle hook mixed (CM), J hook (J), larger than 16/0 circle hook (> 16/0C), mixed of circle and J hooks (M), and smaller than or equal to 16/0 circle hook (< = 16/0C). Abbreviated covariates are SST—sea surface temperature; SST SD—sea surface standard deviation; SSH—sea surface height.

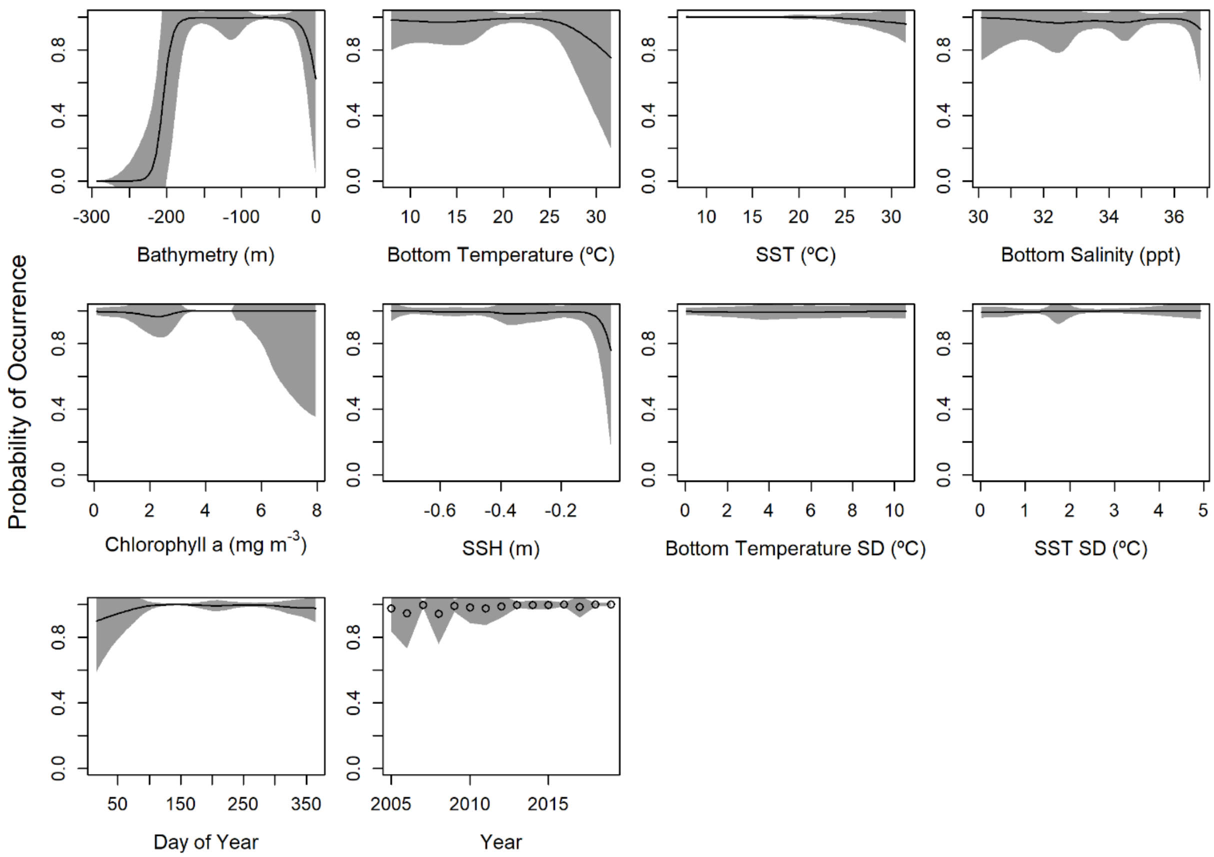


Figure 36. Marginal mean predictions of probability of occurrence (relationships between species and variables) for the sandbar shark in the Atlantic region shark bottom longline at each covariate in the best model. The black line shows the actual marginal means for each covariate, while the grey area represents the 95% confidence intervals generated through bootstrapping. Abbreviated covariates are SST—sea surface temperature; SST SD—sea surface standard deviation; SSH—sea surface height; Bottom Temperature SD—bottom temperature standard deviation.

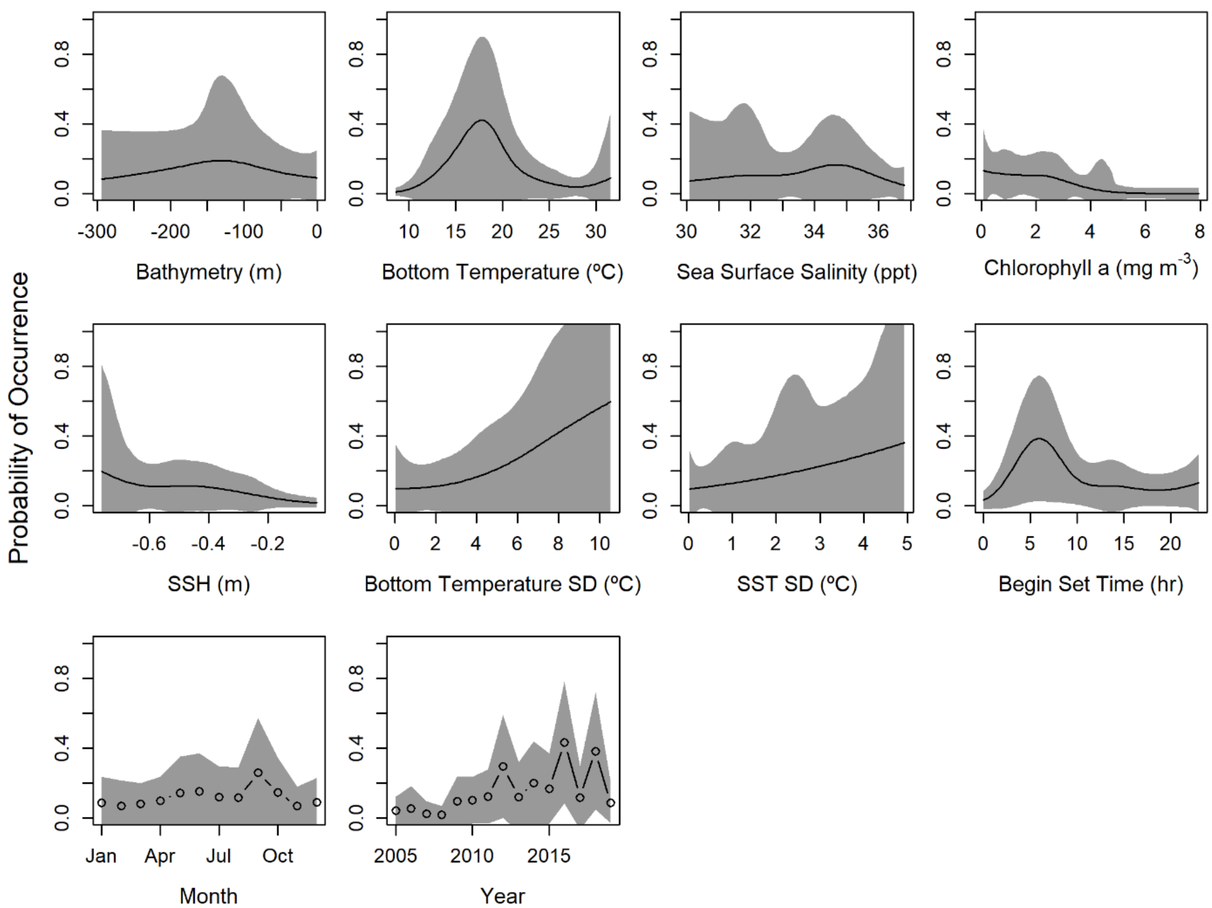


Figure 37. Marginal mean predictions of probability of occurrence (relationships between species and variables) for the dusky shark in the Atlantic region shark bottom longline at each covariate in the best model. The black line shows the actual marginal means for each covariate, while the grey area represents the 95% confidence intervals generated through bootstrapping. Abbreviated covariates are SST—sea surface temperature; SST SD—sea surface standard deviation; SSH—sea surface height; Bottom Temperature SD—bottom temperature standard deviation.

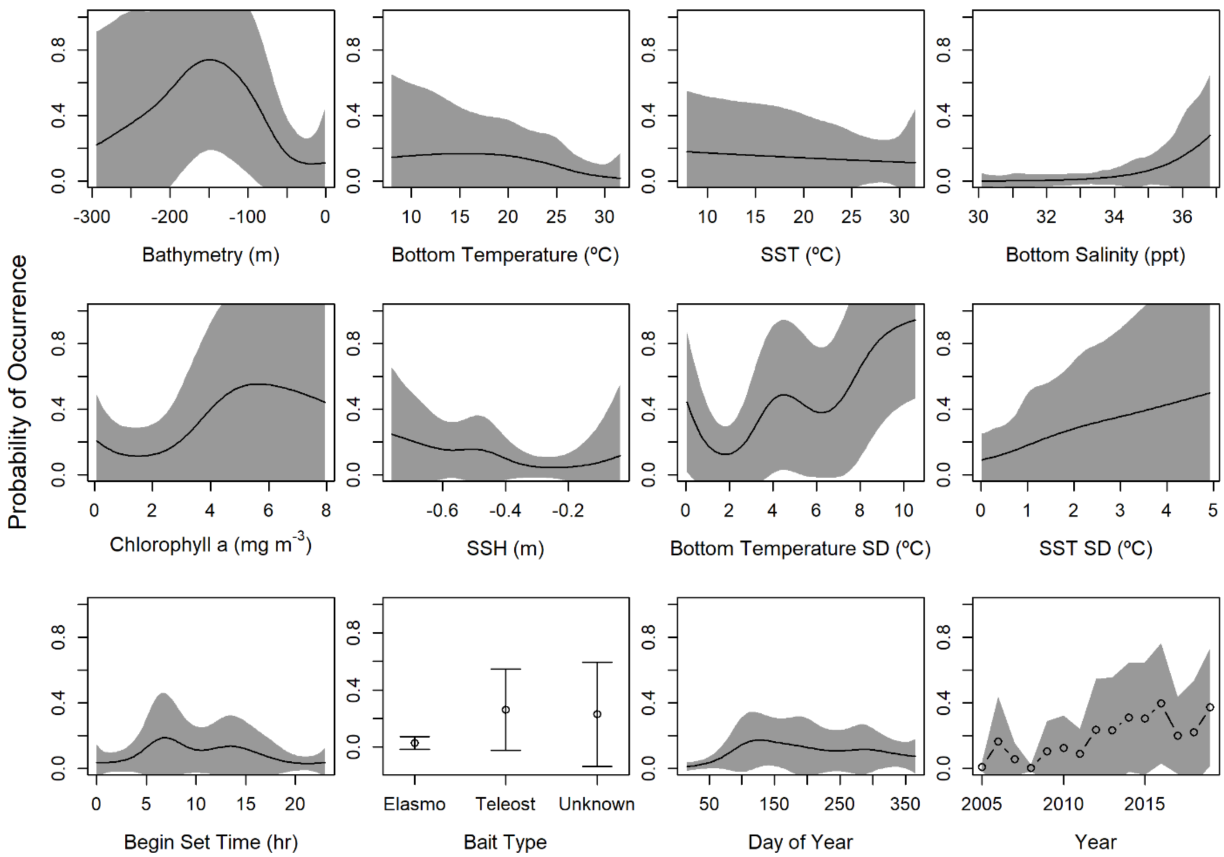


Figure 38. Marginal mean predictions of probability of occurrence (relationships between species and variables) for the scalloped hammerhead shark in the Atlantic region shark bottom longline at each covariate in the best model. The black line shows the actual marginal means for each covariate, while the grey area represents the 95% confidence intervals generated through bootstrapping. Abbreviated covariates are SST—sea surface temperature; SST SD—sea surface standard deviation; SSH—sea surface height; Bottom Temperature SD—bottom temperature standard deviation.

APPENDIX 3. INTERACTION PROBABILITY MAPS

This appendix provides maps showing interaction probability maps for the bottom longline fishery in the Atlantic and pelagic longline fishery in the Atlantic and Gulf of Mexico regions. Areas on the map that are yellow and orange indicate high interaction probability while areas in dark purple indicate low interaction probability. For the bottom longline in the Atlantic region, monthly interaction probability maps were generated for dusky shark, sandbar shark, and scalloped hammerhead shark (1st subsection). For the pelagic longline in the Atlantic region, similar maps were generated for leatherback sea turtle, shortfin mako shark, the billfish species group, loggerhead sea turtle, and bluefin tuna (2nd subsection). For the pelagic longline in the Gulf of Mexico region maps were developed for leatherback sea turtle, shortfin mako shark, the billfish species group, and bluefin tuna (3rd subsection). As detailed in “Step 1” (Section 2.3), all species interaction probabilities except bluefin tuna were formally incorporated into the high-bycatch-risk area maps (Appendix 4) and the metric and modification scoring (Appendix 5). Bluefin tuna interaction probabilities were simply used as a consideration when designing modification options. This information supports the discussion of “Step 3” (Section 2.5).

BOTTOM LONGLINE - ATLANTIC REGION

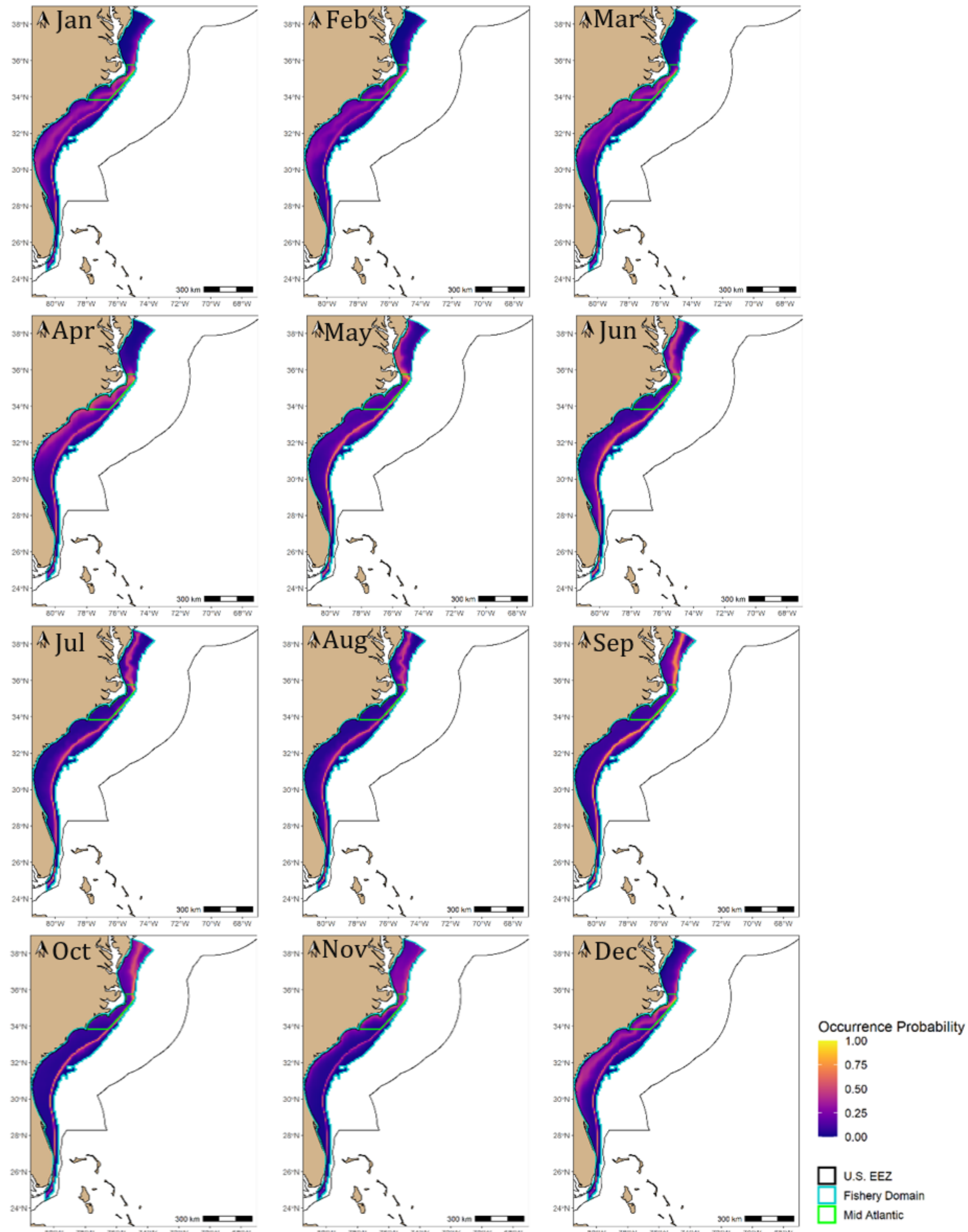


Figure 39. Estimated dusky shark fishery interaction distribution outputs (occurrence probabilities) during average conditions each month from 2017 through 2019 within the bottom longline fishery domain (light blue) in the Atlantic region. The area in green is the Mid-Atlantic shark closed area.

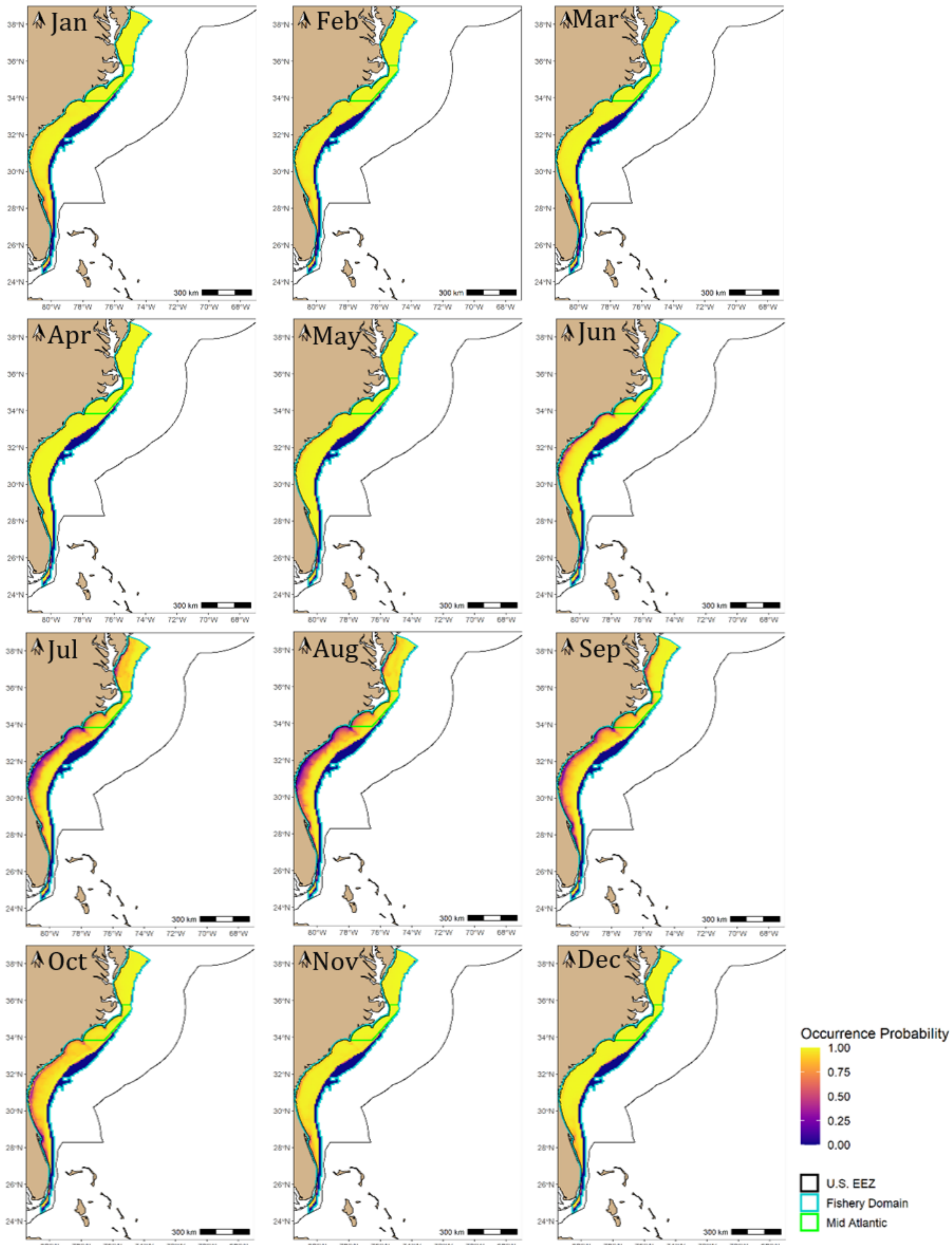


Figure 40. Estimated sandbar shark fishery interaction distribution outputs (occurrence probabilities) during average conditions each month from 2017 through 2019 within the bottom longline fishery domain (light blue) in the Atlantic region. The area in green is the Mid-Atlantic shark closed area.

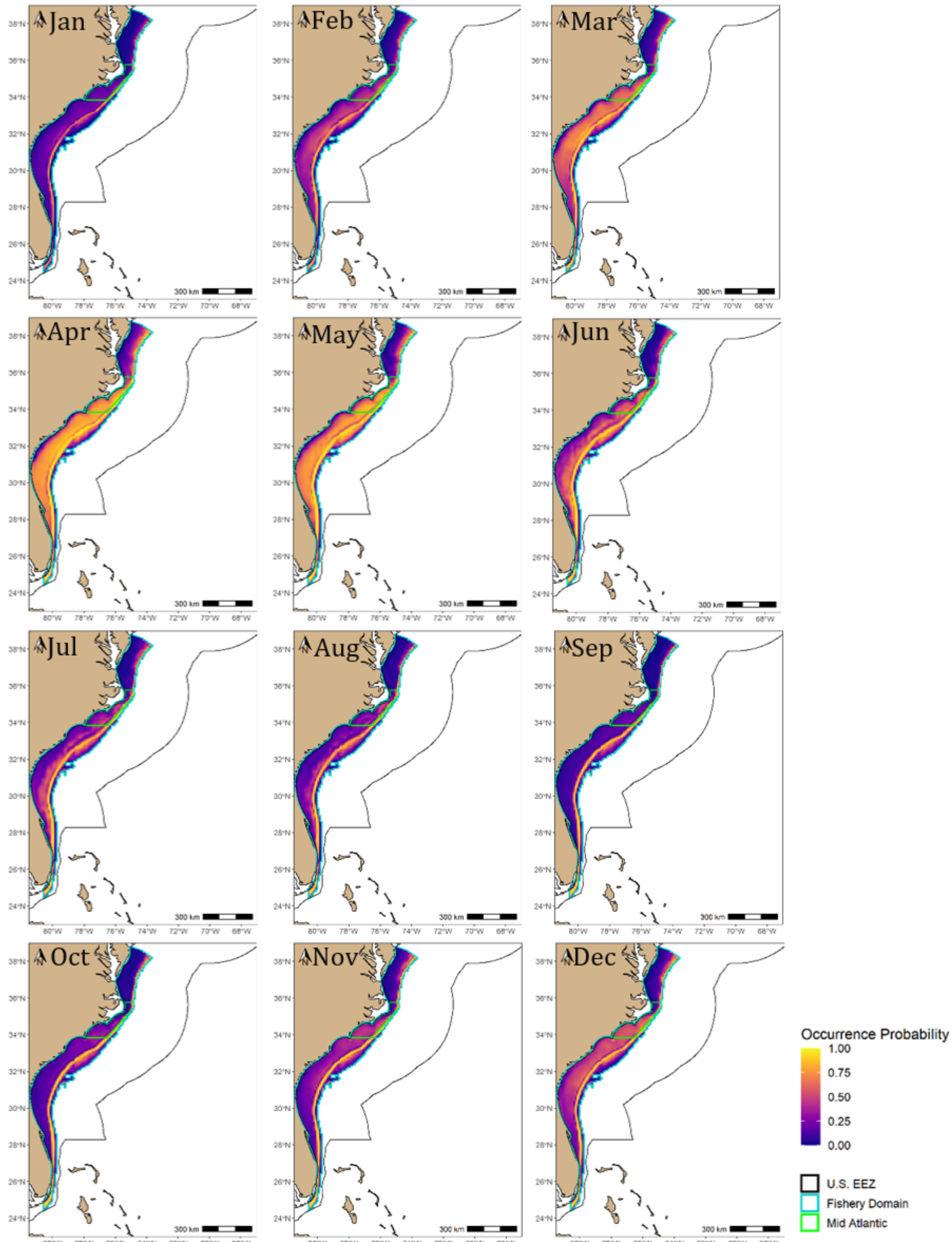


Figure 41. Estimated scalloped hammerhead shark fishery interaction distribution outputs (occurrence probabilities) during average conditions each month from 2017 through 2019 within the bottom longline fishery domain (light blue) in the Atlantic region. The area in green is the Mid-Atlantic shark closed area.

PELAGIC LONGLINE - ATLANTIC REGION

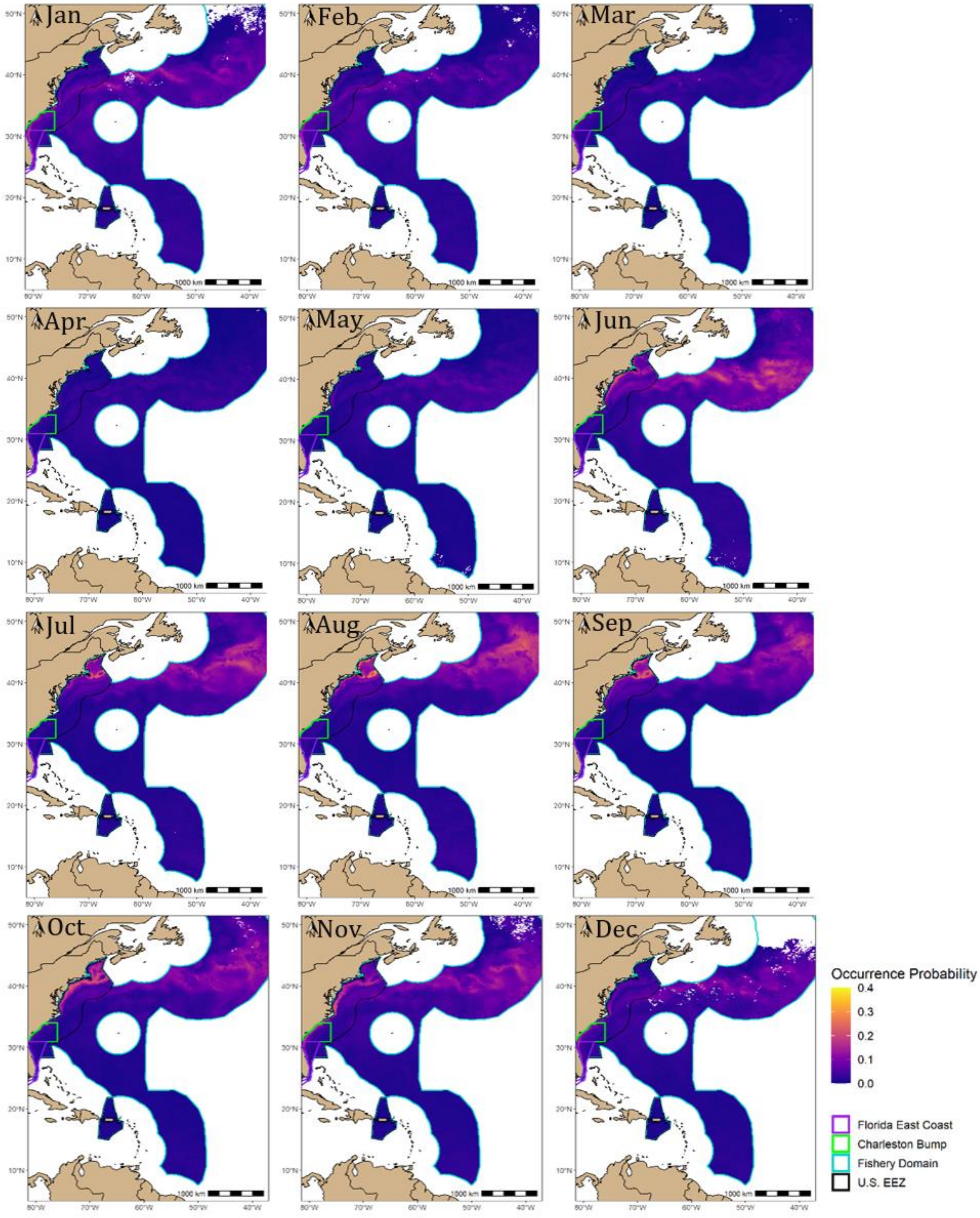


Figure 42. Estimated leatherback sea turtle fishery interaction distribution outputs (occurrence probabilities) during average conditions each month from 2017 through 2019 within the pelagic longline fishery domain (light blue) in the Atlantic region. The area in green is the Charleston Bump Closed Area, while the area in purple is the East Florida Coast Closed Area.

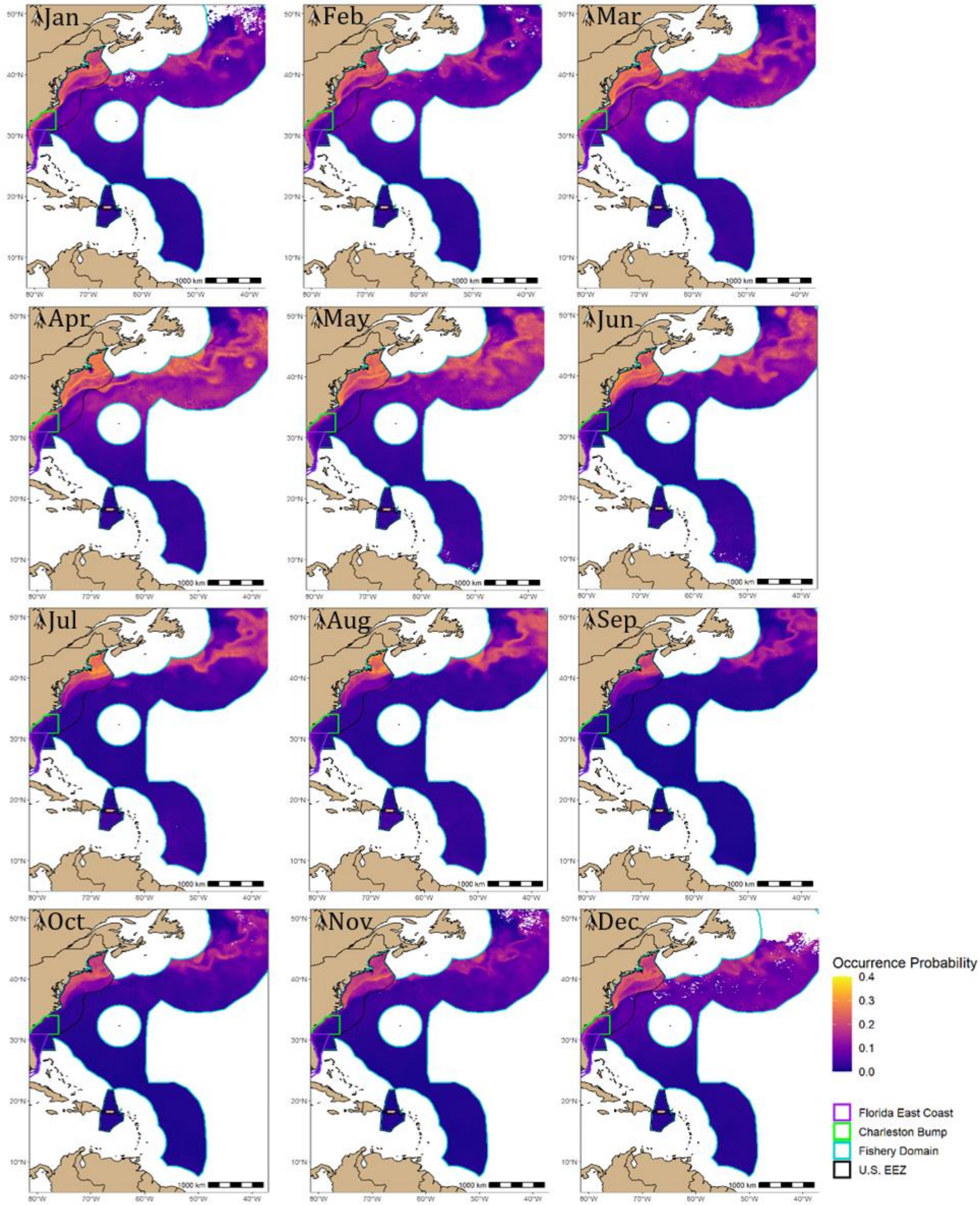


Figure 43. Estimated shortfin mako shark fishery interaction distribution outputs (occurrence probabilities) during average conditions each month from 2017 through 2019 within the pelagic longline fishery domain (light blue) in the Atlantic region. The area in green is the Charleston Bump Closed Area, while the area in purple is the East Florida Coast Closed Area.

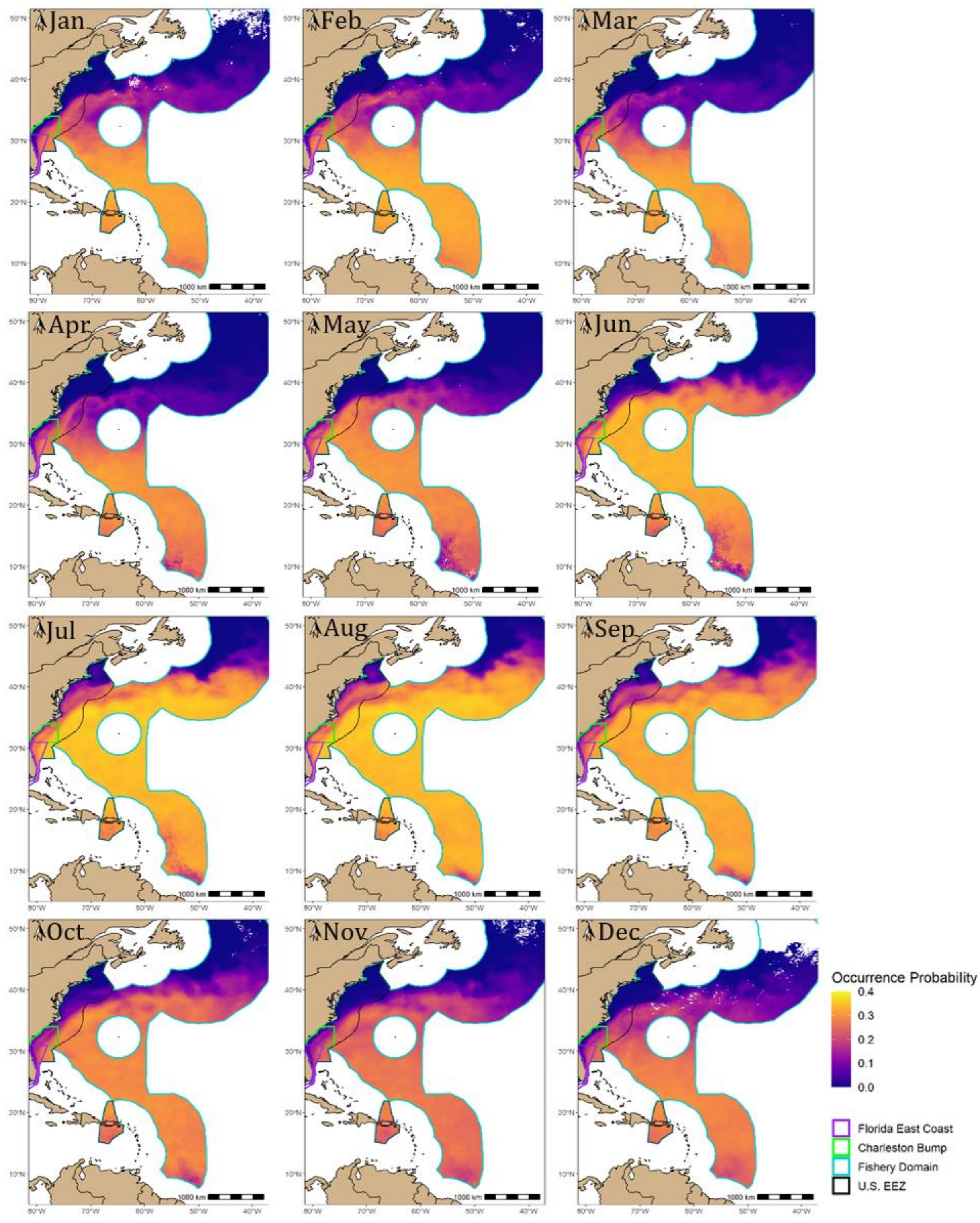


Figure 44. Estimated billfish species fishery interaction distribution outputs (occurrence probabilities) during average conditions each month from 2017 through 2019 within the pelagic longline fishery domain (light blue) in the Atlantic region. The area in green is the Charleston Bump Closed Area, while the area in purple is the East Florida Coast Closed Area.

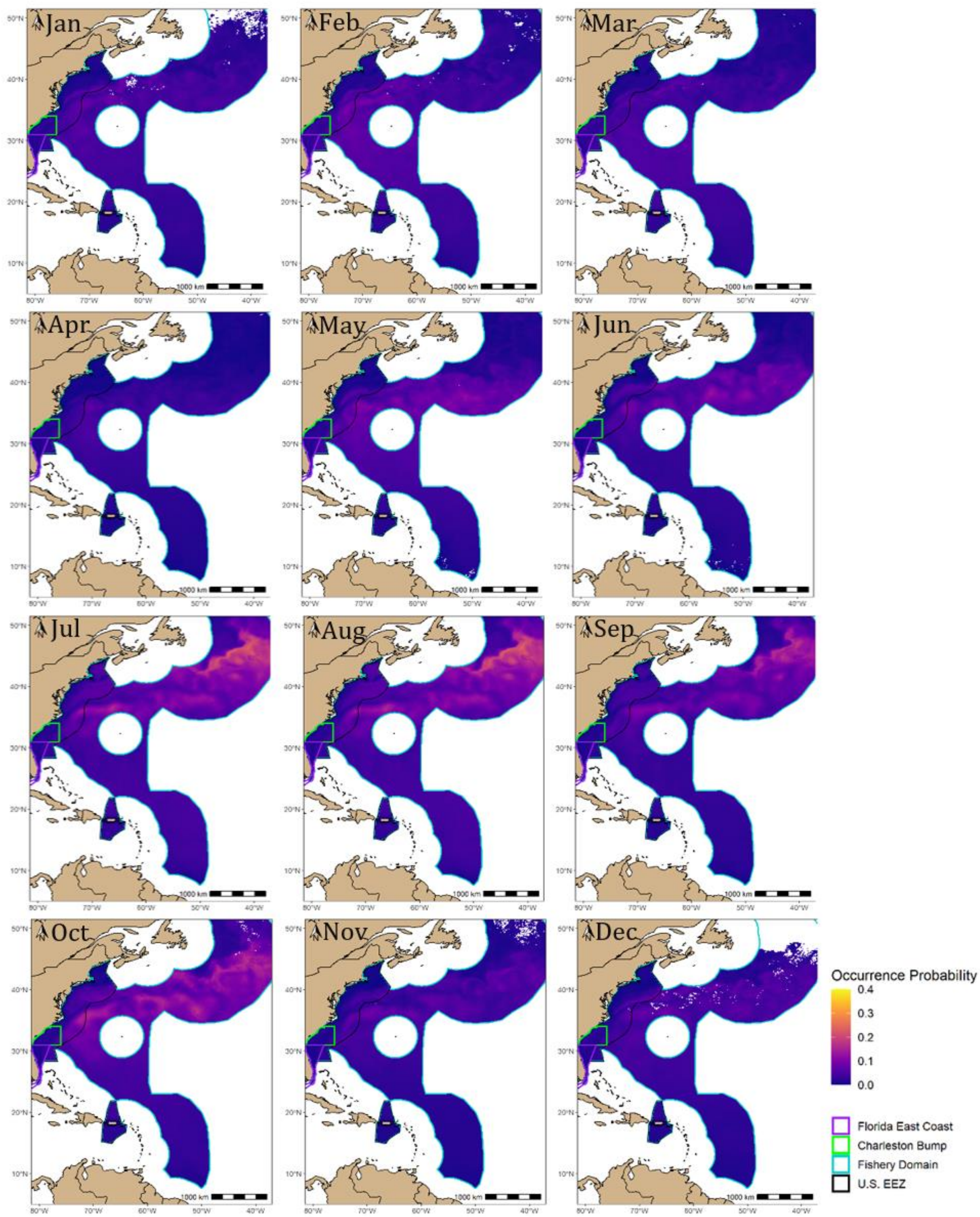


Figure 45. Estimated loggerhead sea turtle fishery interaction distribution outputs (occurrence probabilities) during average conditions each month from 2017 through 2019 within the pelagic longline fishery domain (light blue) in the Atlantic region. The area in green is the Charleston Bump Closed Area, while the area in purple is the East Florida Coast Closed Area.

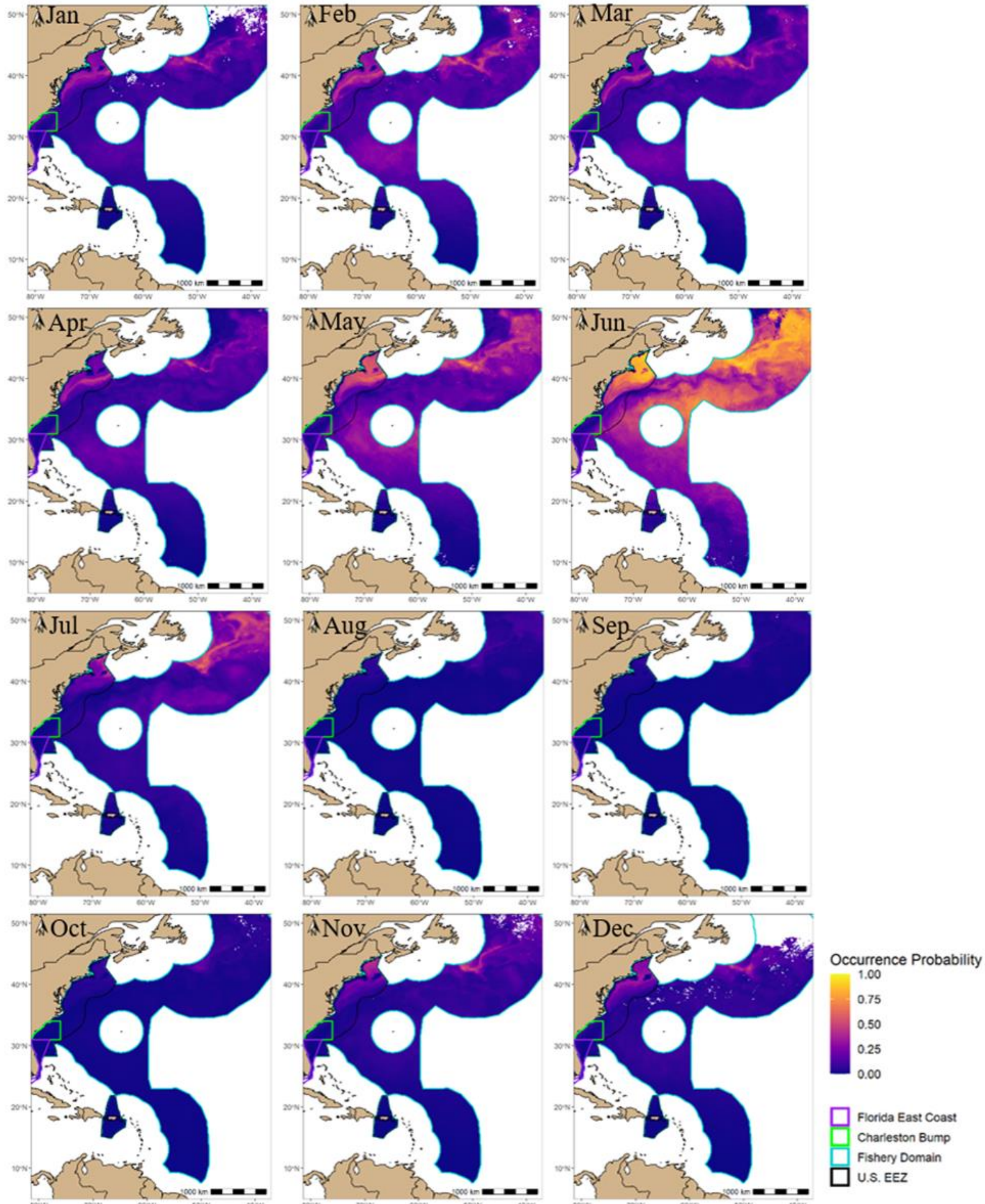


Figure 46. Estimated bluefin tuna fishery interaction distribution outputs (occurrence probabilities) during average conditions each month from 2017 through 2019 within the pelagic longline fishery domain (light blue) in the Atlantic region. The area in green is the Charleston Bump Closed Area, while the area in purple is the East Florida Coast Closed Area.

Pelagic Longline - Gulf of Mexico

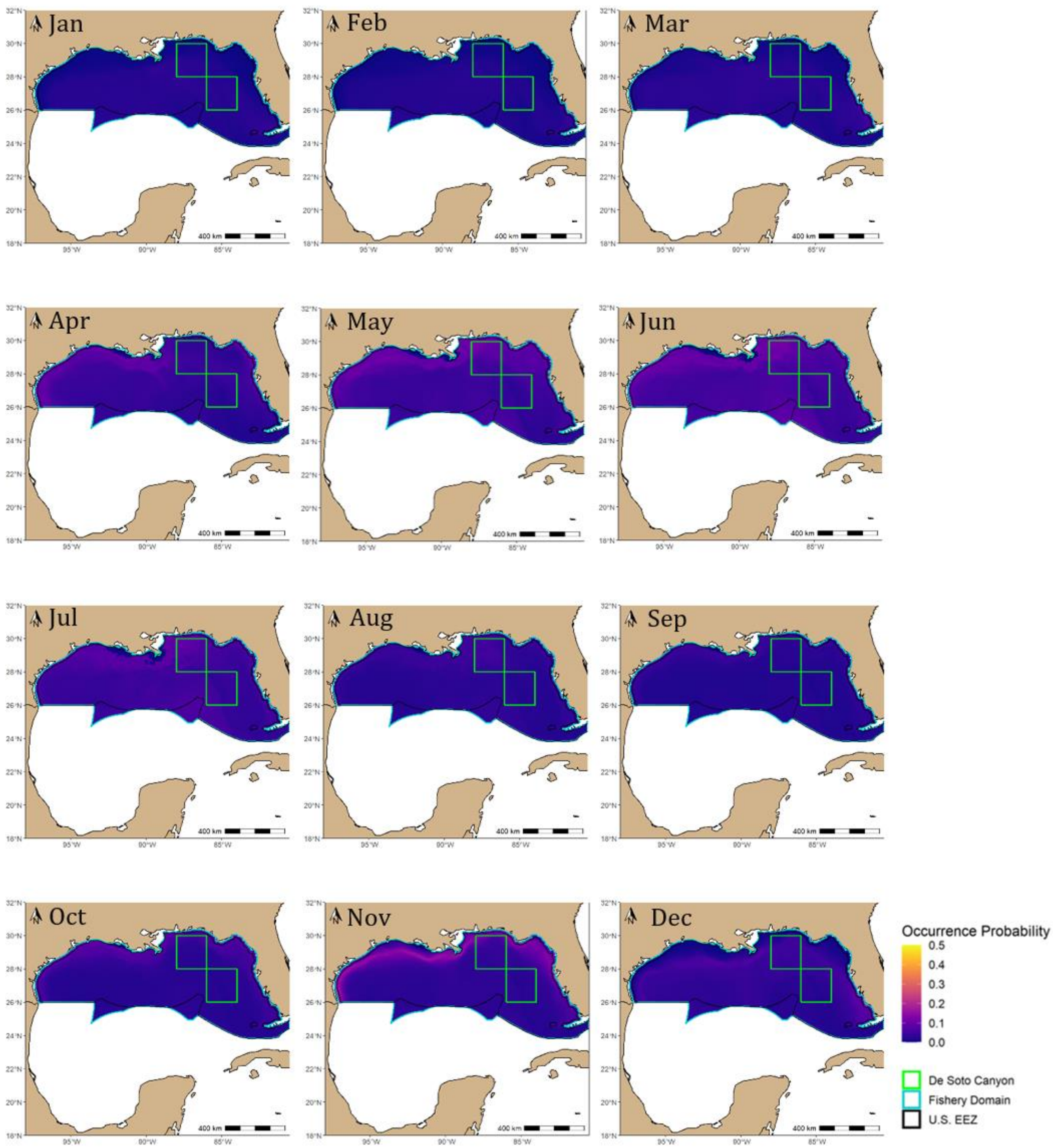


Figure 47. Estimated leatherback sea turtle fishery interaction distribution outputs (occurrence probabilities) during average conditions each month from 2017 through 2019 within the pelagic longline fishery domain (light blue) in the Atlantic region. The area in green is the DeSoto Canyon Closed Area.

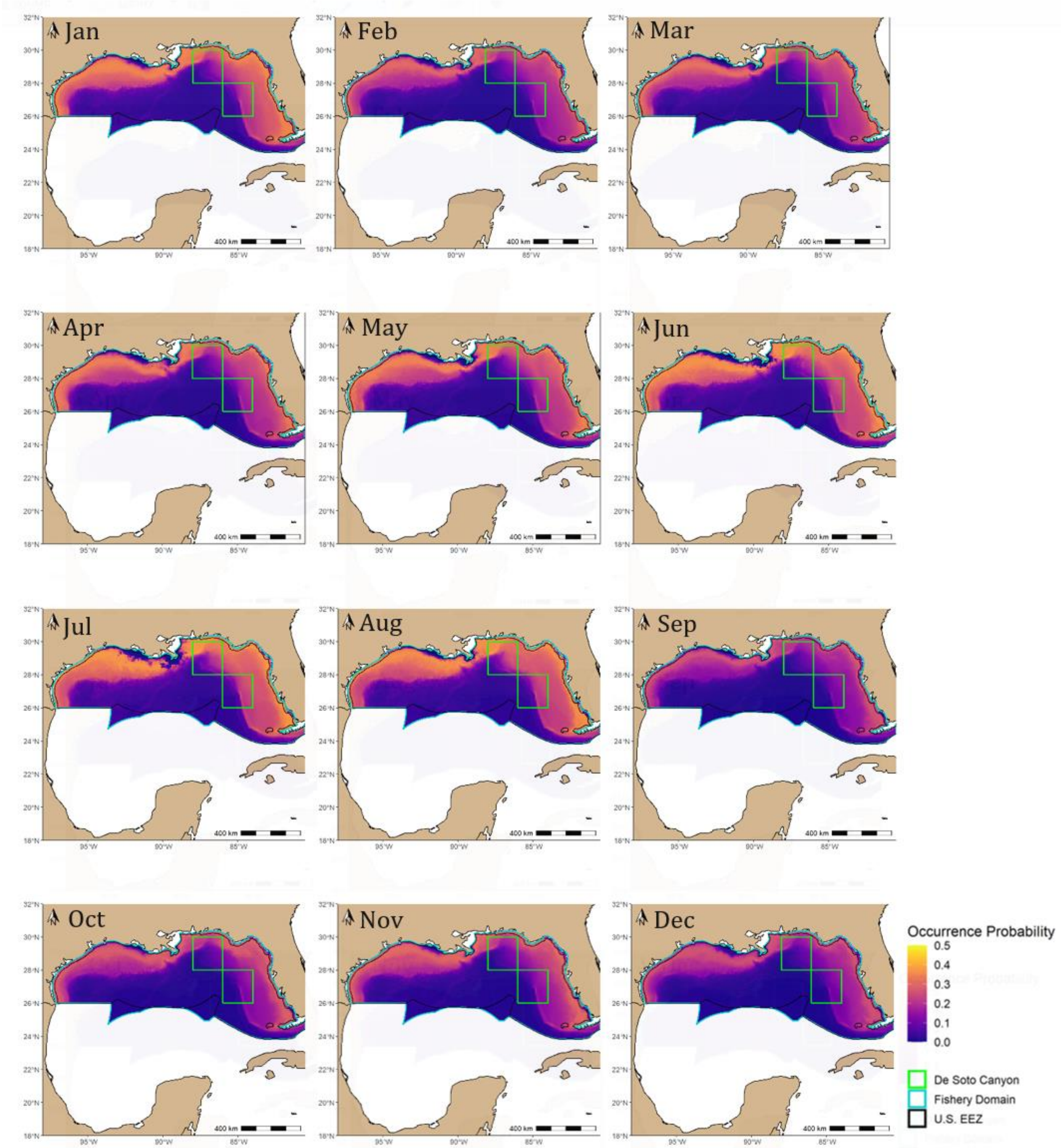


Figure 48. Estimated shortfin mako shark fishery interaction distribution outputs (occurrence probabilities) during average conditions each month from 2017 through 2019 within the pelagic longline fishery domain (light blue) in the Atlantic region. The area in green is the DeSoto Canyon Closed Area.

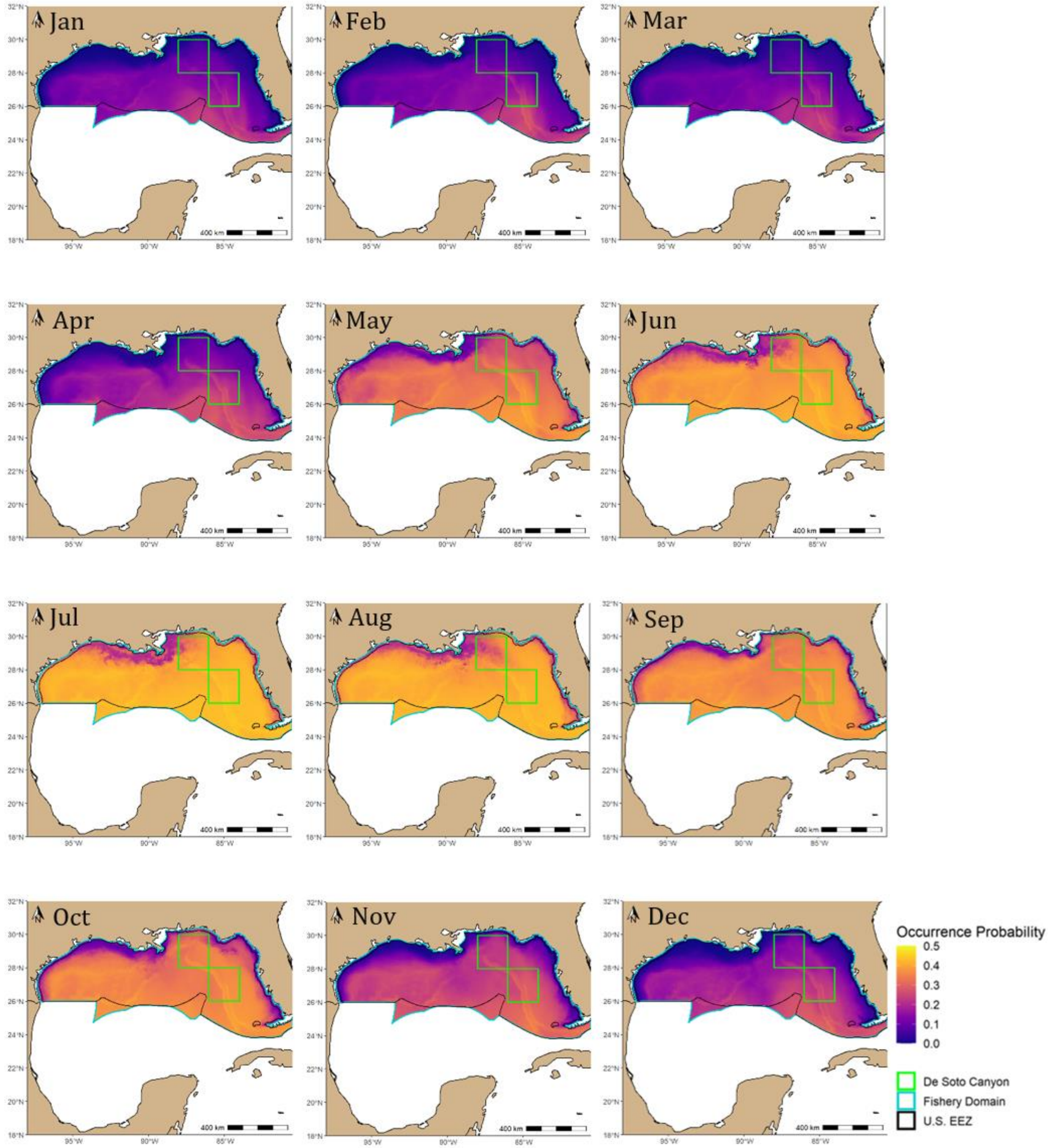


Figure 49. Estimated billfish species fishery interaction distribution outputs (occurrence probabilities) during average conditions each month from 2017 through 2019 within the pelagic longline fishery domain (light blue) in the Atlantic region. The area in green is the DeSoto Canyon Closed Area.

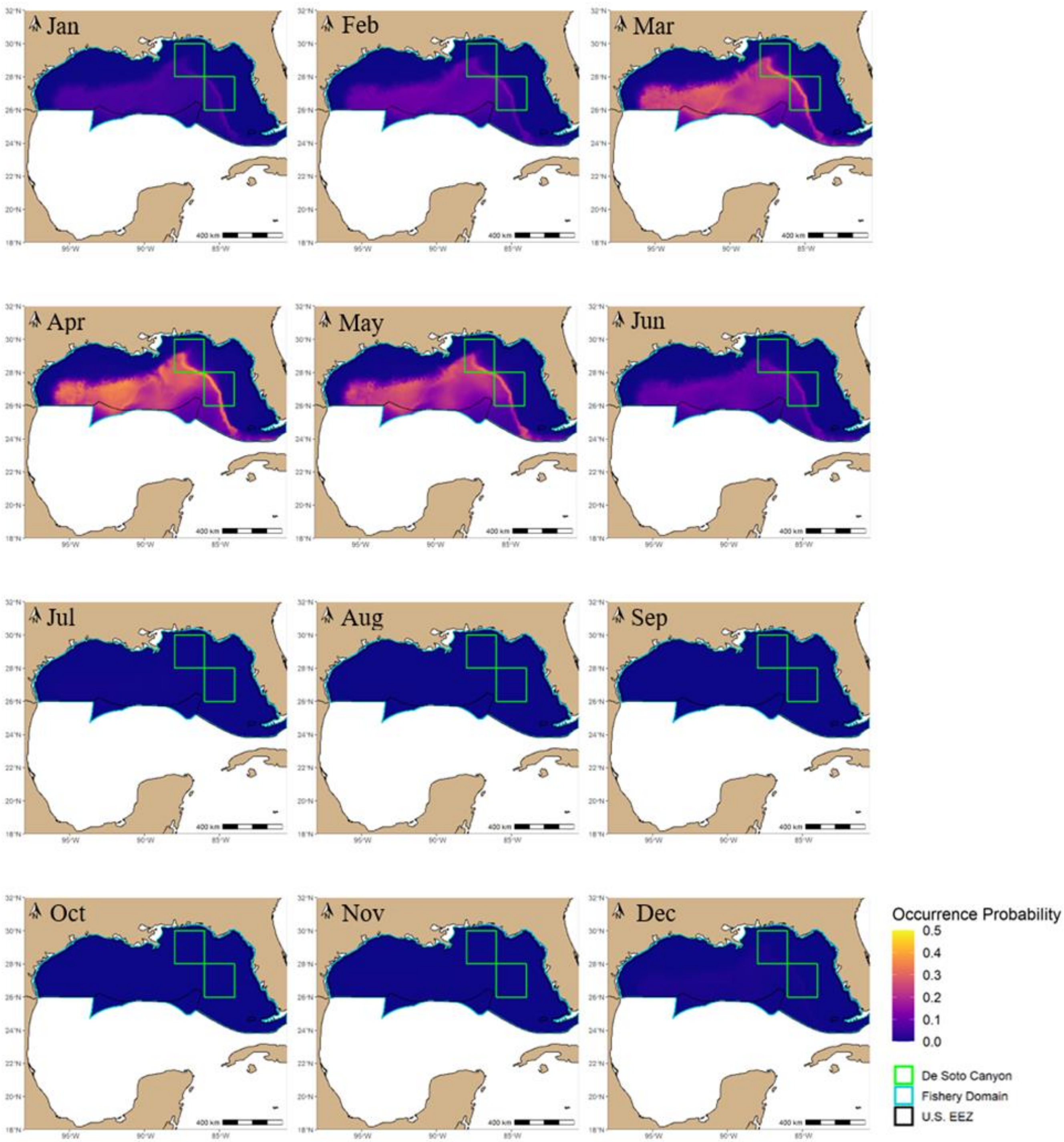


Figure 50. Estimated bluefin tuna fishery interaction distribution outputs (occurrence probabilities) during average conditions each month from 2017 through 2019 within the pelagic longline fishery domain (light blue) in the Gulf of Mexico region. The area in green is the DeSoto Canyon Closed Area.

APPENDIX 4. HIGH-BYCATCH-RISK AREAS

This appendix provides maps showing the high-bycatch-risk areas of each species by month and area. The maps were developed from the interaction probability maps (Appendix 3) and *occurrence probability threshold* for each species (Section 2.5). The solid color on each of these maps represents the high-bycatch-risk area for a given month and species. For the bottom longline in the Atlantic region, monthly interaction probability maps were generated for dusky shark, sandbar shark, and scalloped hammerhead shark (1^{st} subsection). For the pelagic longline in the Atlantic region, similar maps were generated for leatherback sea turtle, shortfin mako shark, the billfish species group, and loggerhead sea turtle (2^{nd} subsection). For the pelagic longline in the Gulf of Mexico region, maps were developed for leatherback sea turtle, shortfin mako shark, and the billfish species group (3^{rd} subsection). All high-bycatch-risk area maps were used to inform the metrics and modification scoring (Appendix 5). This information supports the discussion of “Step 3” (Section 2.5).

BOTTOM LONGLINE - ATLANTIC REGION

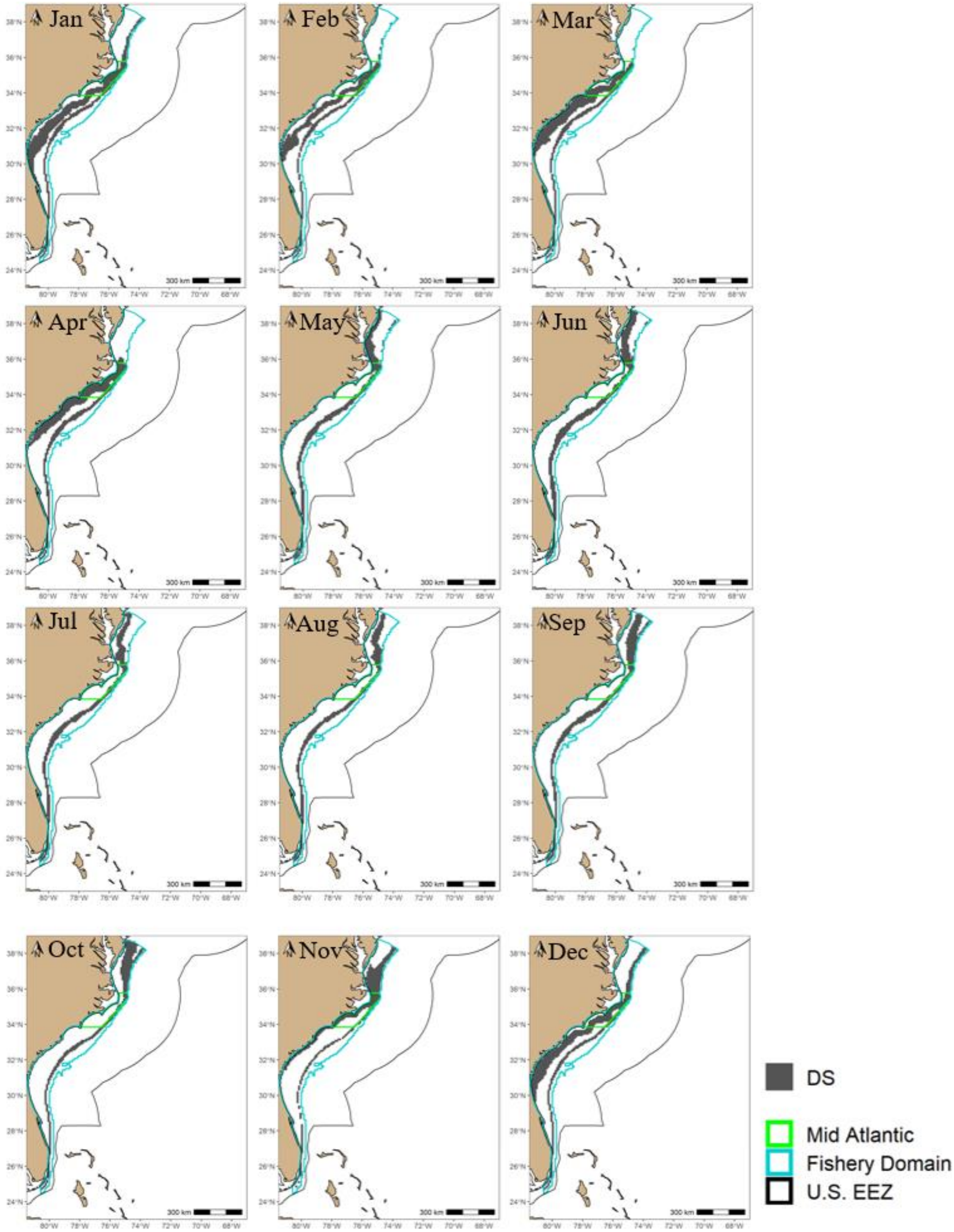


Figure 51. Dusky shark high-bycatch-risk area (dark grey) within the bottom longline fishery domain for each month. The Mid-Atlantic shark closed area is indicated by the light green outline. Species abbreviations are as follows: DS = dusky shark.

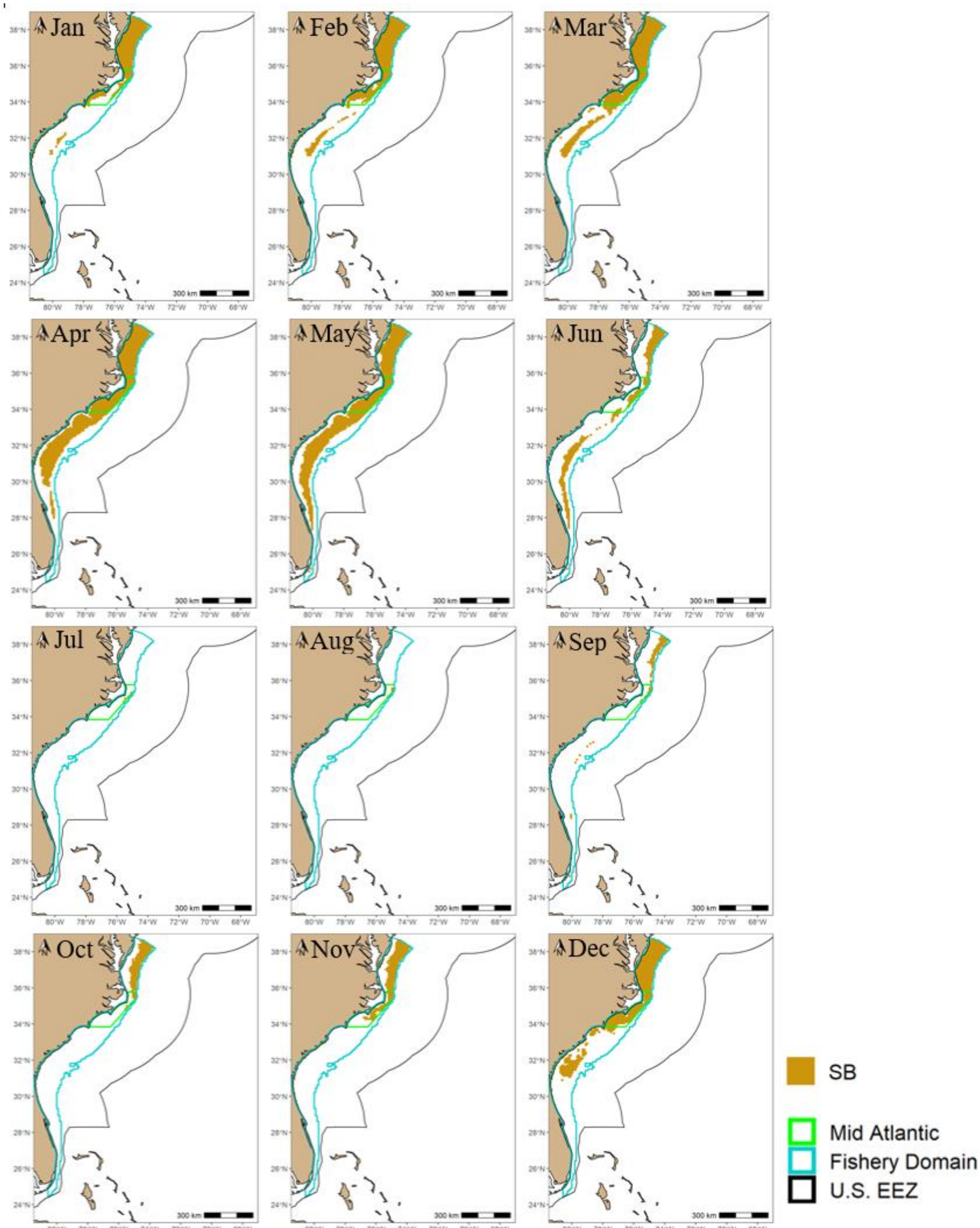


Figure 52. Sandbar shark high-bycatch-risk area (gold) within the bottom longline fishery domain for each month. The Mid-Atlantic shark closed area is indicated by the light green outline. Species abbreviations are as follows: SB = sandbar shark.

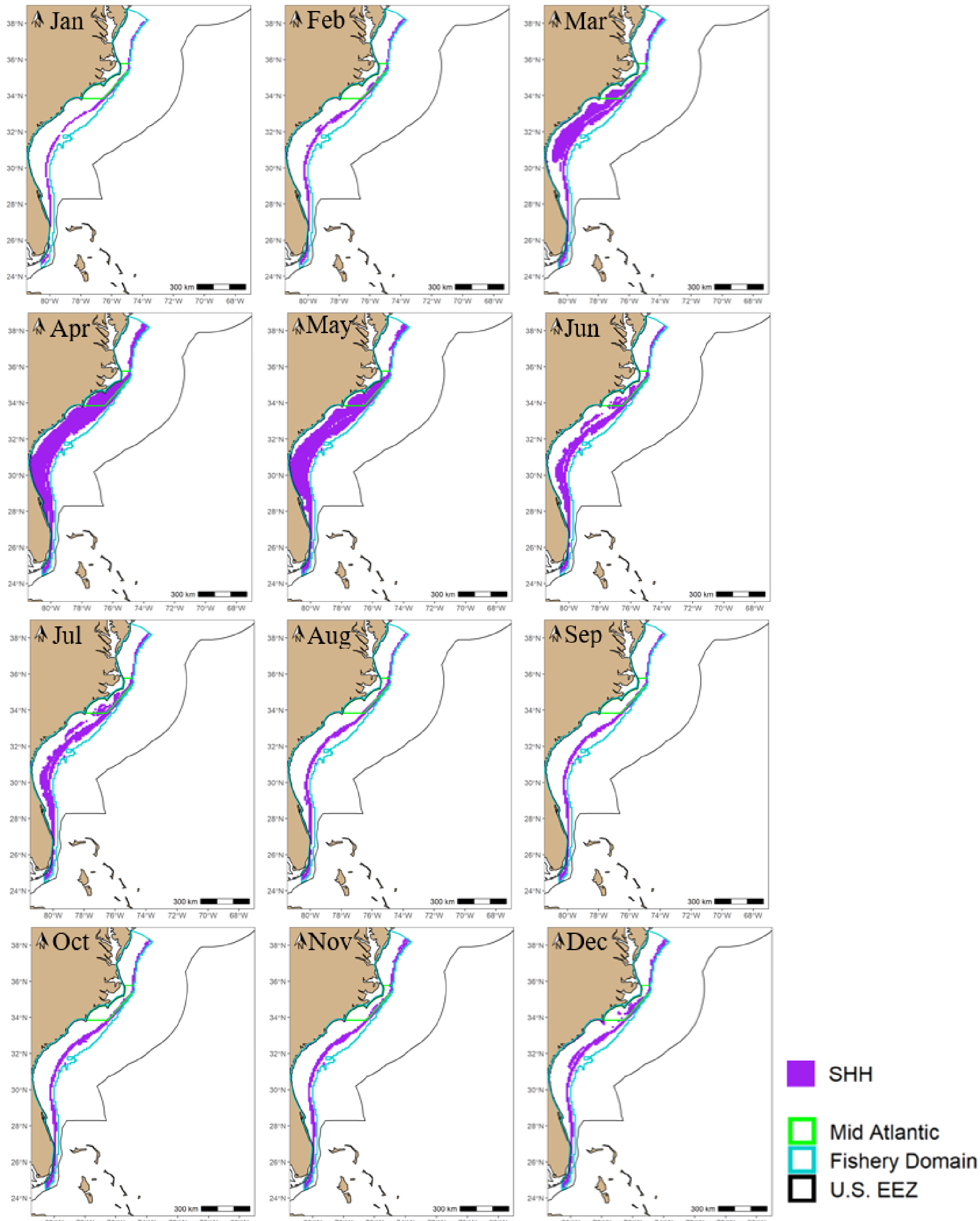


Figure 53. Scalloped hammerhead shark high-bycatch-risk area (purple) within the bottom longline fishery domain for each month. The Mid-Atlantic shark closed area is indicated by the light green outline. Species abbreviations are as follows: SHH = scalloped hammerhead.

PELAGIC LONGLINE - ATLANTIC REGION

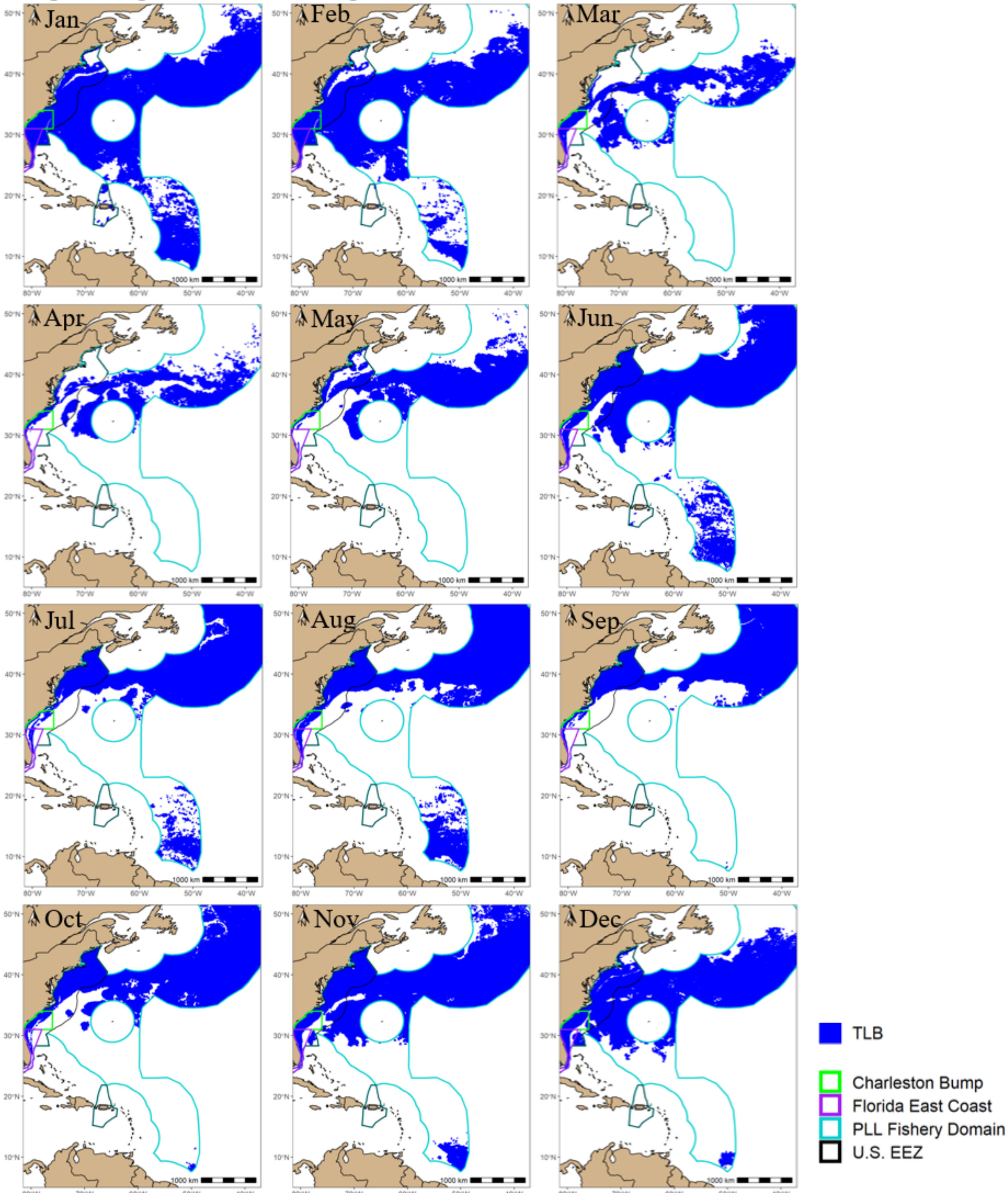


Figure 54. Leatherback sea turtle high-bycatch-risk area (blue) within the pelagic longline fishery domain (also includes U.S. EEZ) each month. The Charleston Bump Closed Area and East Florida Coast Closed Area are indicated by the light green outline and purple outlines, respectively. The light blue outline represents the fishery domain. Species abbreviations are as follows: TLB = leatherback sea turtle.

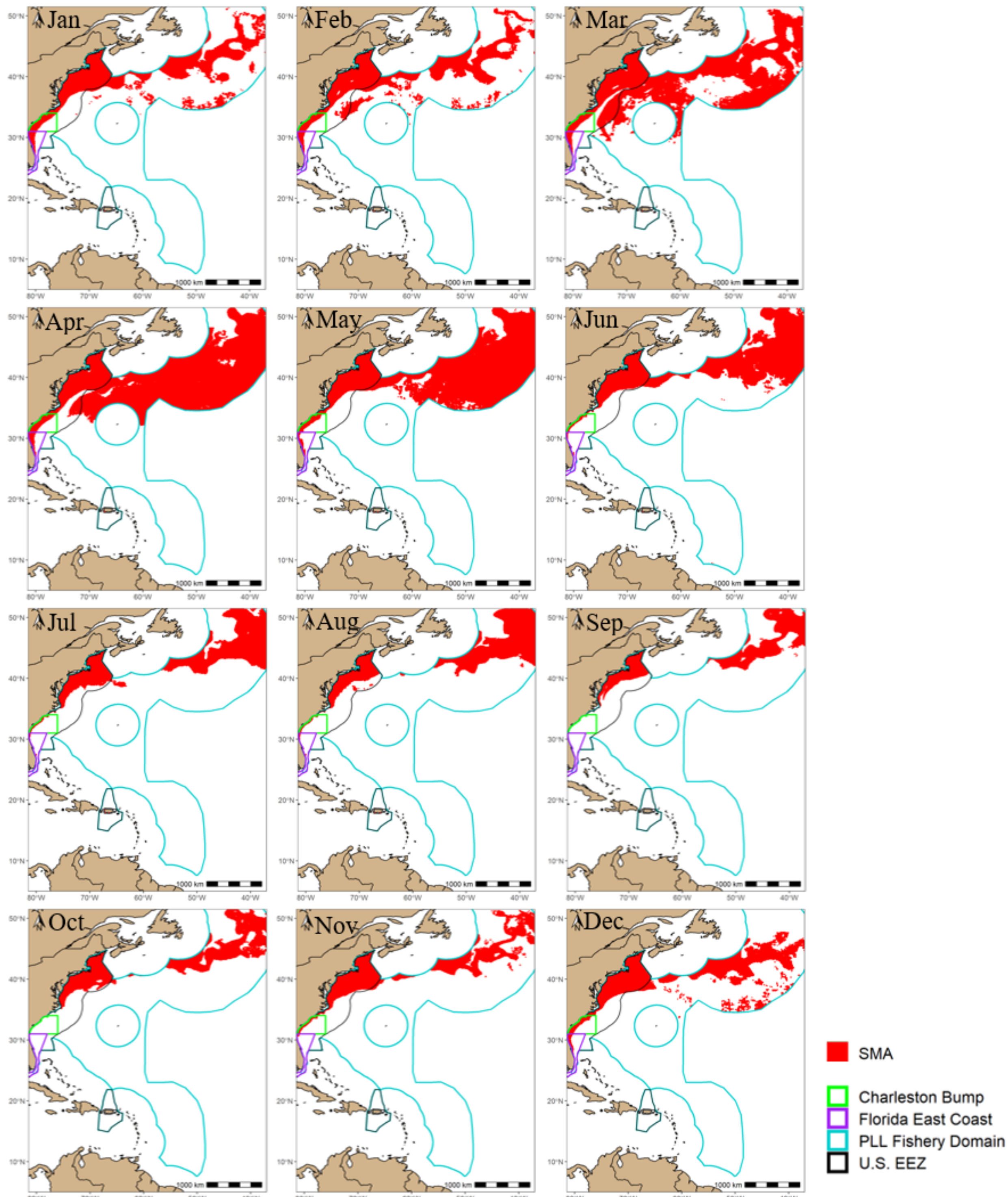


Figure 55. Shortfin mako shark high-bycatch-risk area (red) within the pelagic longline fishery domain (also includes U.S. EEZ for each month. The Charleston Bump Closed Area and East Florida Coast Closed Area are indicated by the light green outline and purple outlines, respectively. The light blue outline represents the fishery domain. Species abbreviations are as follows: SMA = shortfin mako shark.

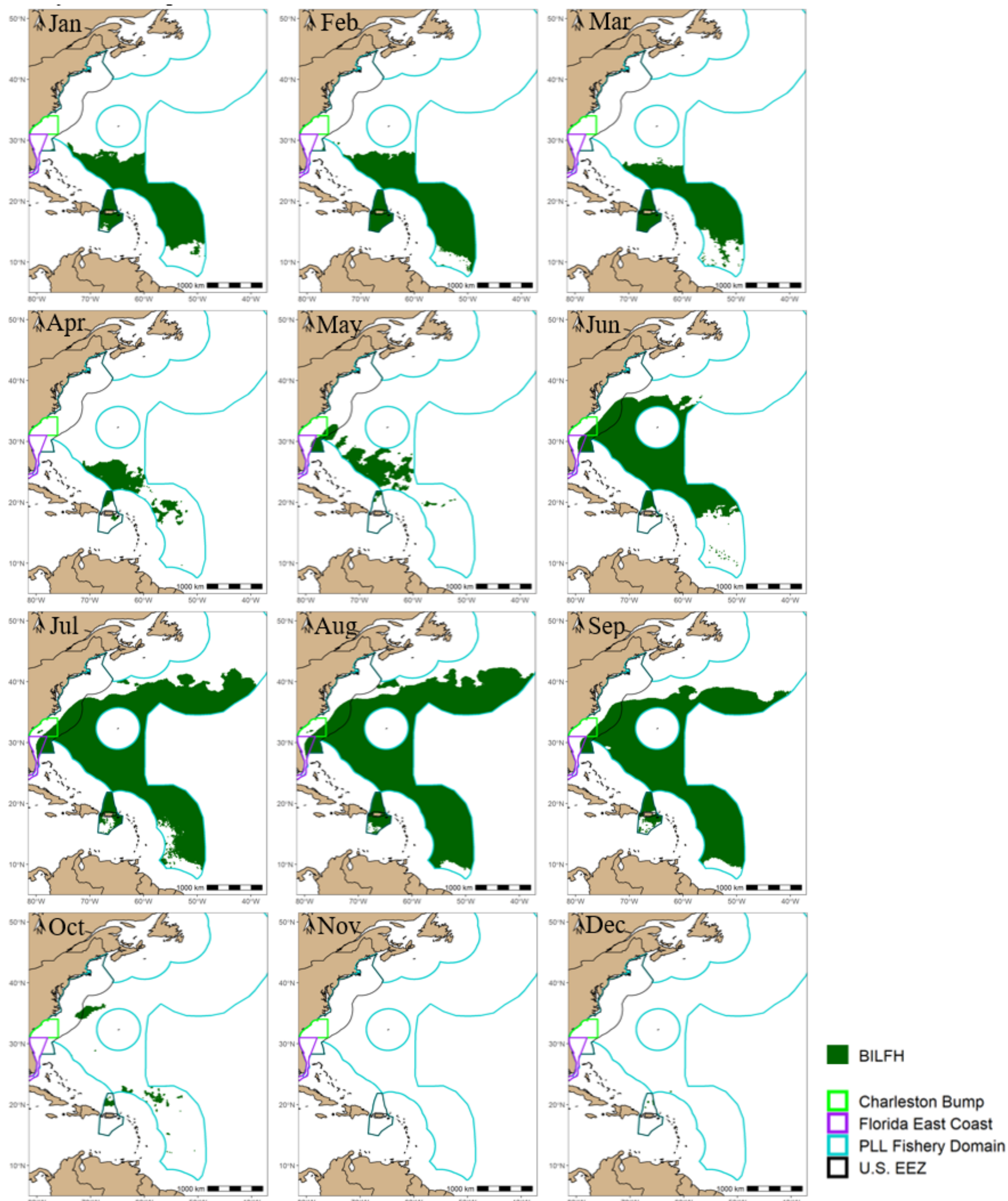


Figure 56. Billfish species high-bycatch-risk area (green) within the pelagic longline fishery domain (also includes U.S. EEZ) for each month. The Charleston Bump Closed Area and East Florida Coast Closed Area are indicated by the light green outline and purple outlines, respectively. The light blue outline represents the fishery domain. Species abbreviations are as follows: BILFH = billfish species group.

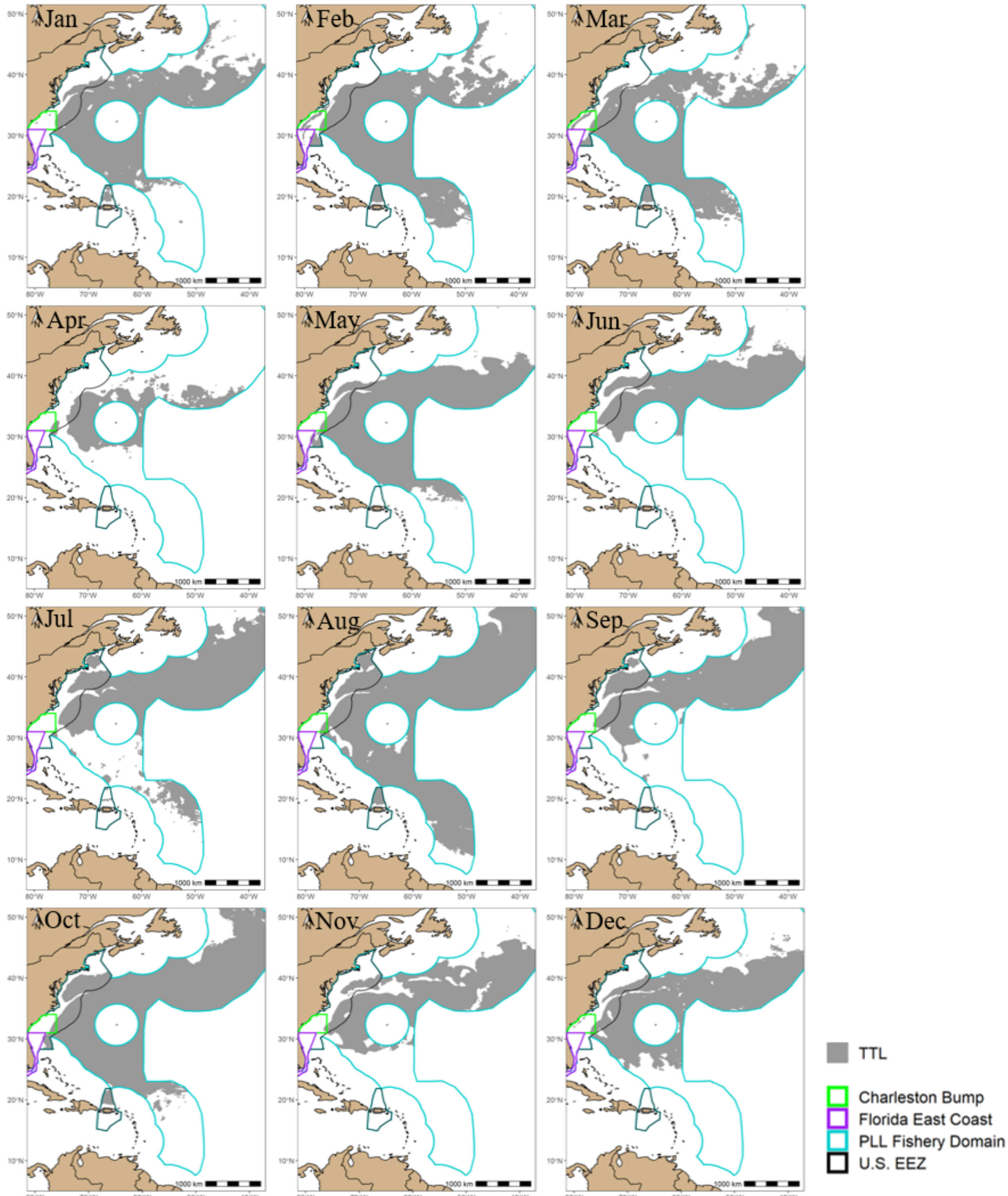


Figure 57. Loggerhead sea turtle high-bycatch-risk area (light grey) within the pelagic longline fishery domain (also includes U.S. EEZ) for each month. The Charleston Bump Closed Area and East Florida Coast Closed Area are indicated by the light green outline and purple outlines, respectively. The light blue outline represents the fishery domain. Species abbreviations are as follows: TTL = loggerhead sea turtle.

PELAGIC LONGLINE - GULF OF MEXICO REGION

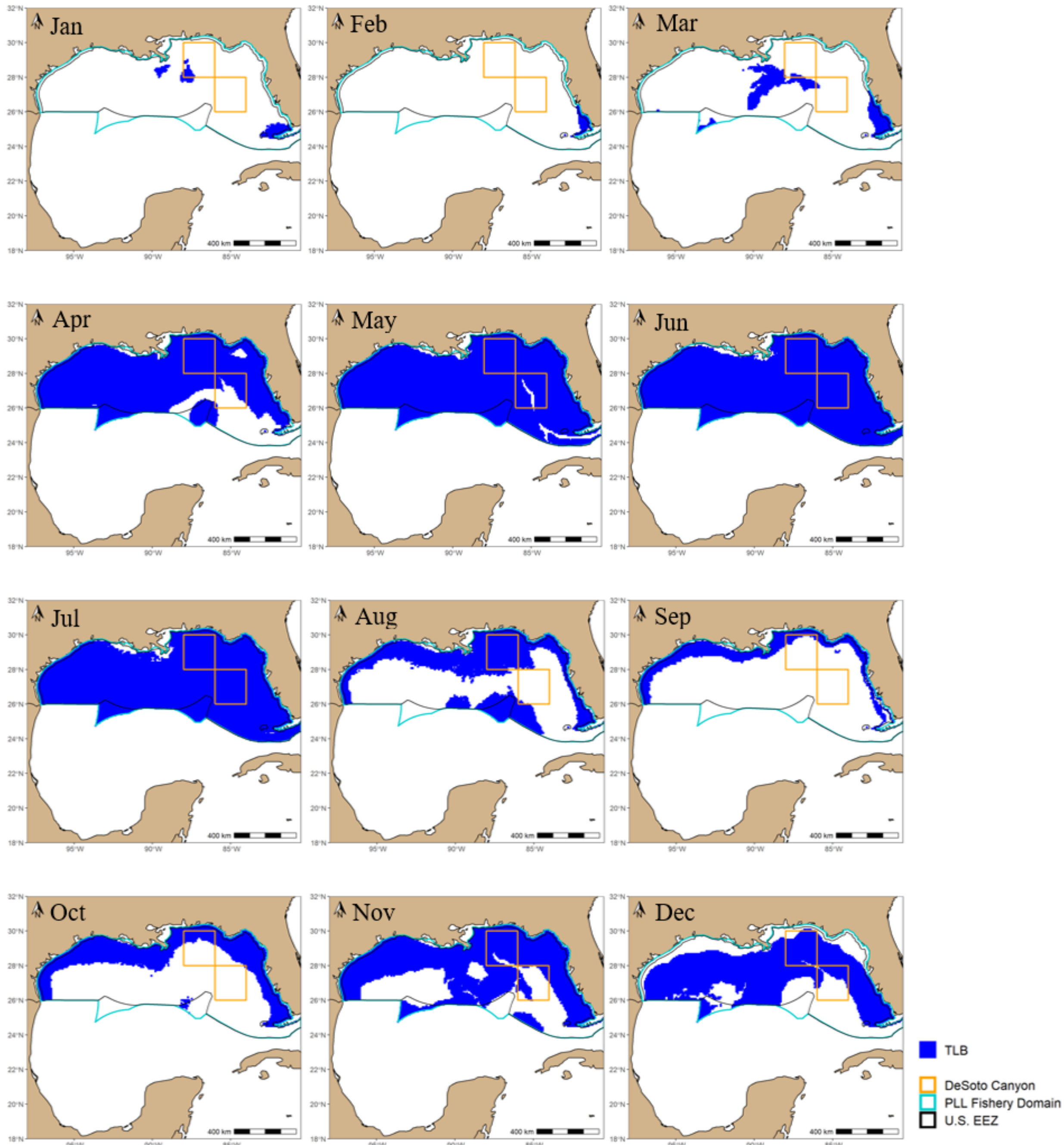


Figure 58. Leatherback sea turtle high-bycatch-risk area (blue) within the pelagic longline fishery domain (also includes U.S. EEZ) for each month. The DeSoto Canyon Closed Area is indicated by the light orange outline. The light blue outline represents the fishery domain. Species abbreviations are as follows: TLB = leatherback sea turtle.

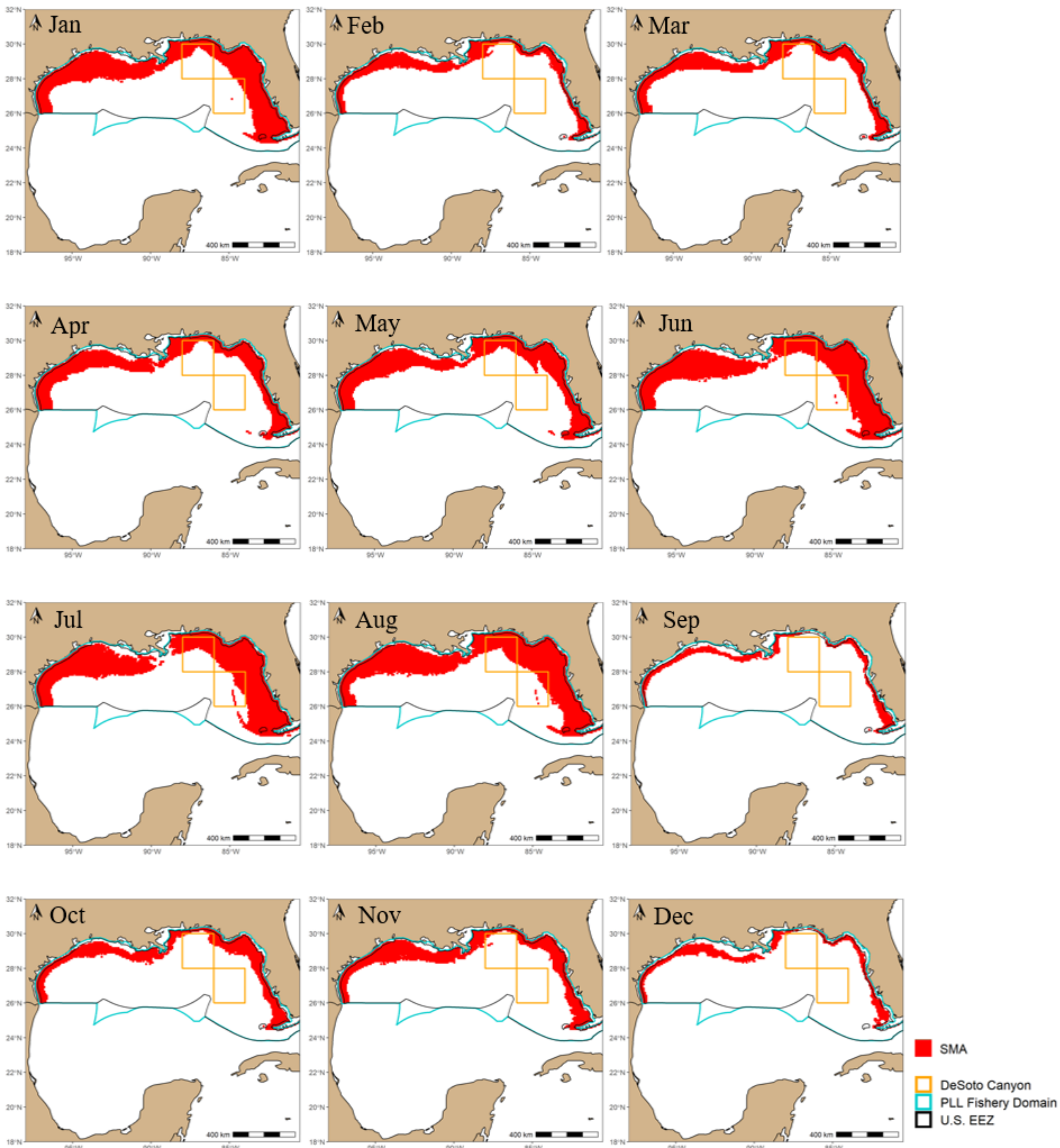


Figure 59. Shortfin mako shark high-bycatch-risk area (red) within the pelagic longline fishery domain (also includes U.S. EEZ) for each month. The DeSoto Canyon Closed Area is indicated by the light orange outline. The light blue outline represents the fishery domain. Species abbreviations are as follows: SMA = shortfin mako shark.

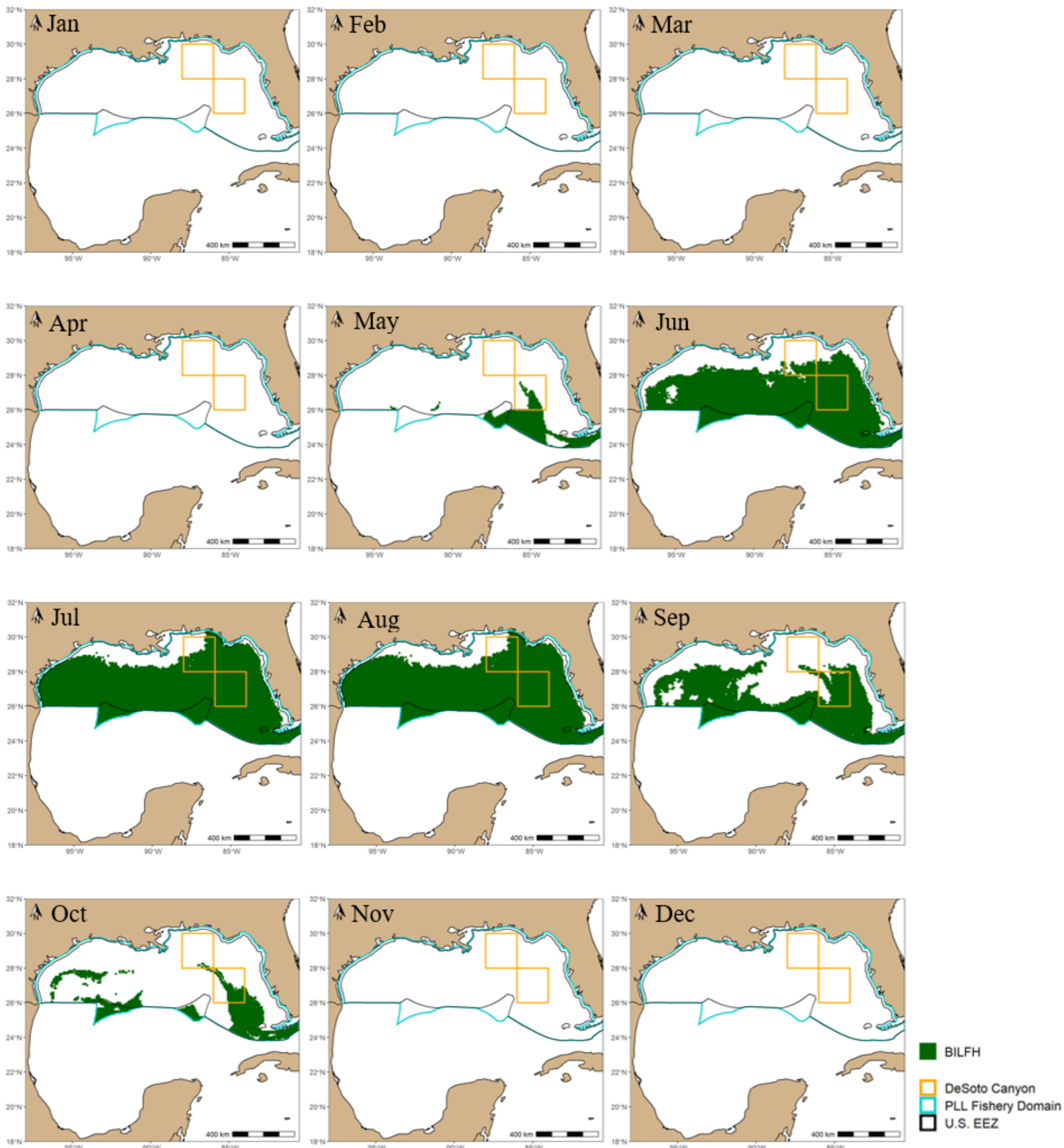


Figure 60. Billfish species high-bycatch-risk area (green) within the pelagic longline fishery domain (also includes U.S. EEZ) for each month. The DeSoto Canyon Closed Area is indicated by the light orange outline. The light blue outline represents the fishery domain. Species abbreviations are as follows: BILFH = billfish species group.

APPENDIX 5. OPTIONS, METRICS, AND SCORING

This appendix provides maps and figures detailing the modification options and metrics for each spatial management area. As detailed in Section 2.8, modification alternatives were chosen from these modification options based on a variety of factors. This information supports the discussion of "Step 3" (Section 2.5), "Step 4" (Section 2.6), "Step 5" (Section 2.7), and "Step 6" (Section 2.8).

OPTIONS AND METRICS

Metrics Captions

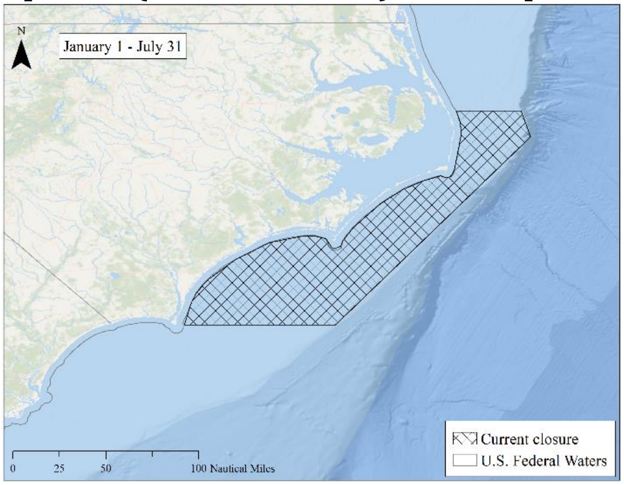
Metric 1: Monthly mean occurrence probability inside the closed area (red line) and the observed mean occurrence rate outside the closed area (black line) during the months the areas would be closed for a specific Option for each species.

Metric 2: Ratios of median values each month inside and outside the areas that would be closed for a specific Option. Species monthly ratios are calculated as (median high-risk area occurrence probability inside the closed area)/(median high-risk area occurrence probability outside the closed area). Values above 1 (the dashed line) indicate when high risk area was higher risk inside the closed area compared to outside the closed area. For the Charleston Bump Closed Area and the Mid-Atlantic Closed Area, the shaded grey area indicates the months the area would be closed for a specific option. No shaded regions were used for the East Florida Coast or DeSoto Canyon Closed Areas because for some options, the spatial extent changes between two temporal periods. Months where there are no values indicate when no high-risk area occurred inside the fishery domain.

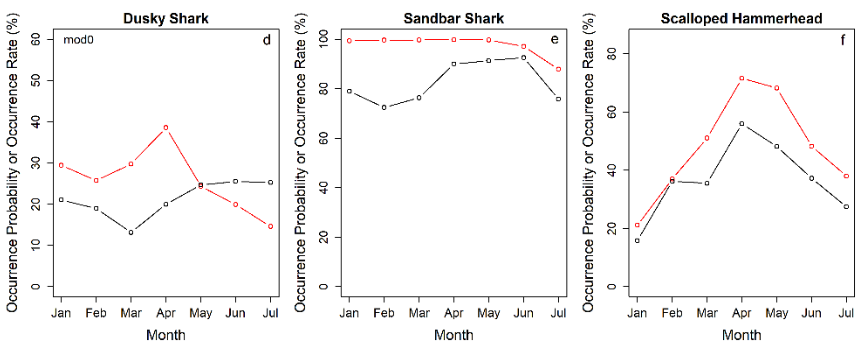
Metric 3: Percent of total high-risk area inside the closed area. Months where there are no values indicate when no high-risk area occurred inside the fishery domain. For the Charleston Bump Closed Area and the Mid-Atlantic Closed Area the shaded grey area indicates the months the closed areas are in effect. No shaded regions were used for East Florida Coast or DeSoto Canyon Closed Areas because for some options, the spatial extent changes between two temporal periods. Species abbreviations are as follows: DS = dusky shark; SB = sandbar shark; SHH = scalloped hammerhead; TLB = leatherback sea turtle; SMA = shortfin mako shark; BILFH = billfish species group; TTL = loggerhead sea turtle.

Metric 4: Percent of the closed area covered by high-risk area. For the Charleston Bump Closed Area and the Mid-Atlantic Closed Area the shaded grey area indicates the months the closed areas are in effect. No shaded regions were used for East Florida Coast or DeSoto Canyon Closed Areas because for some options, the spatial extent changes between two temporal periods. Species abbreviations are as follows: DS = dusky shark; SB = sandbar shark; SHH = scalloped hammerhead; TLB = leatherback sea turtle; SMA = shortfin mako shark; BILFH = billfish species group; TTL = loggerhead sea turtle.

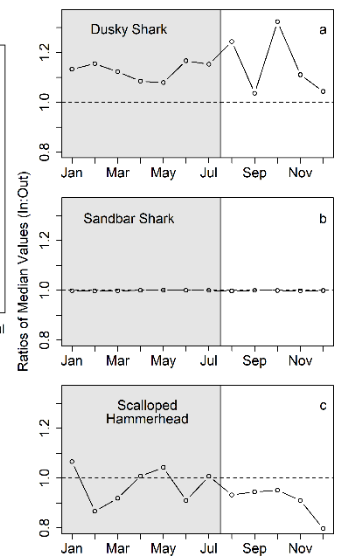
MID-ATLANTIC CLOSED AREA
Option 0 (Sub-Alternative) - Status quo area and time



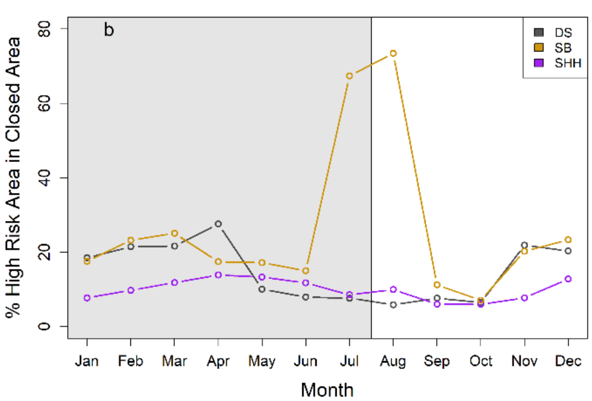
Metric 1



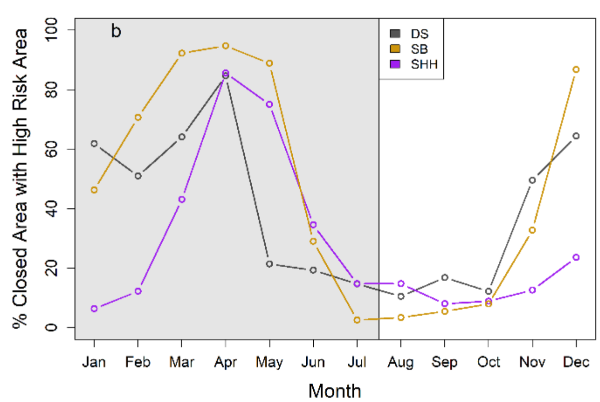
Metric 2



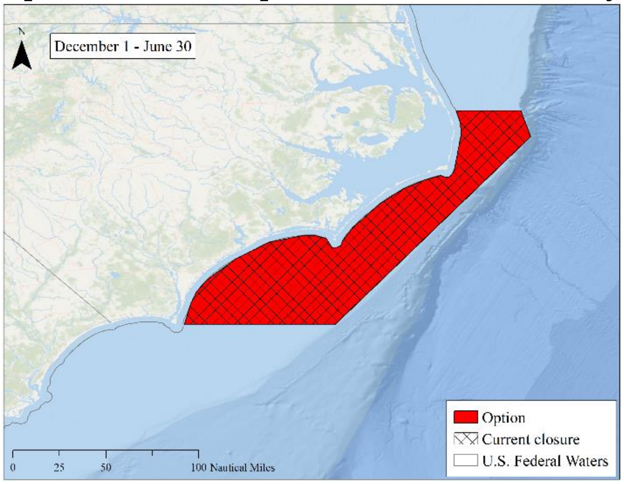
Metric 3



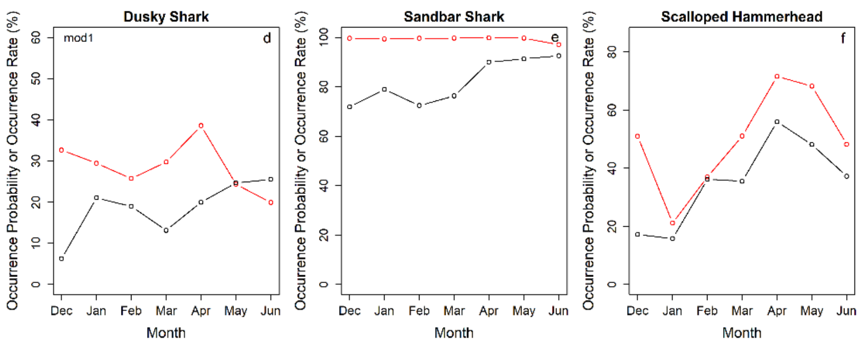
Metric 4



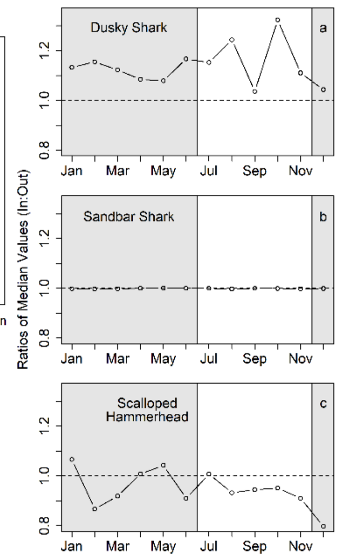
Option 1 - Status quo area; Time shifted by one month



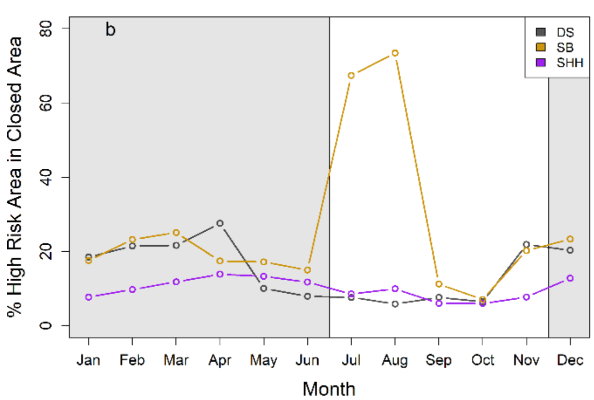
Metric 1



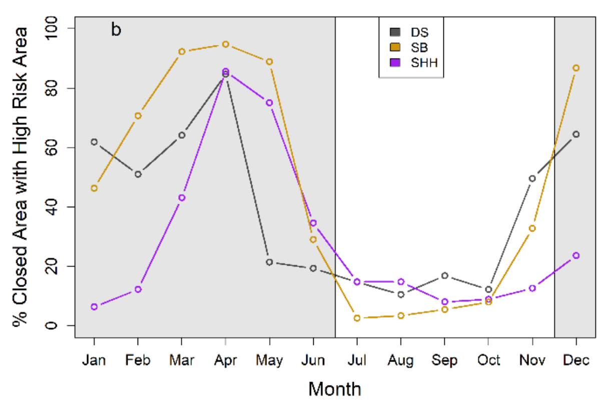
Metric 2



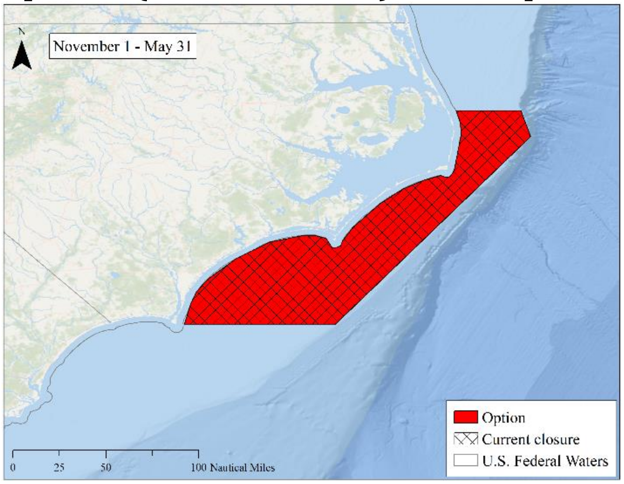
Metric 3



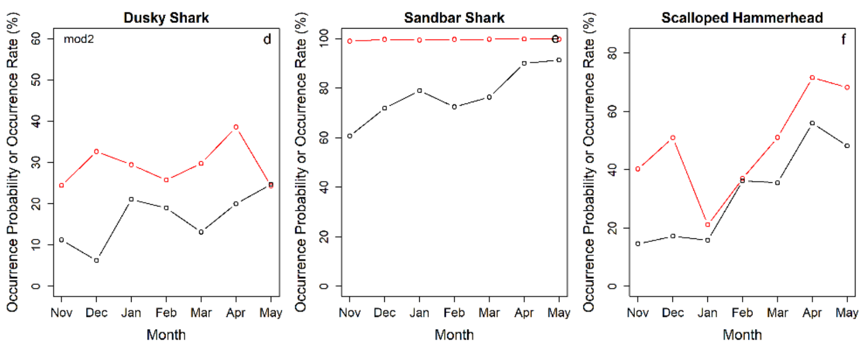
Metric 4



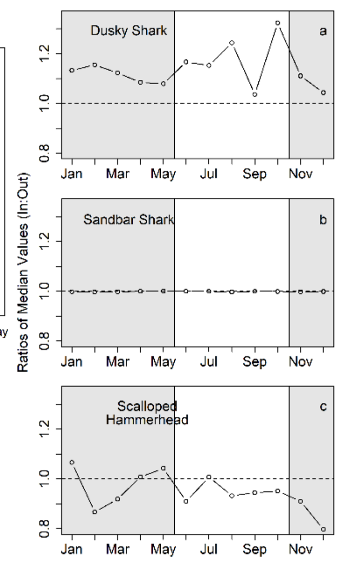
Option 2 (Sub-Alternative) - Status quo area; Time shifted by two months



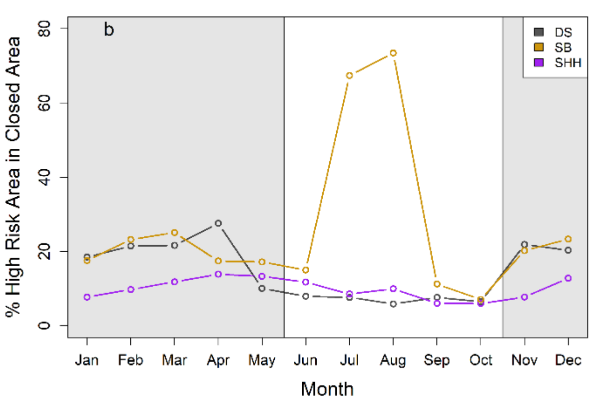
Metric 1



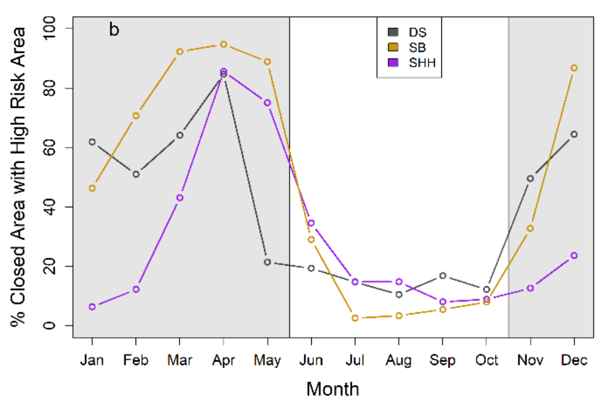
Metric 2



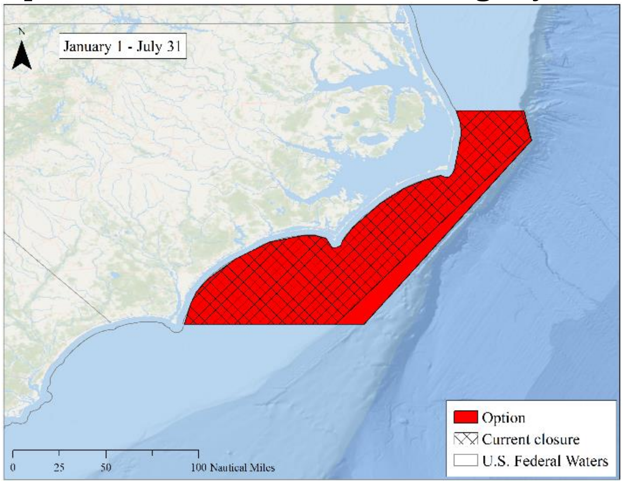
Metric 3



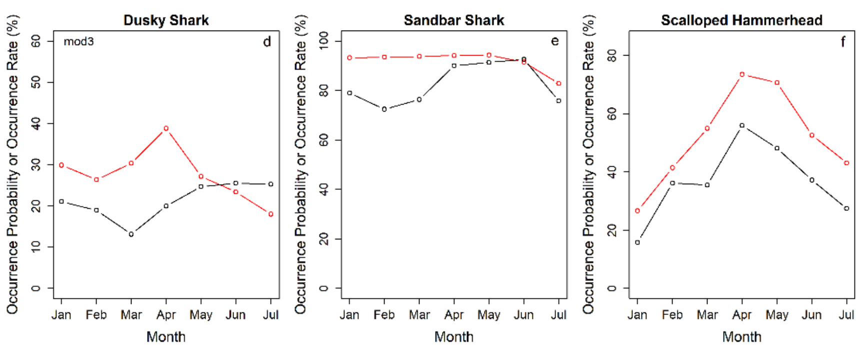
Metric 4



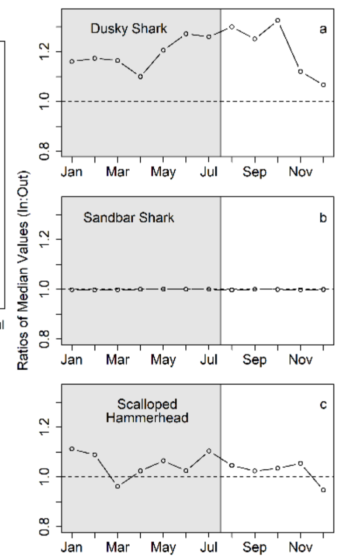
Option 3 - Area extended east slightly; Status quo time



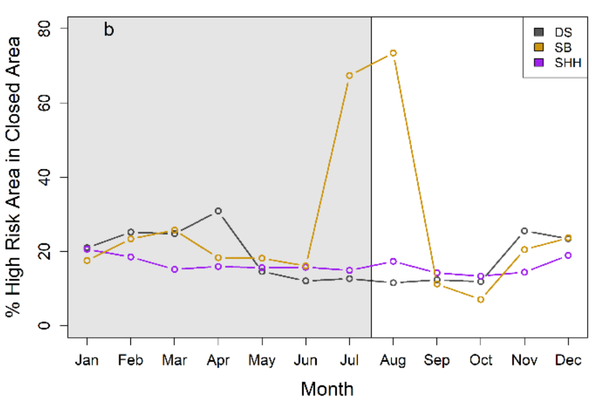
Metric 1



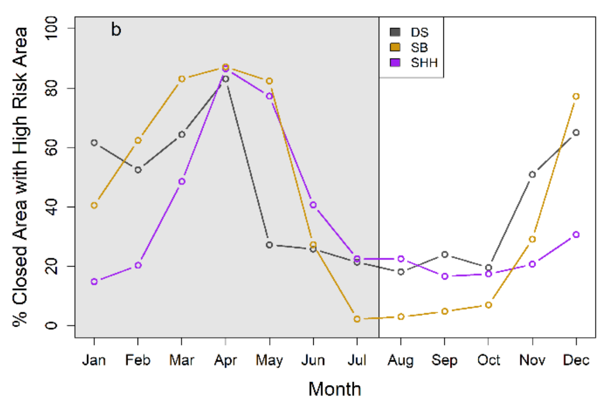
Metric 2



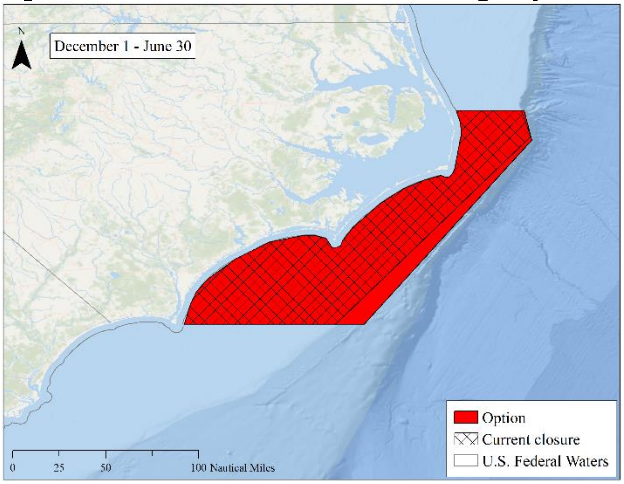
Metric 3



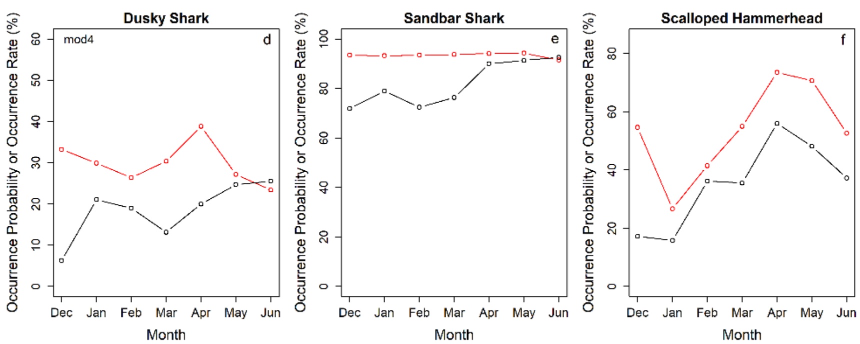
Metric 4



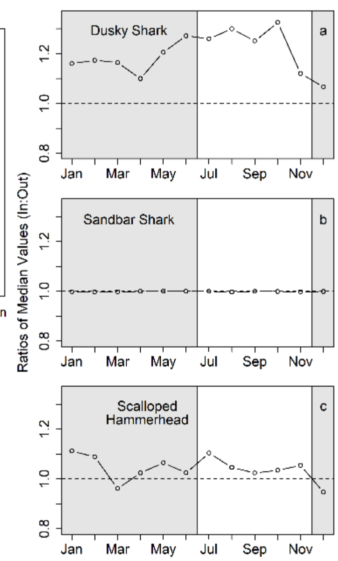
Option 4 - Area extended east slightly; Time shifted by one month



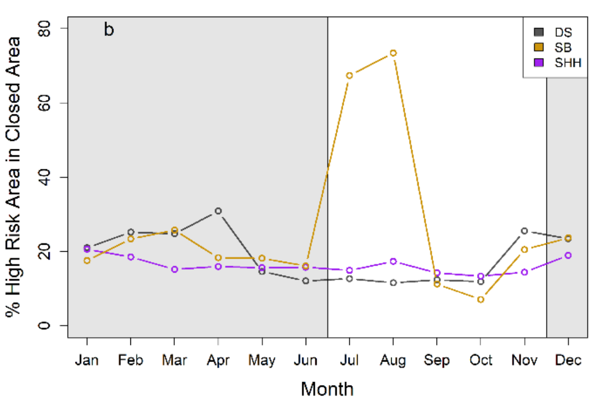
Metric 1



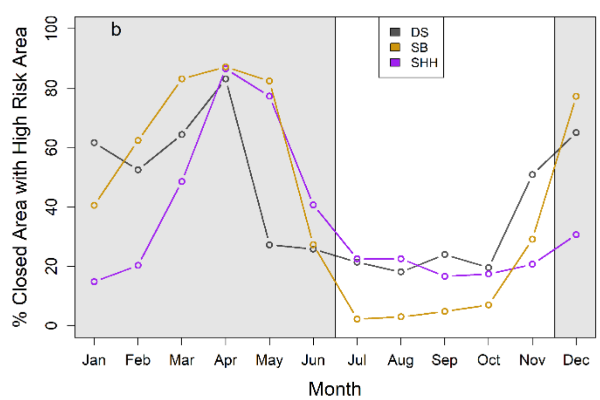
Metric 2



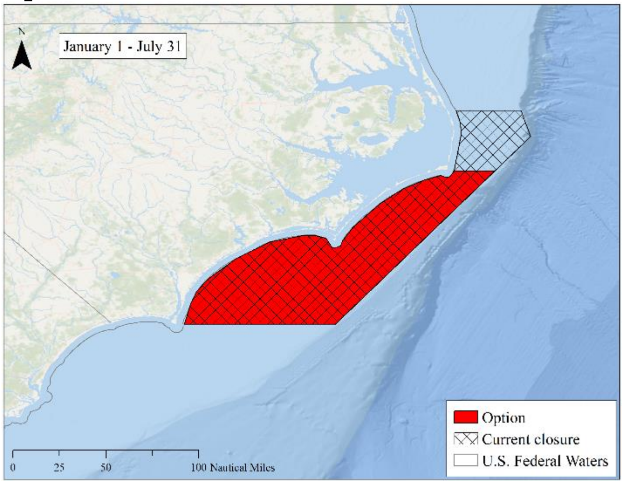
Metric 3



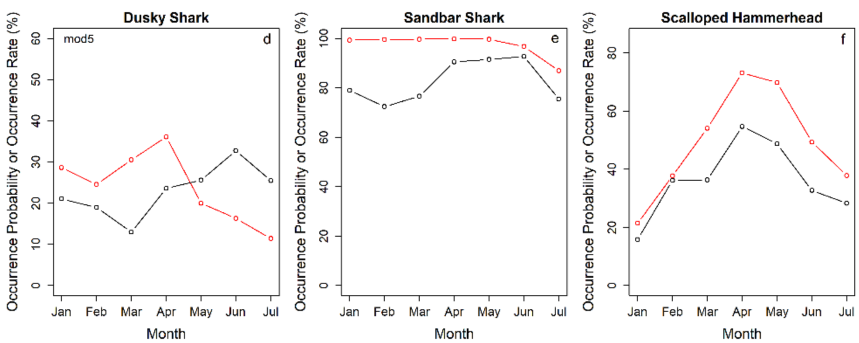
Metric 4



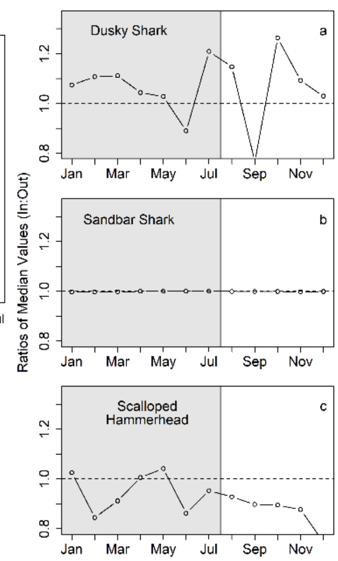
Option 5 - Area reduced from the north; Status quo time



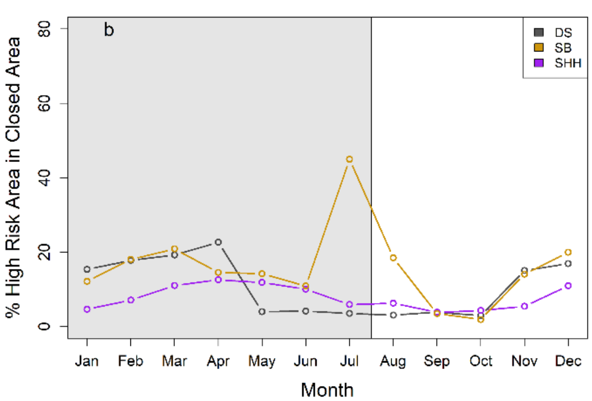
Metric 1



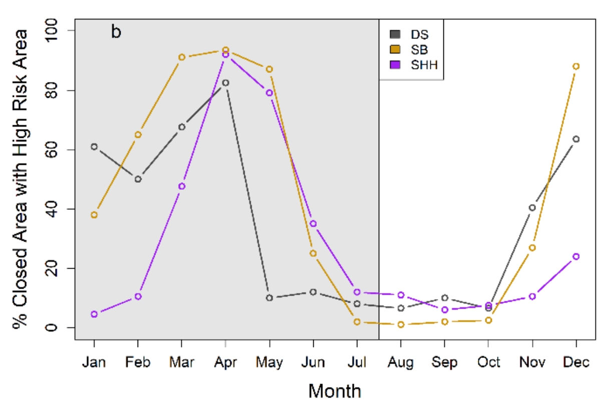
Metric 2



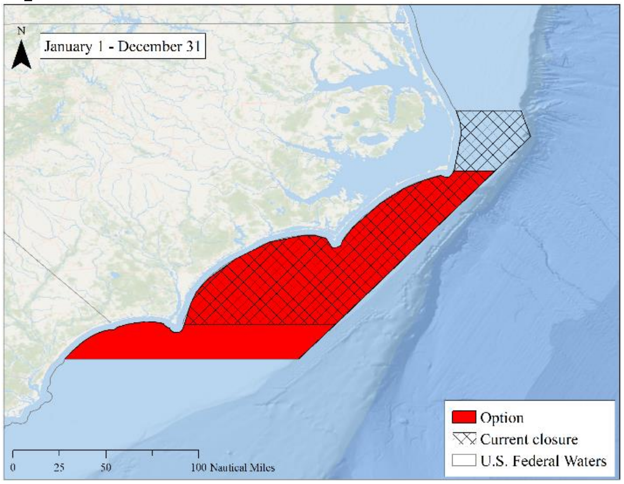
Metric 3



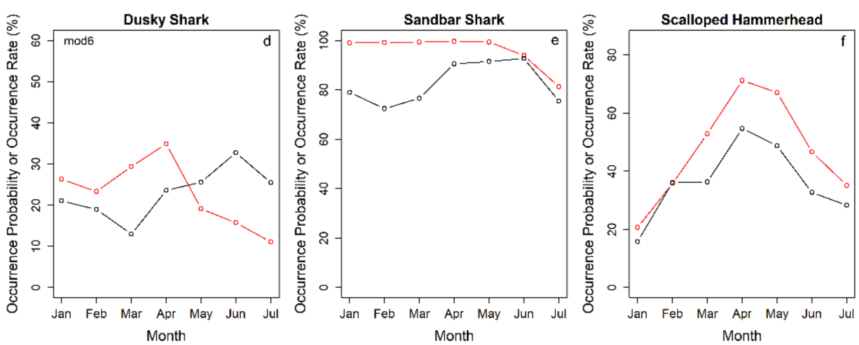
Metric 4



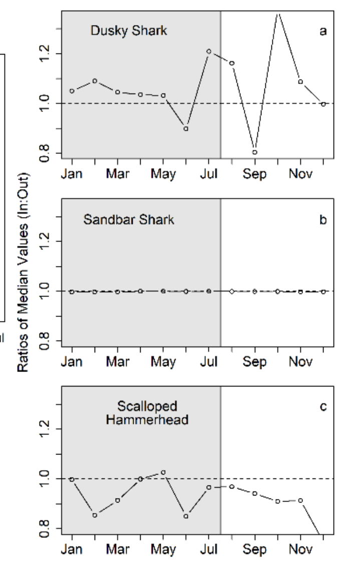
Option 6 - Area extended to the south and reduced from the north; Status quo time



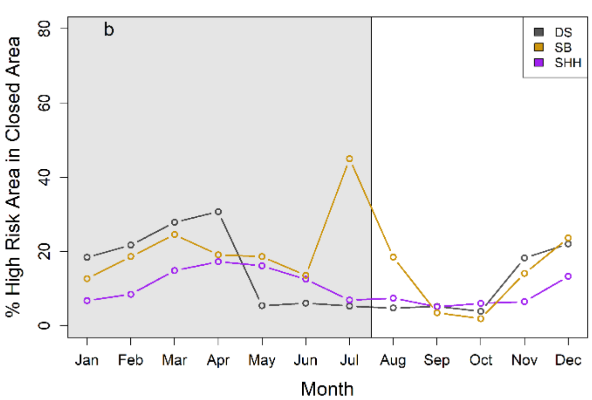
Metric 1



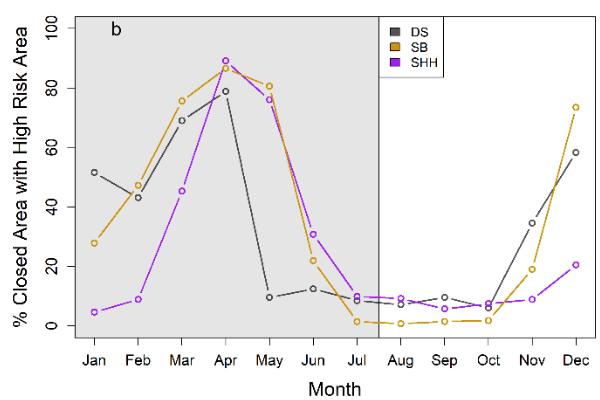
Metric 2



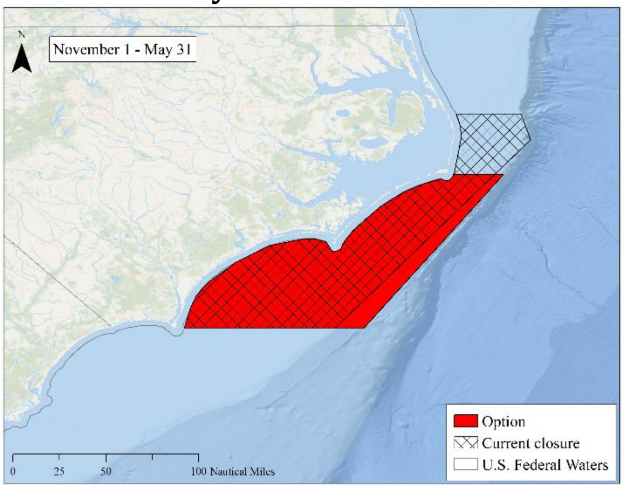
Metric 3



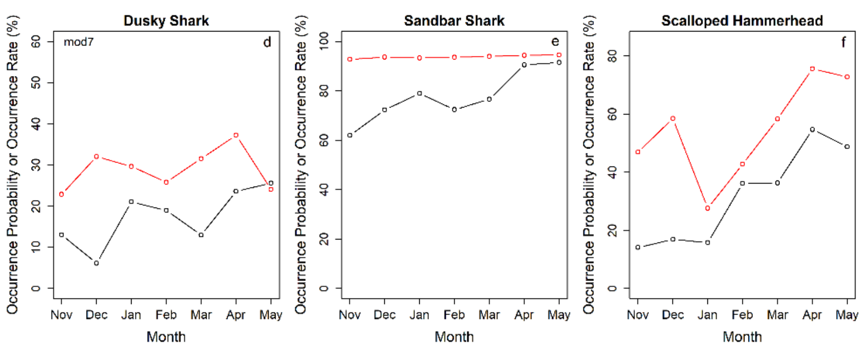
Metric 4



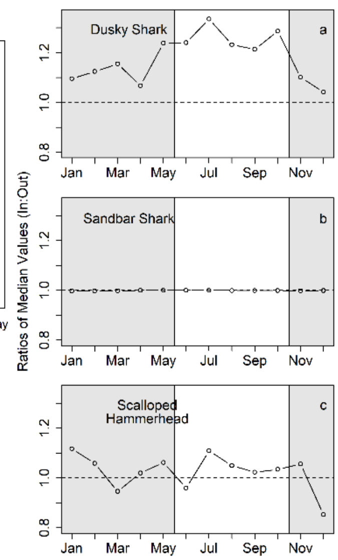
Option 7 (Sub-Alternative) - Area extended east slightly and reduced from the north; Time shifted by two months



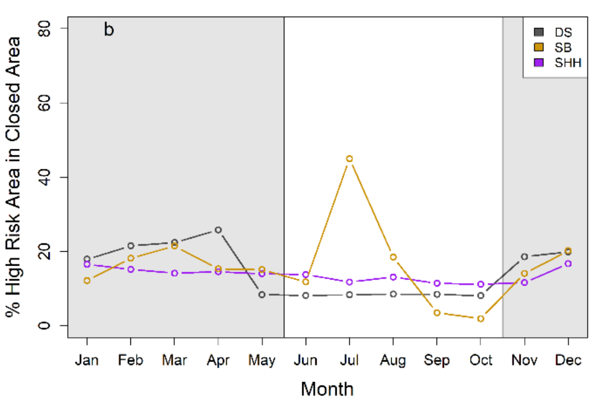
Metric 1



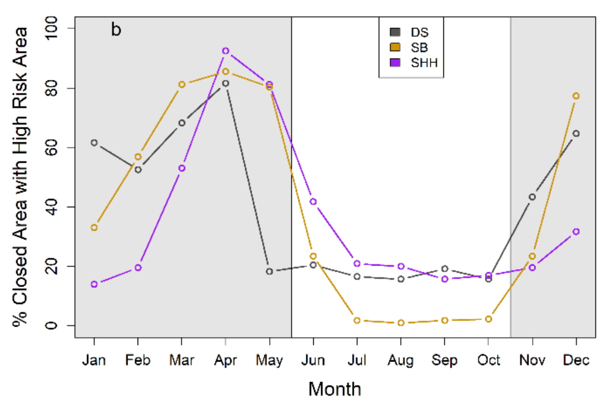
Metric 2



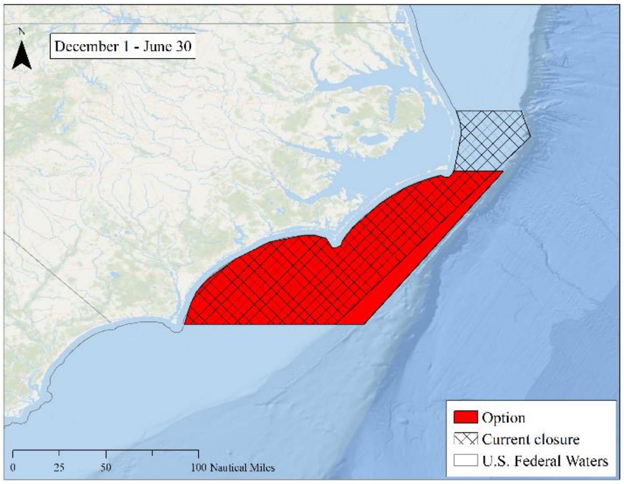
Metric 3



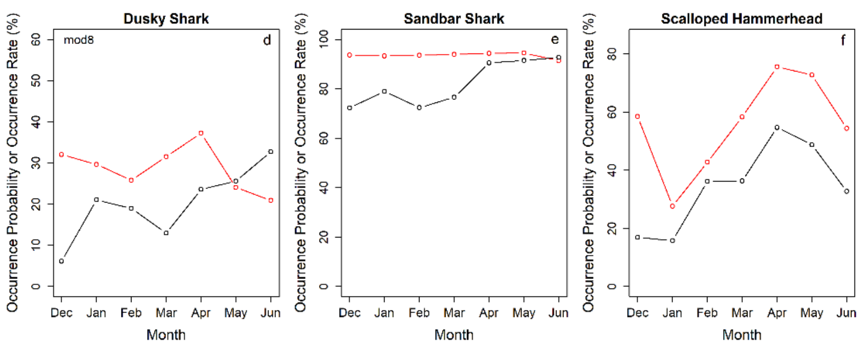
Metric 4



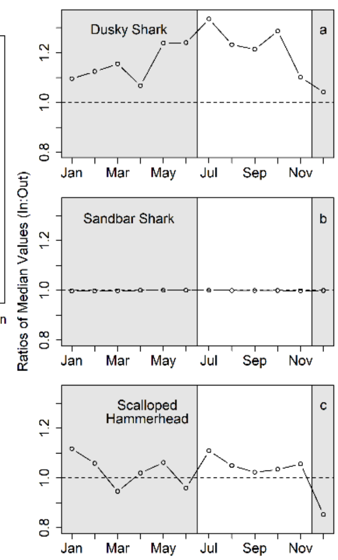
Option 8 - Area extended east slightly and reduced from the north; Time shifted by one month



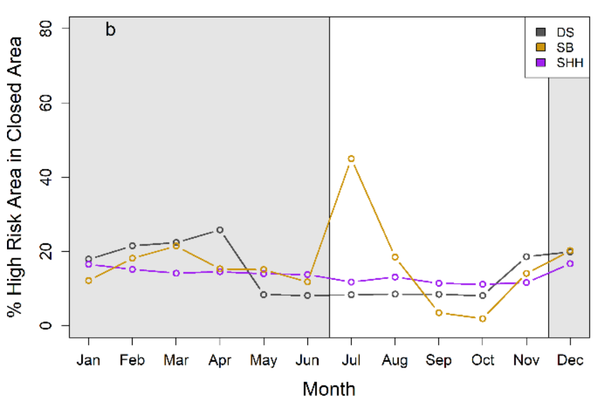
Metric 1



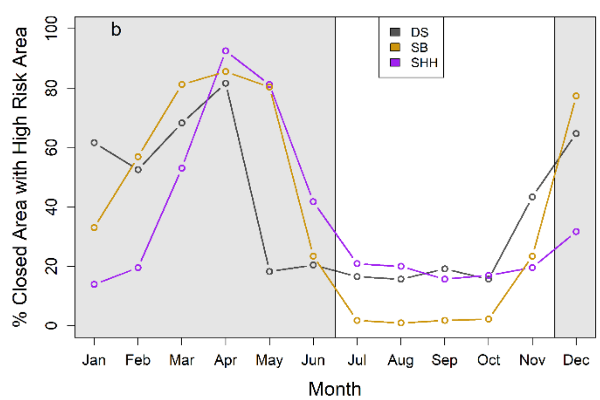
Metric 2



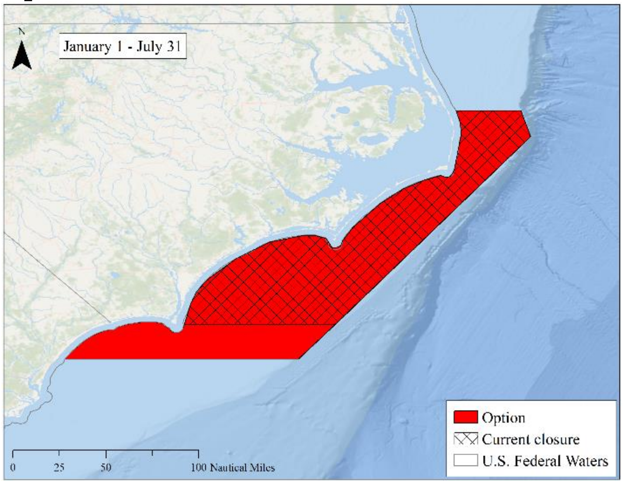
Metric 3



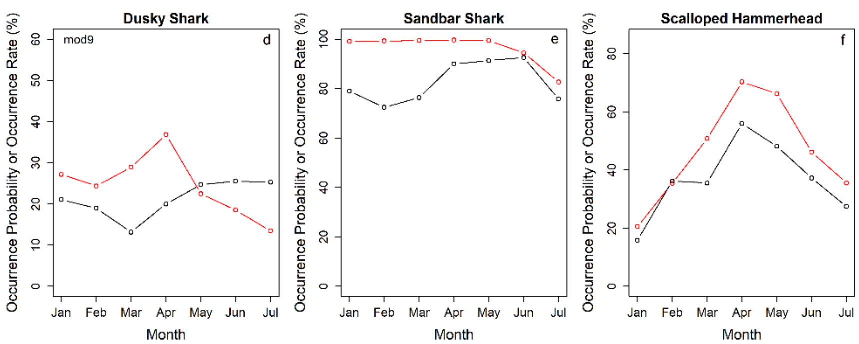
Metric 4



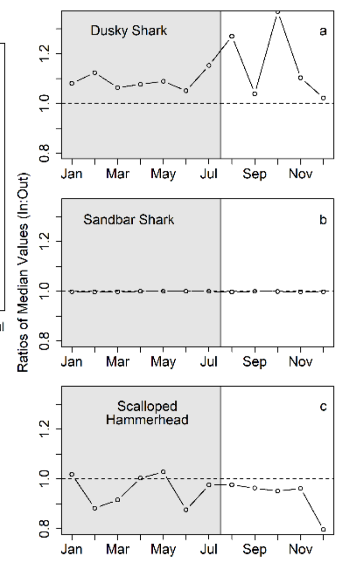
Option 9 - Area extended to the south; Status quo time



Metric 1

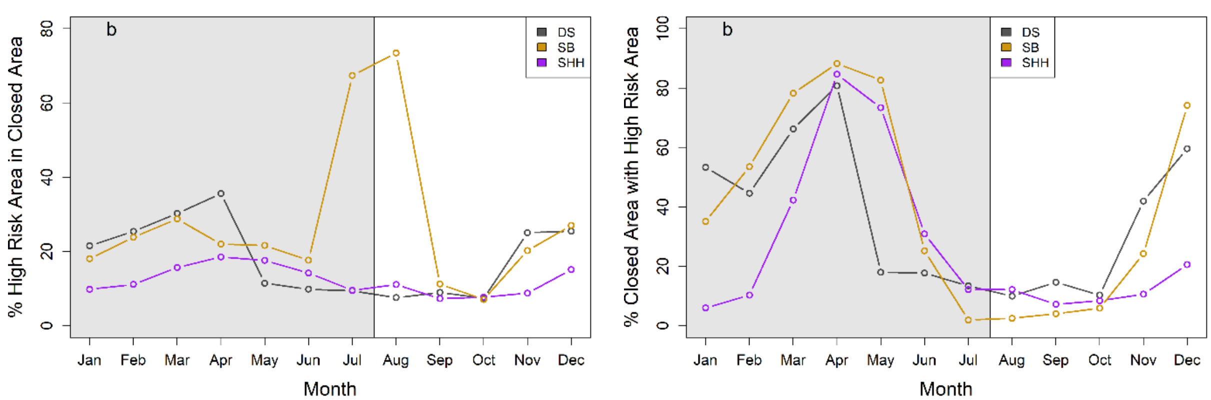


Metric 2

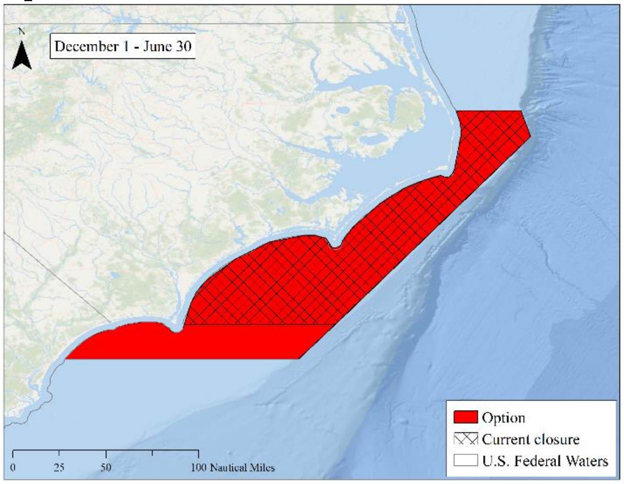


Metric 3

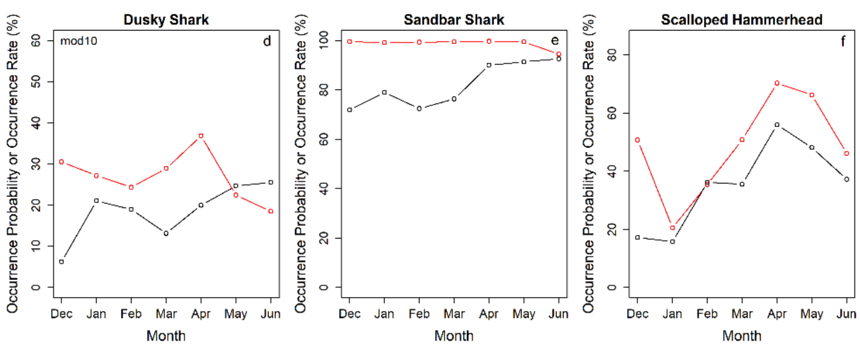
Metric 4



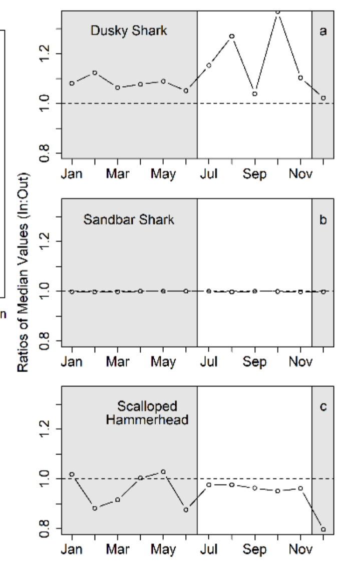
Option 10 - Area extended to the south; Time shifted by one month



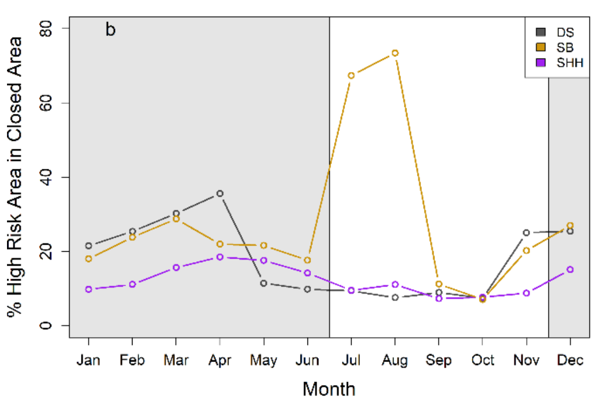
Metric 1



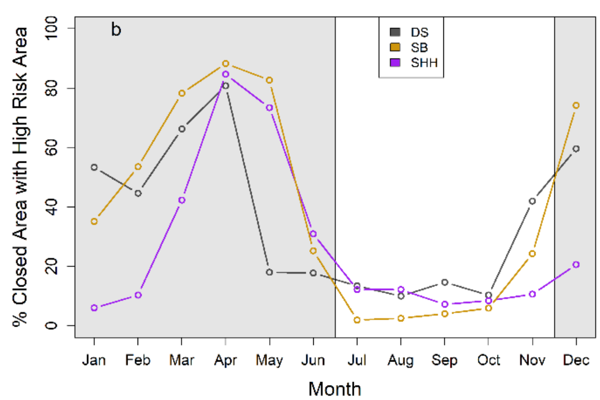
Metric 2



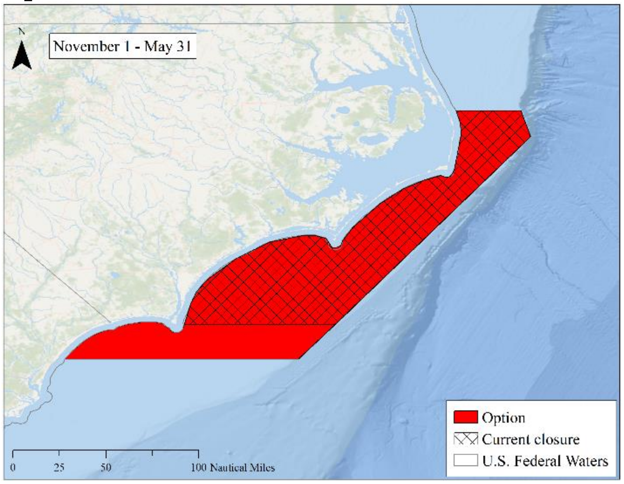
Metric 3



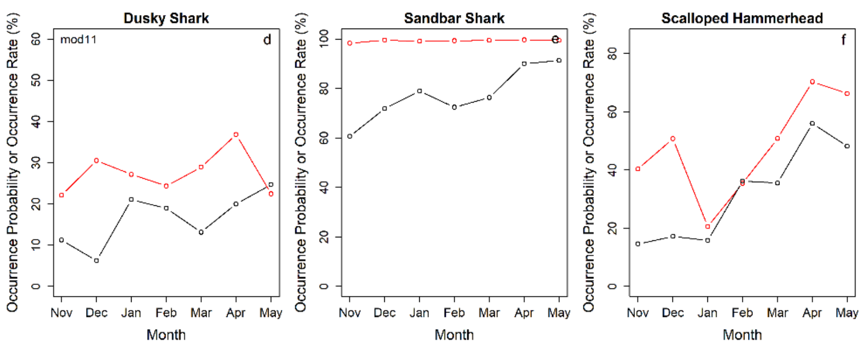
Metric 4



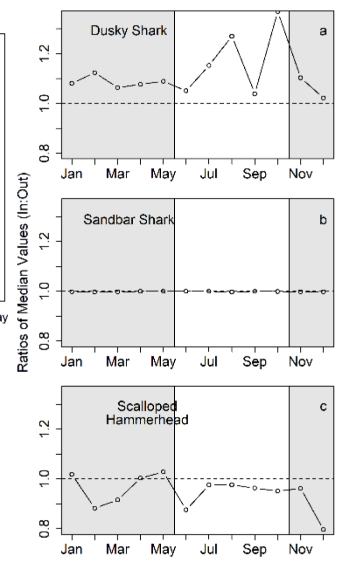
Option 11 - Area extended to the south; Time shifted by two months



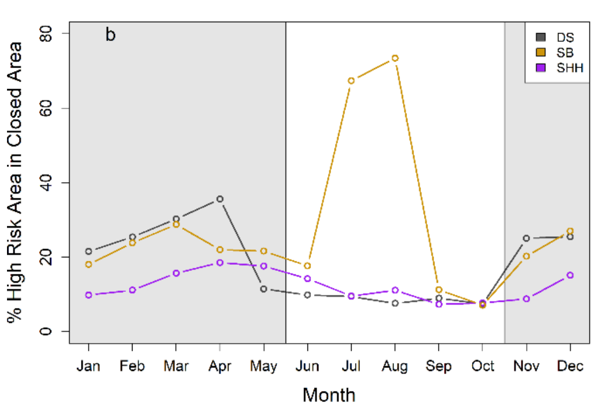
Metric 1



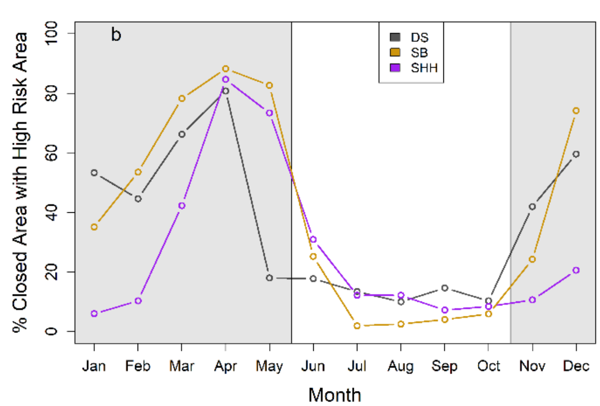
Metric 2



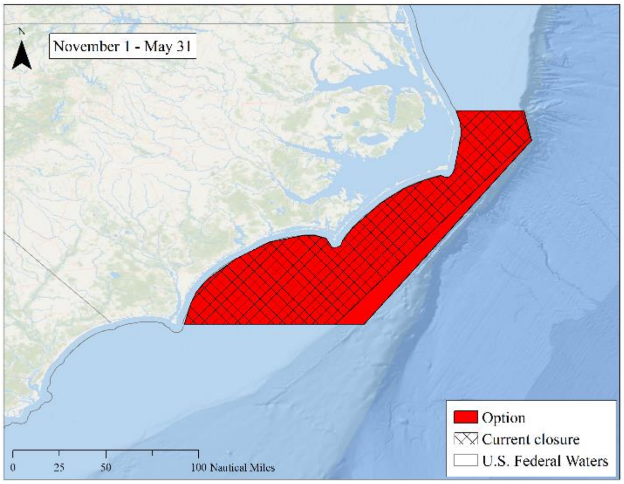
Metric 3



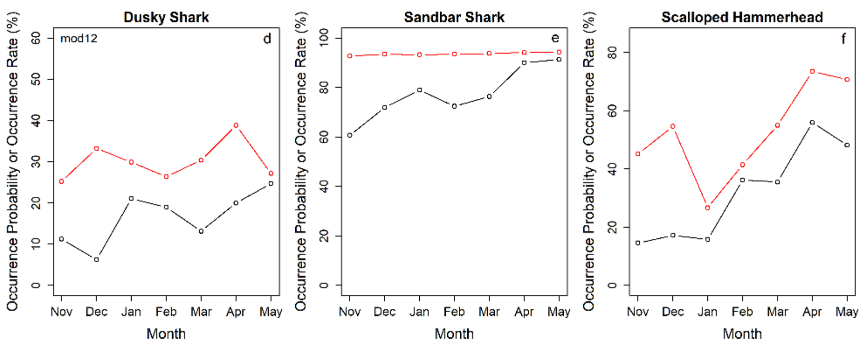
Metric 4



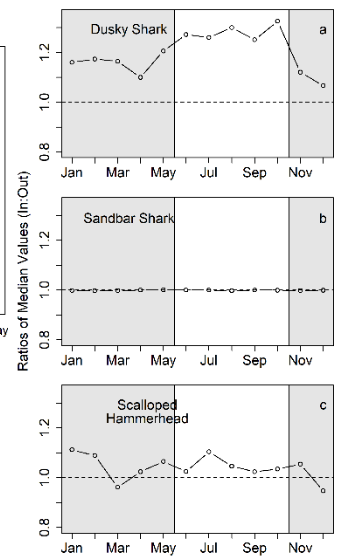
Option 12 (Preferred Sub-Alternative) - Area extended east slightly; Time shifted by two months



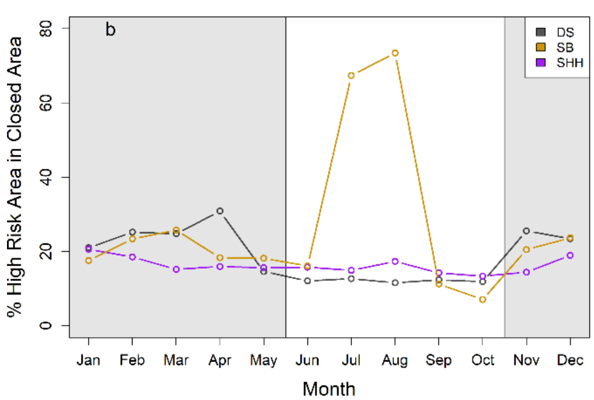
Metric 1



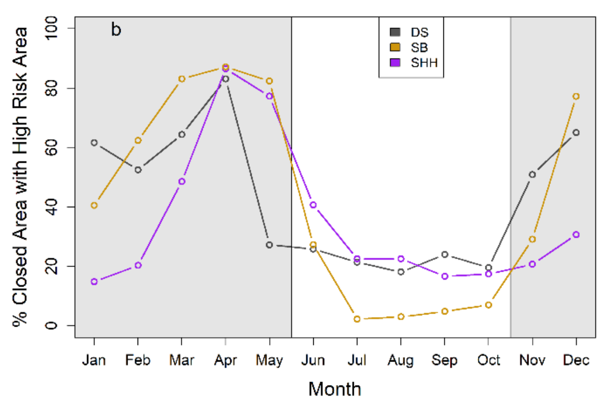
Metric 2



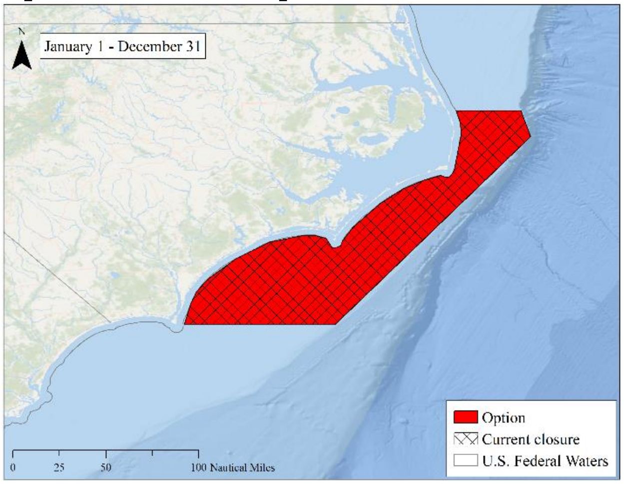
Metric 3



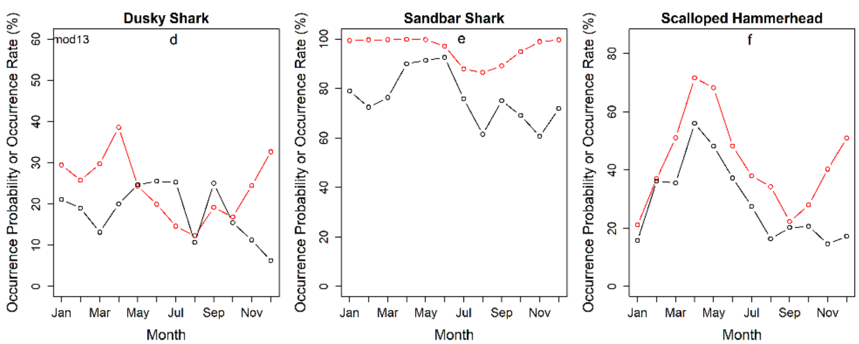
Metric 4



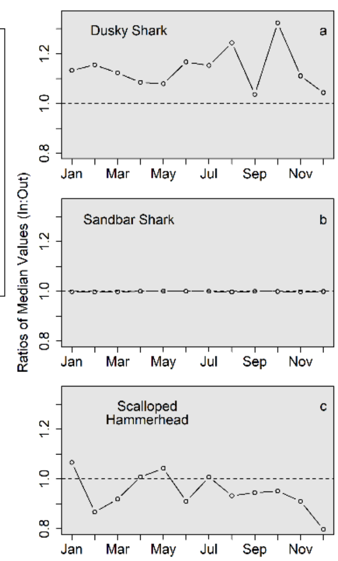
Option 13 - Status quo area; Time extended to year round



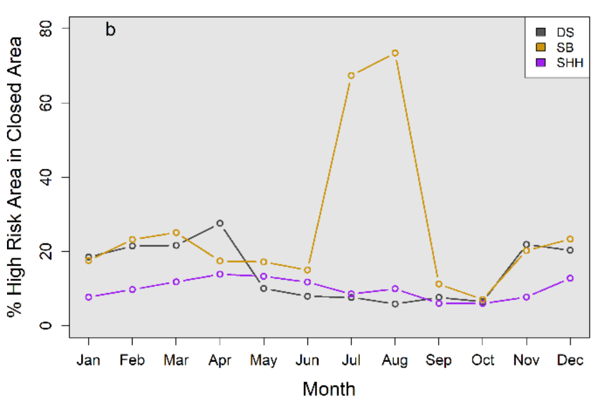
Metric 1



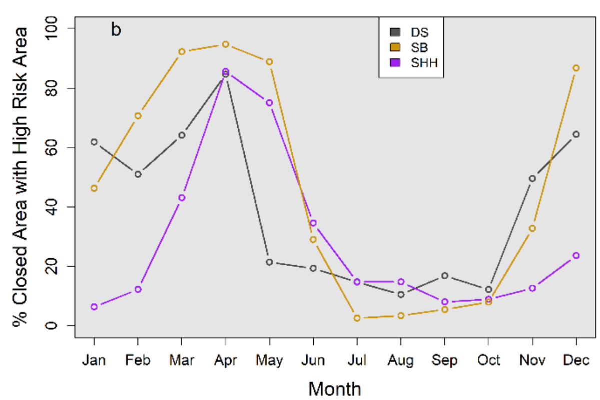
Metric 2



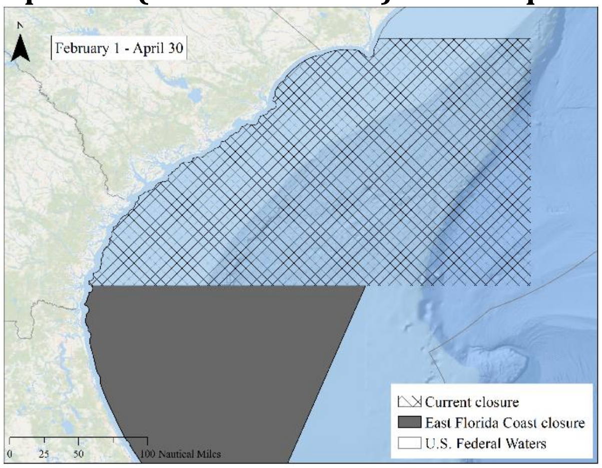
Metric 3



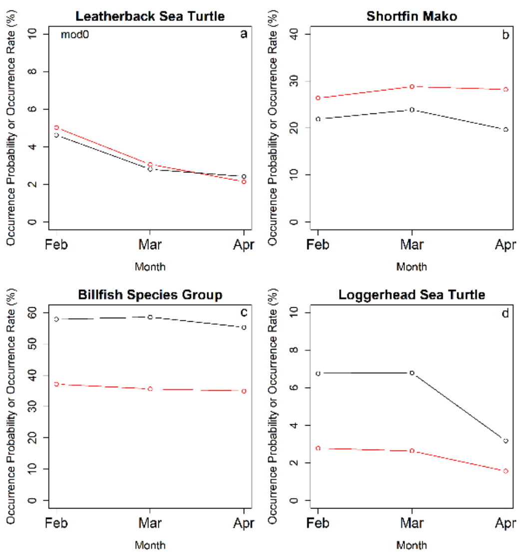
Metric 4



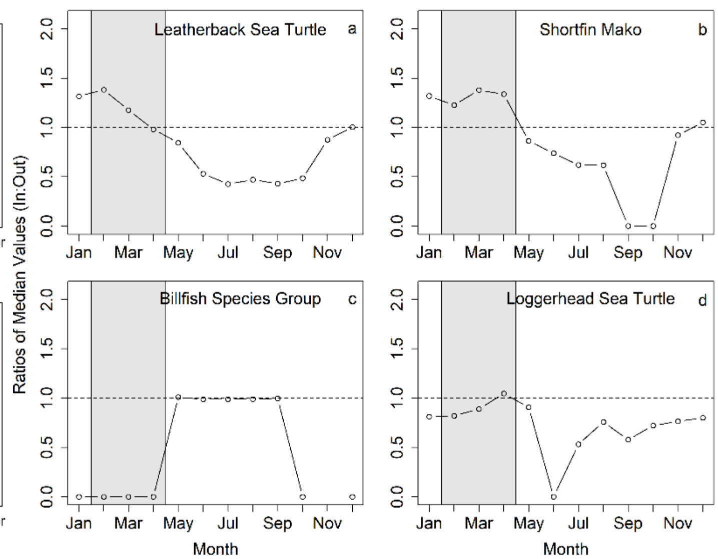
CHARLESTON BUMP CLOSED AREA
Option 0 (Sub-Alternative) - Status quo area and time



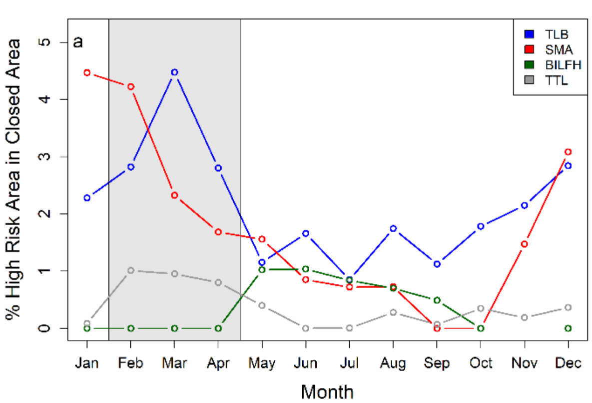
Metric 1



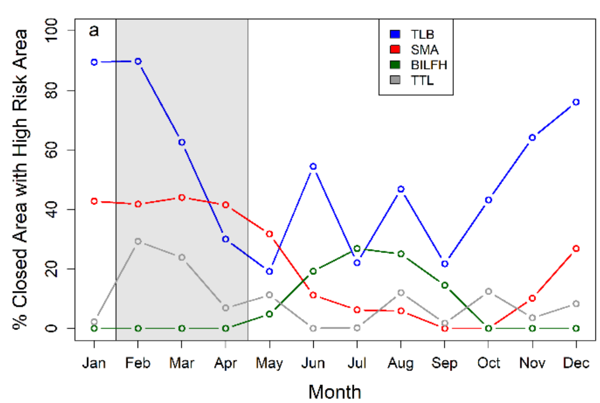
Metric 2



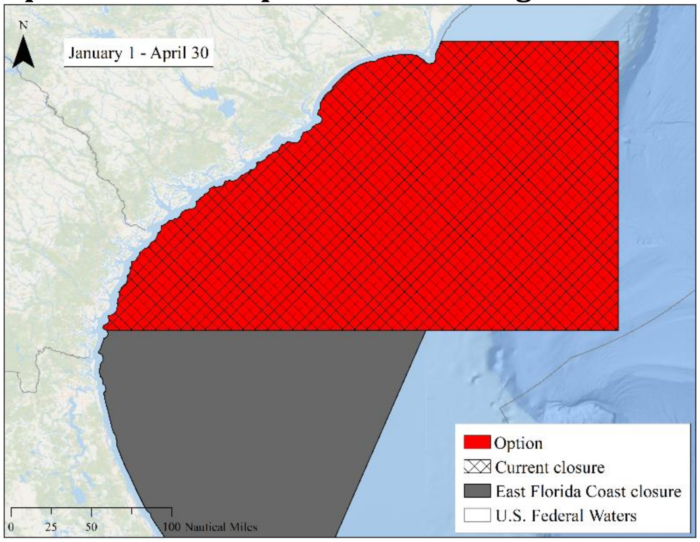
Metric 3



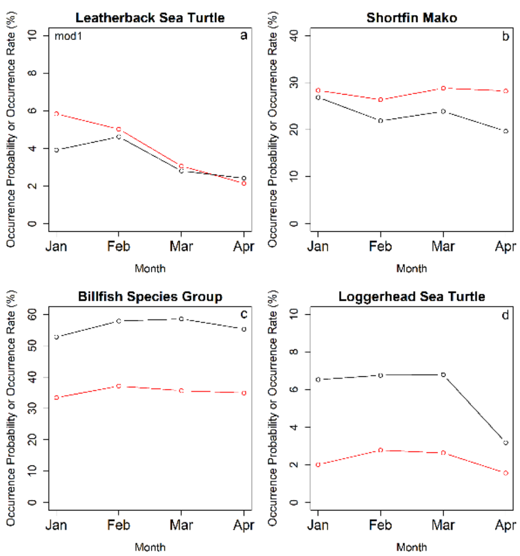
Metric 4



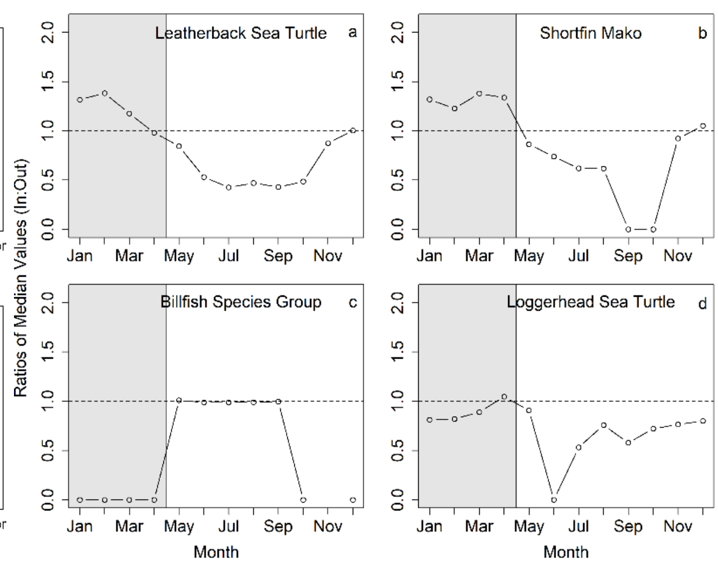
Option 1 - Status quo area; Time begins one month earlier



Metric 1

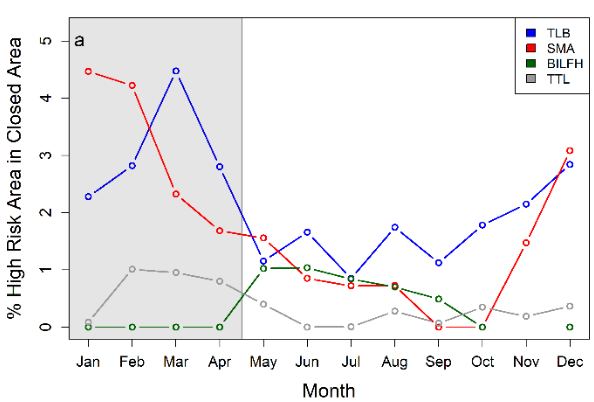


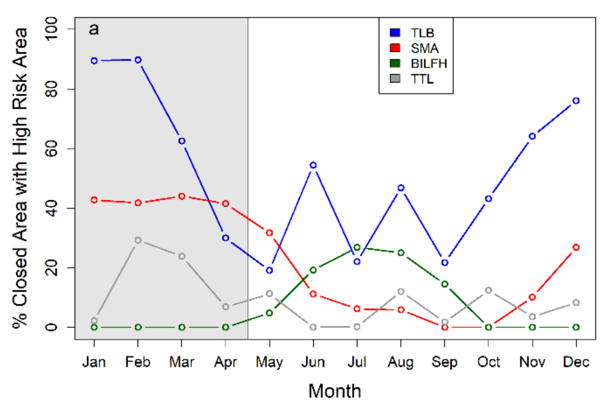
Metric 2



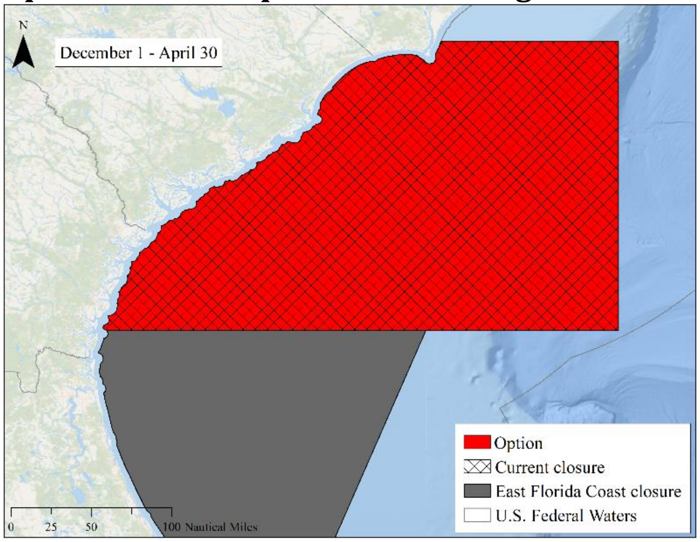
Metric 3

Metric 4

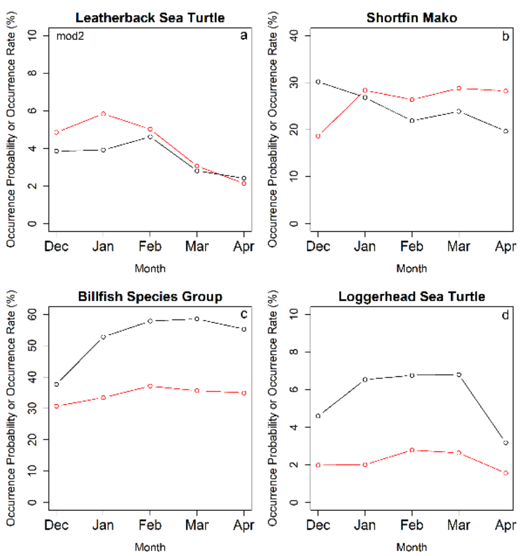




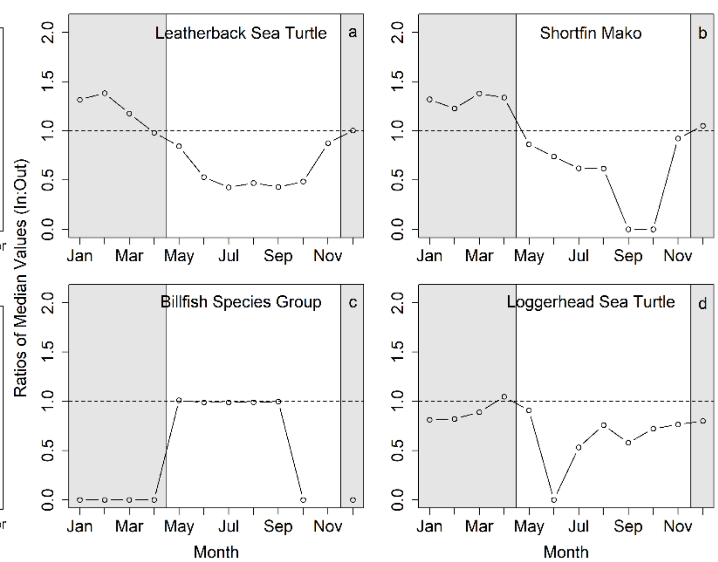
Option 2 - Status quo area; Time begins two months earlier



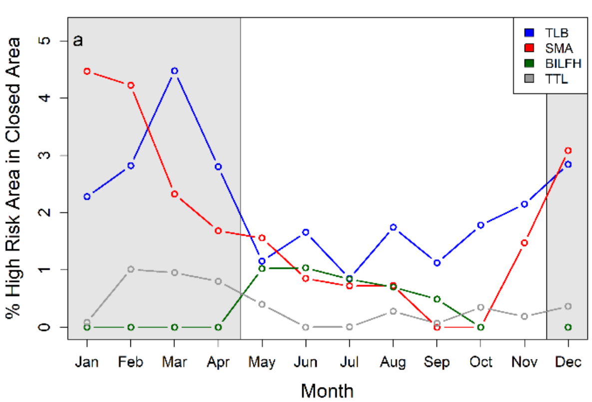
Metric 1



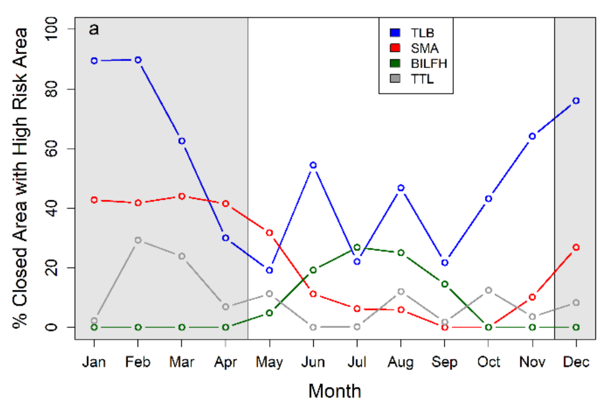
Metric 2



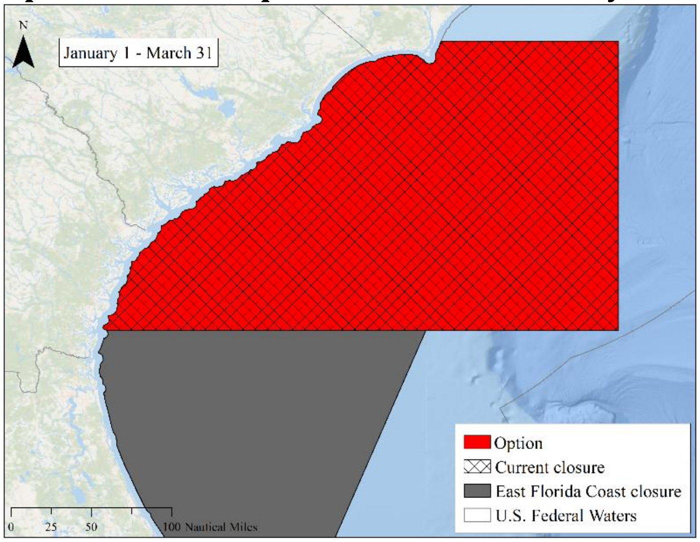
Metric 3



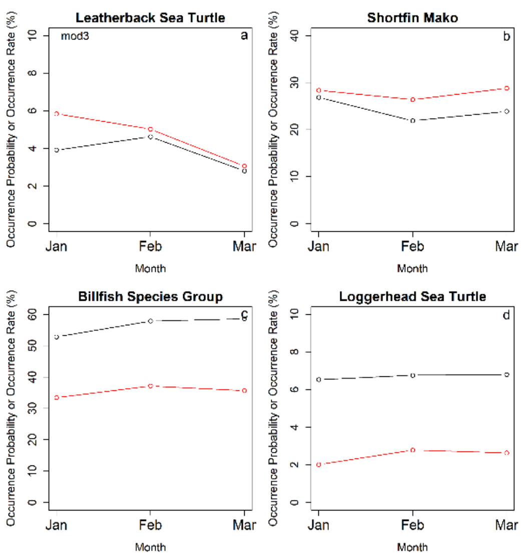
Metric 4



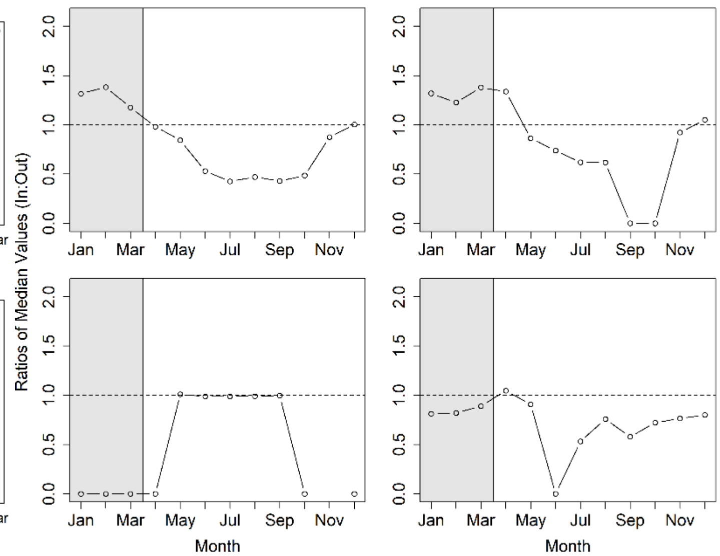
Option 3 - Status quo area; Time shifted by one month



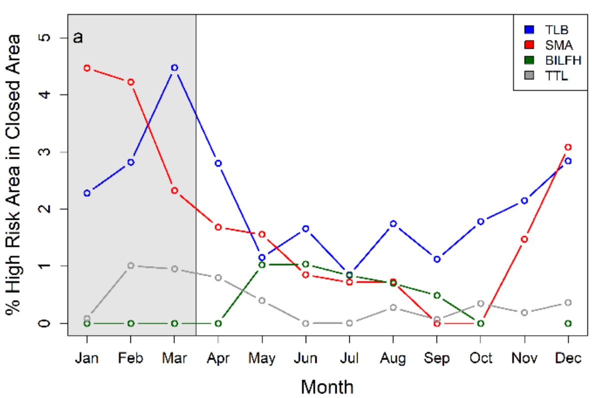
Metric 1



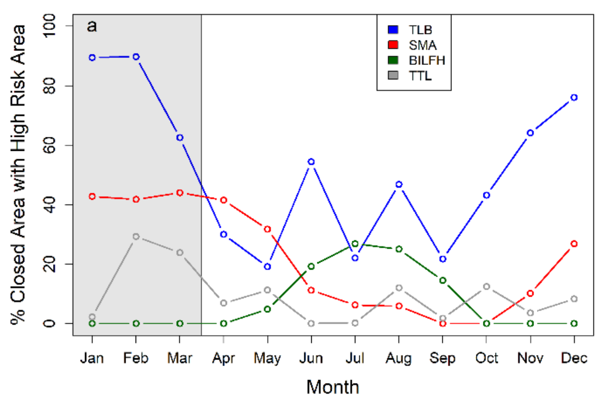
Metric 2



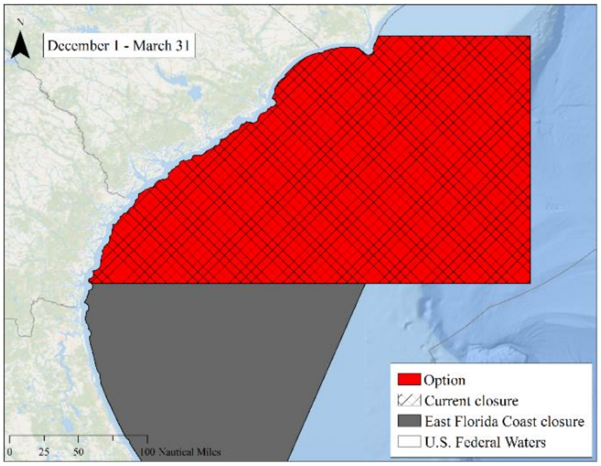
Metric 3



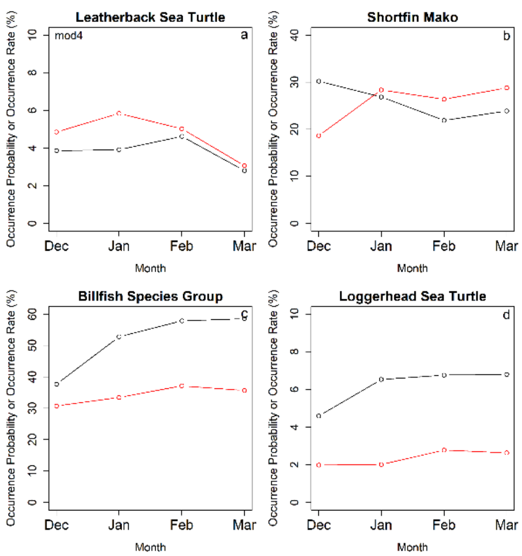
Metric 4



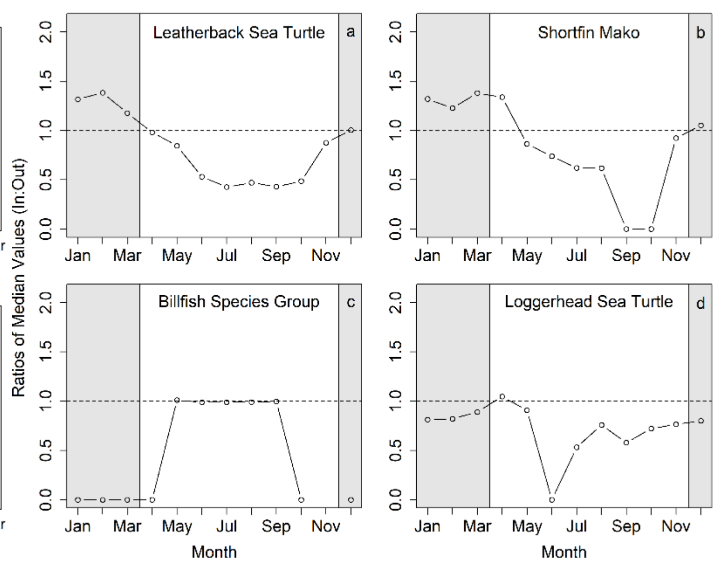
Option 4 (Sub-Alternative) - Status quo area; Time begins two months earlier and ends one month earlier



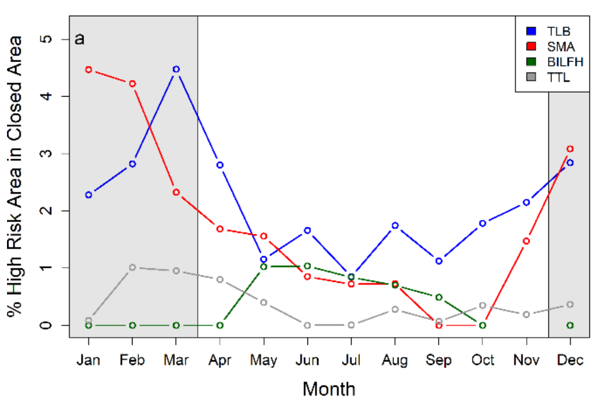
Metric 1



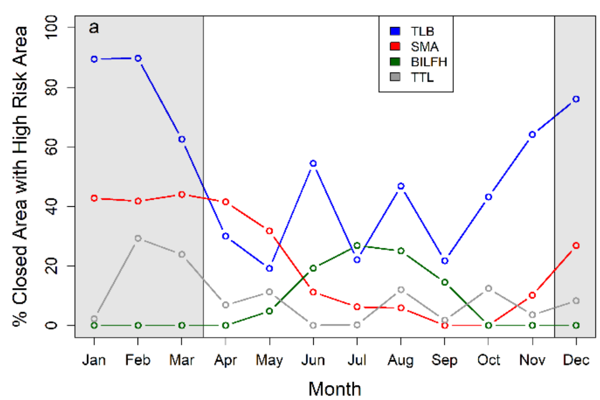
Metric 2



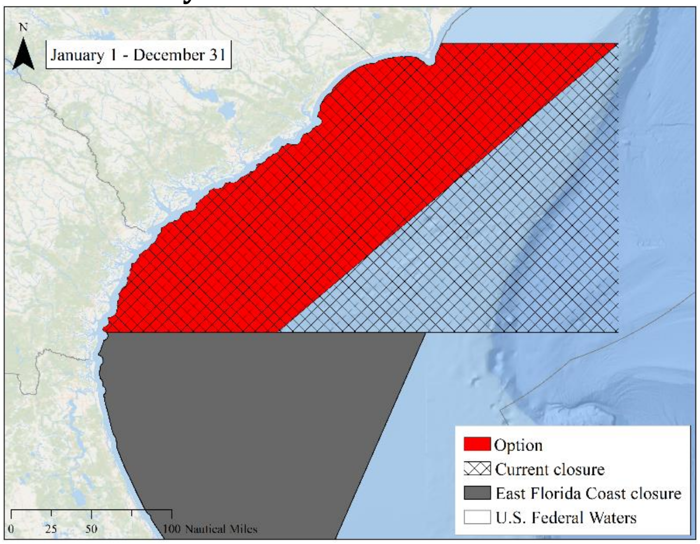
Metric 3



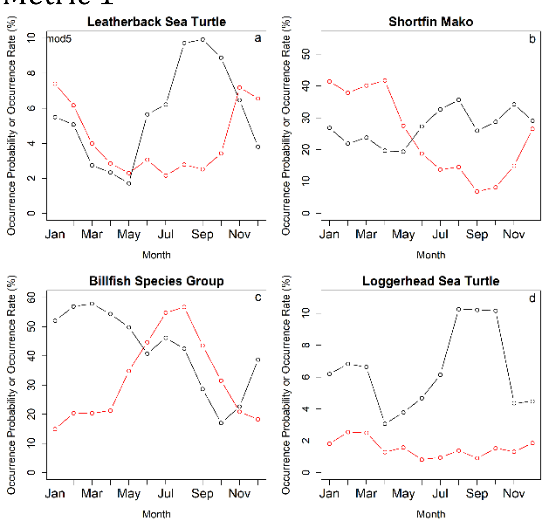
Metric 4



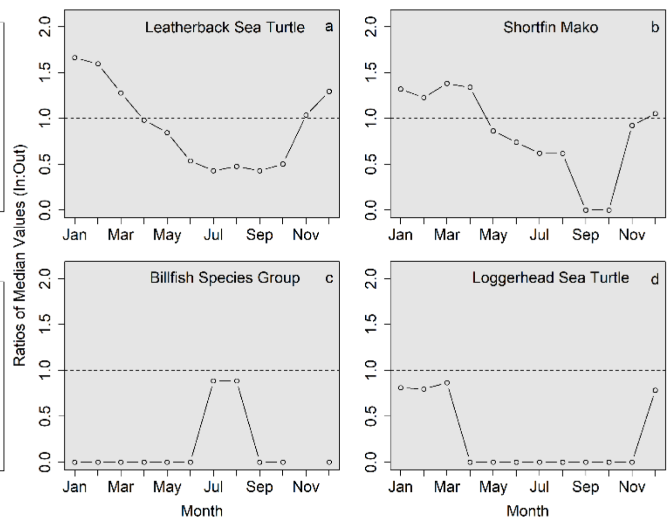
Option 5 (Preferred Sub-Alternative) - Area reduced to west of diagonal; Time extended to year round



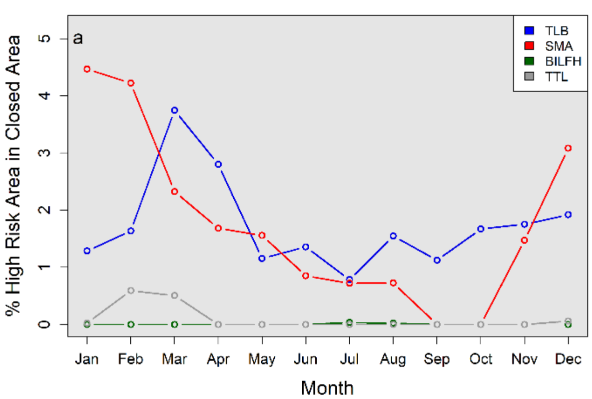
Metric 1



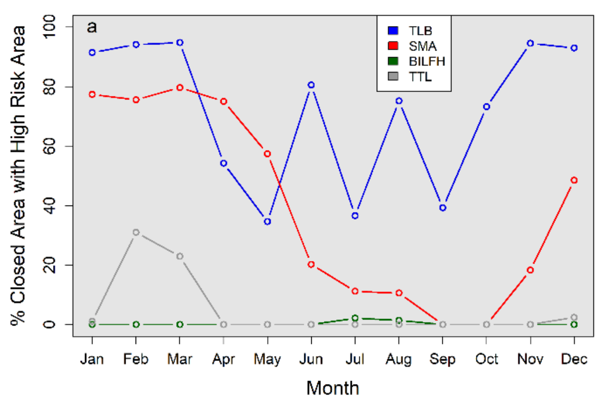
Metric 2



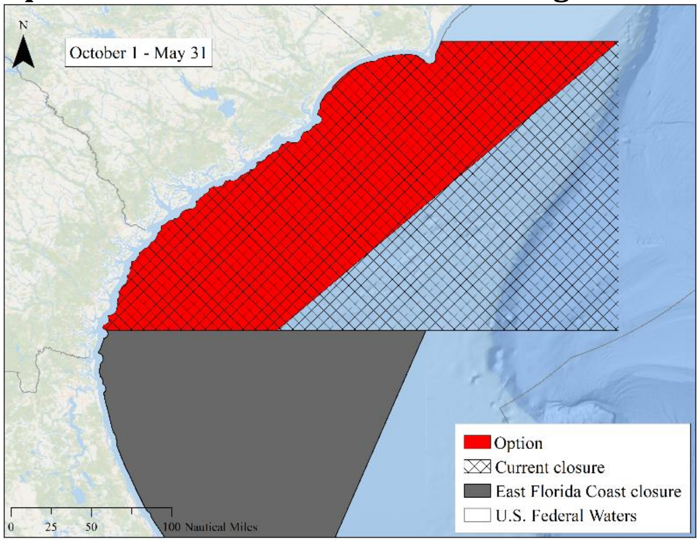
Metric 3



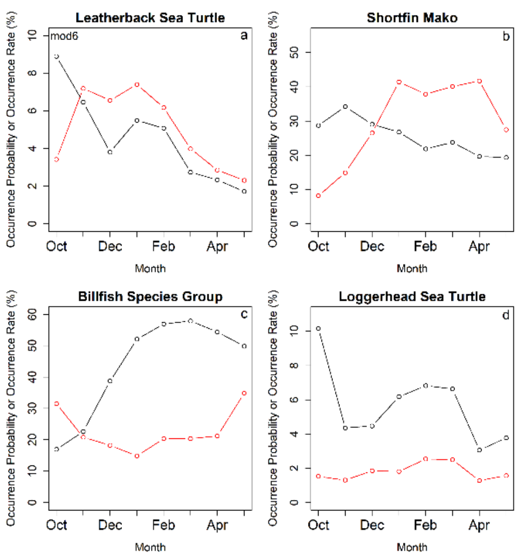
Metric 4



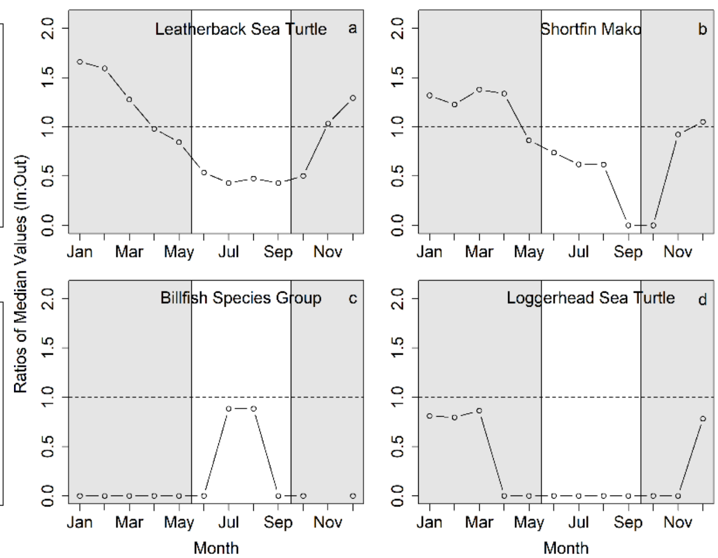
Option 6 - Area reduced to west of diagonal; Time extended to eight months



Metric 1

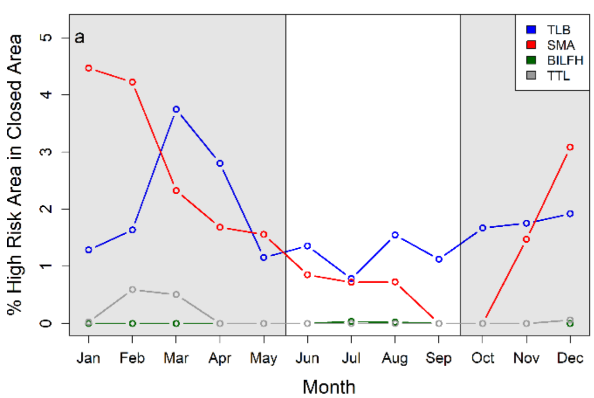


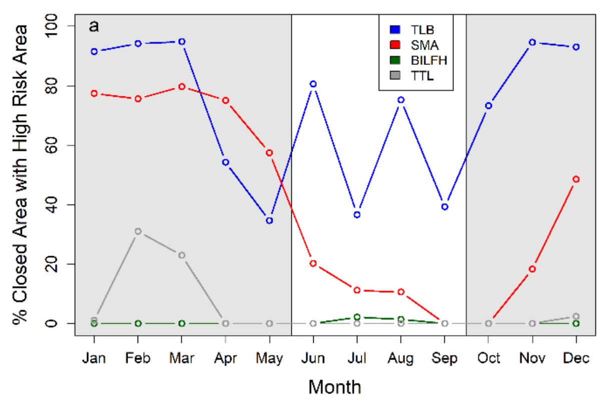
Metric 2



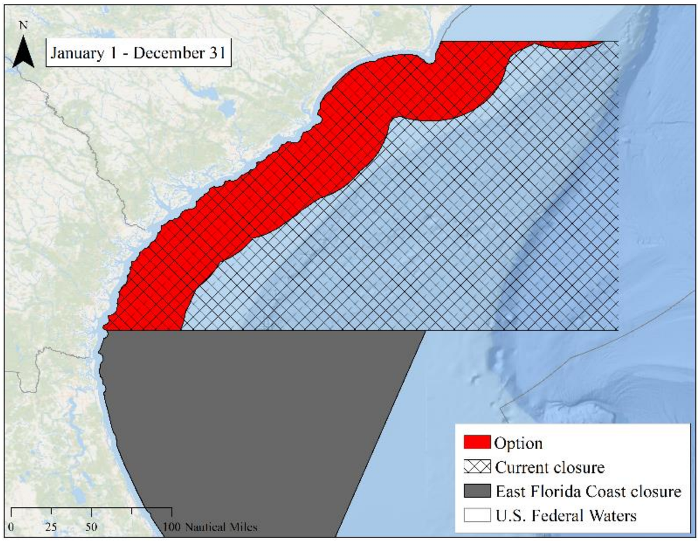
Metric 3

Metric 4

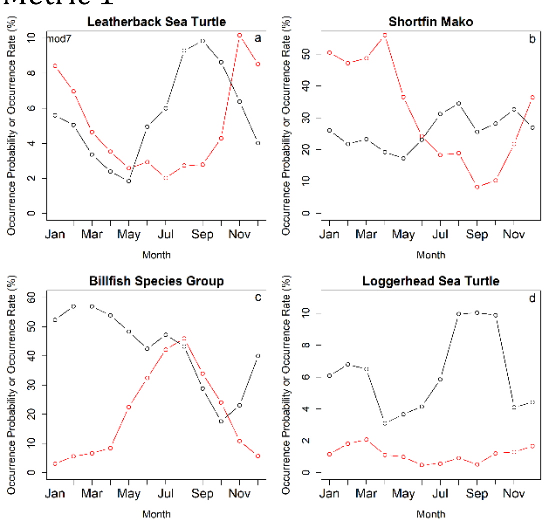




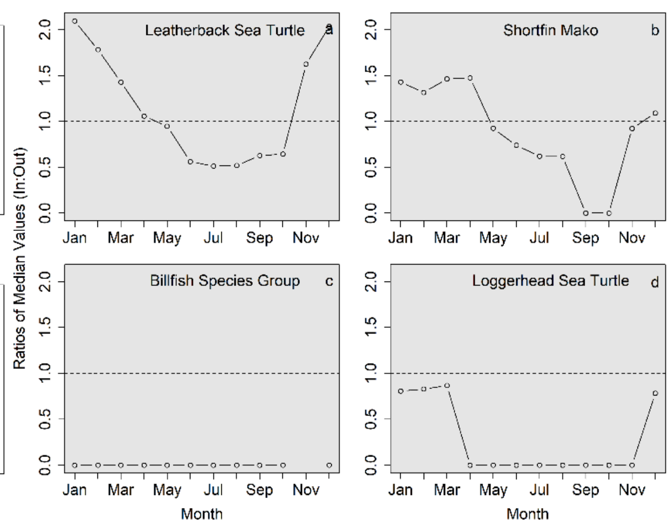
Option 7 - Area reduced to west of 40 nm from coastline; Time extended to year round



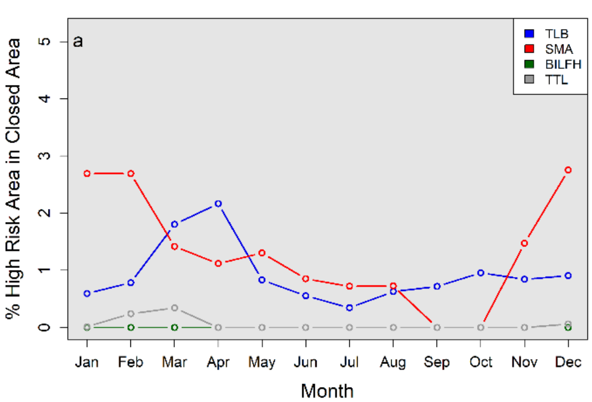
Metric 1



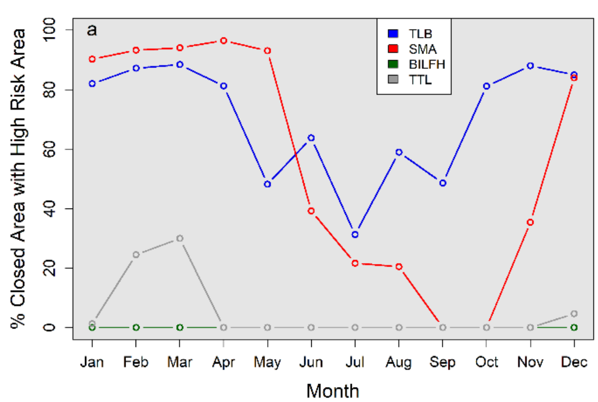
Metric 2



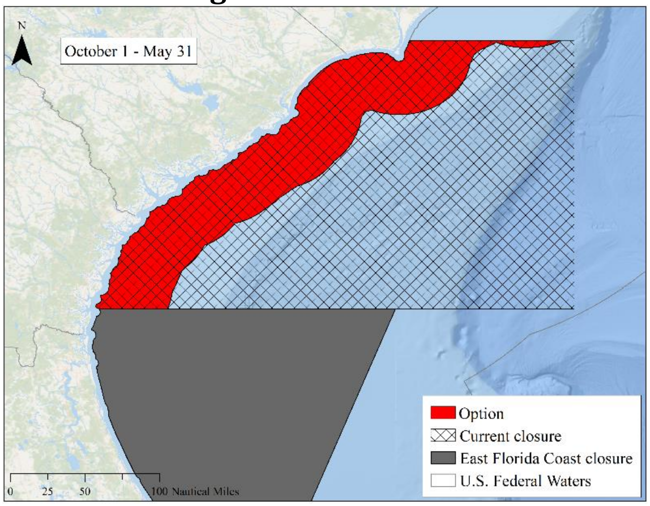
Metric 3



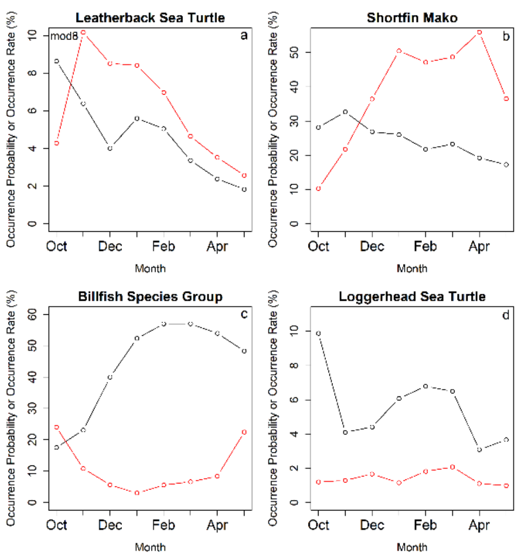
Metric 4



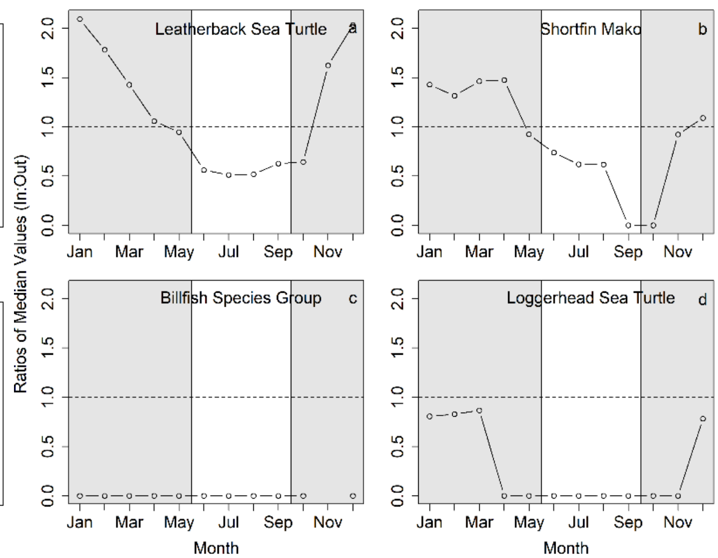
Option 8 (Sub-Alternative) - Area reduced to west of 40 nm from coastline; Time extended to eight months



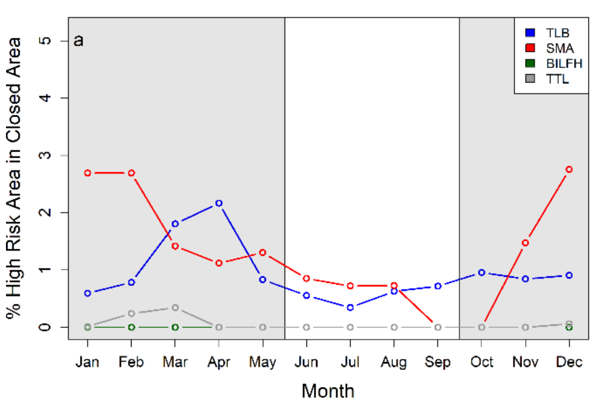
Metric 1



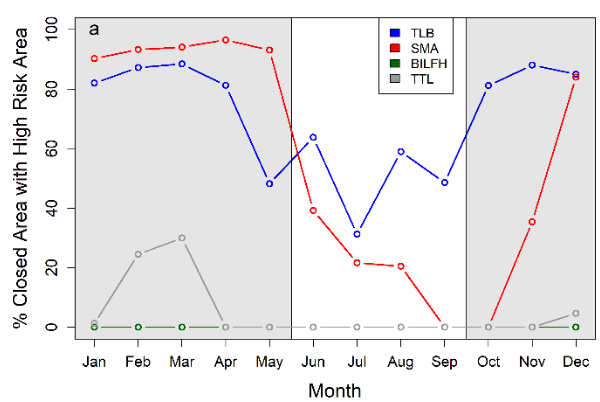
Metric 2



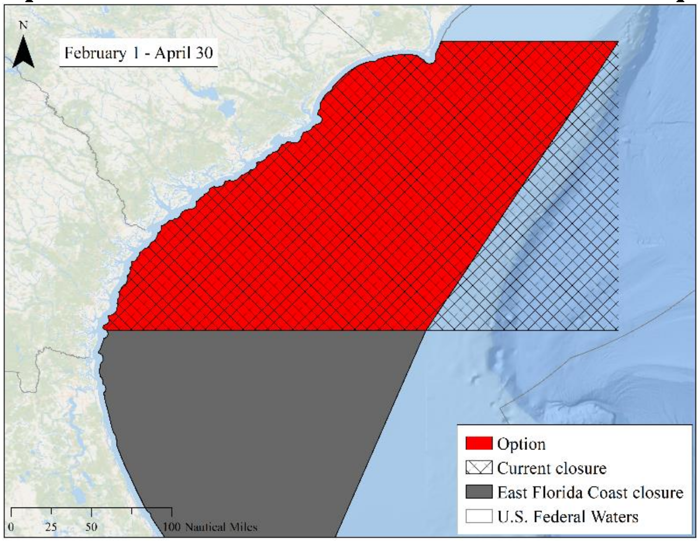
Metric 3



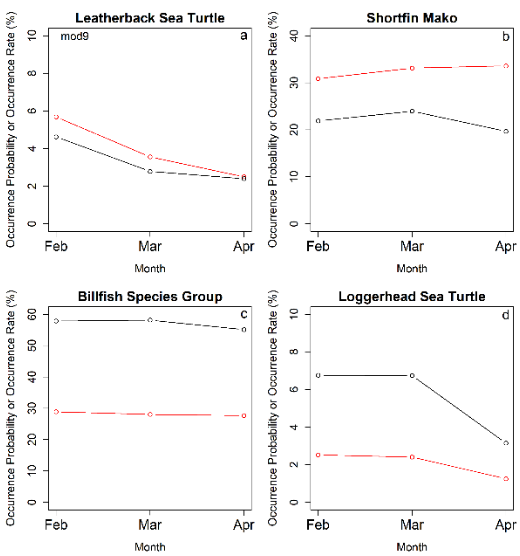
Metric 4



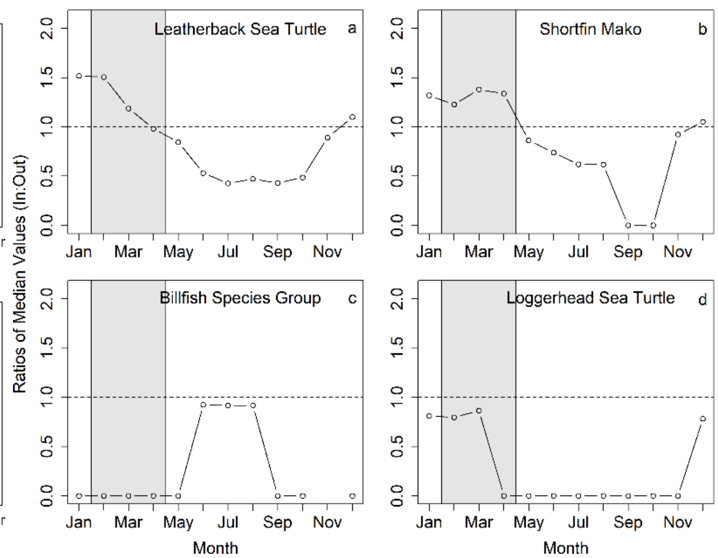
Option 9 - Area reduced from the east; Status quo time



Metric 1

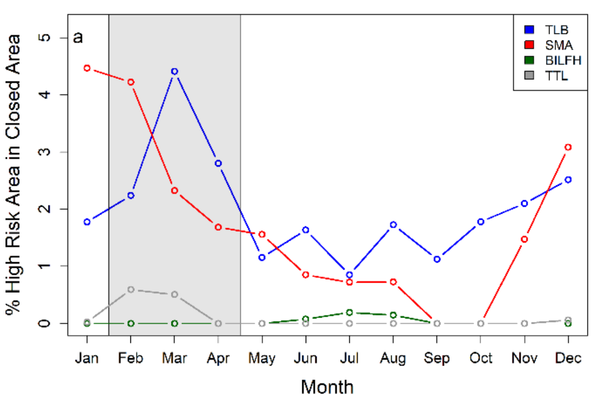


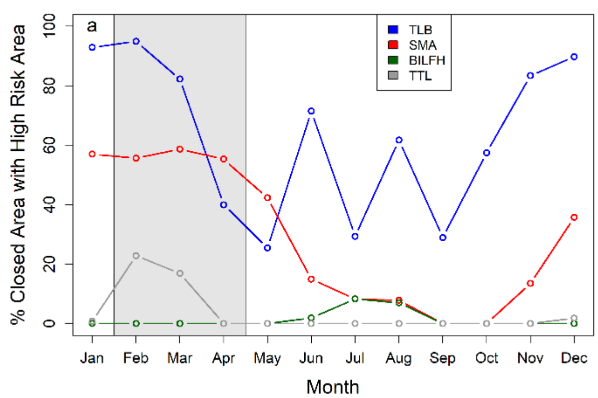
Metric 2



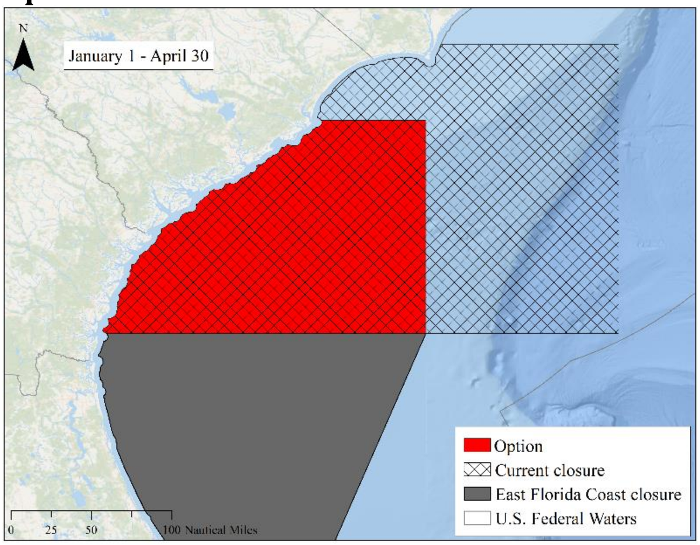
Metric 3

Metric 4

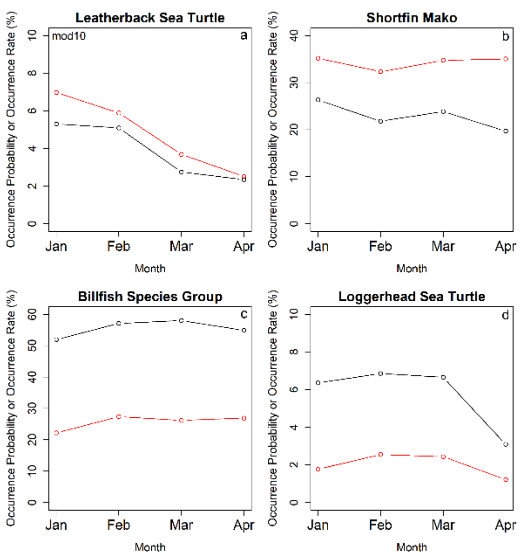




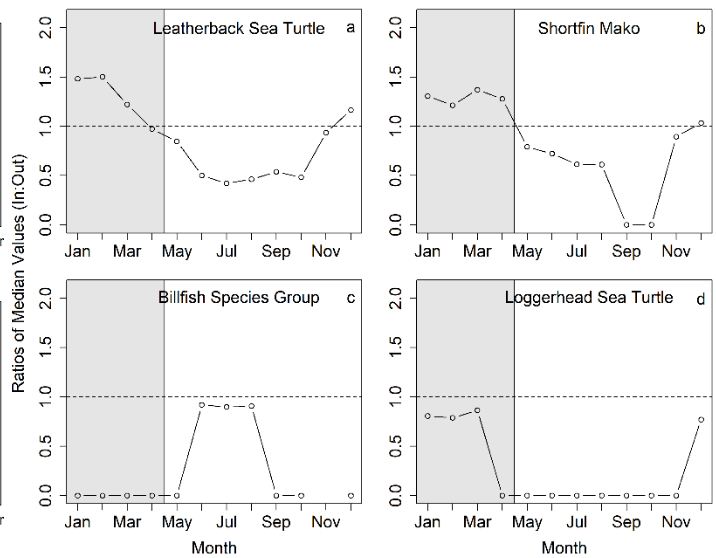
Option 10 - Area reduced from the east and north; Time begins one month earlier



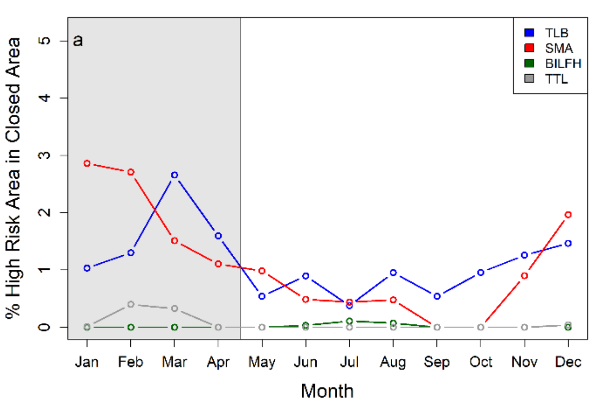
Metric 1



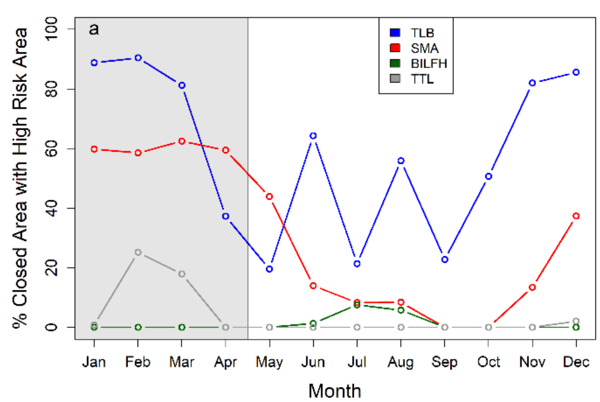
Metric 2



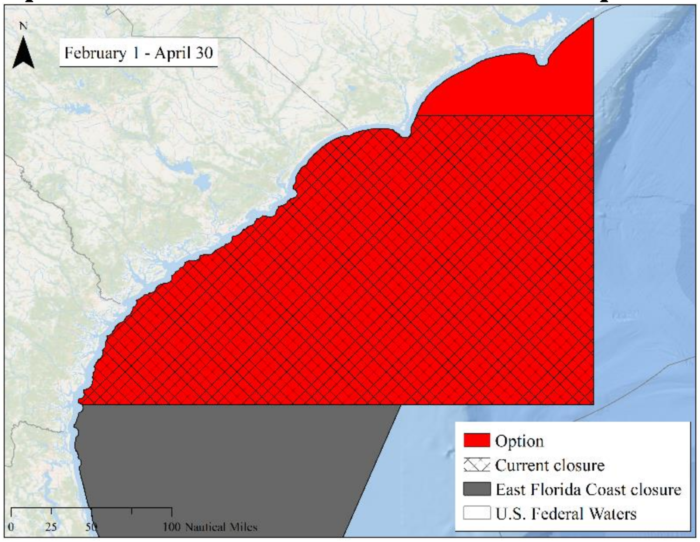
Metric 3



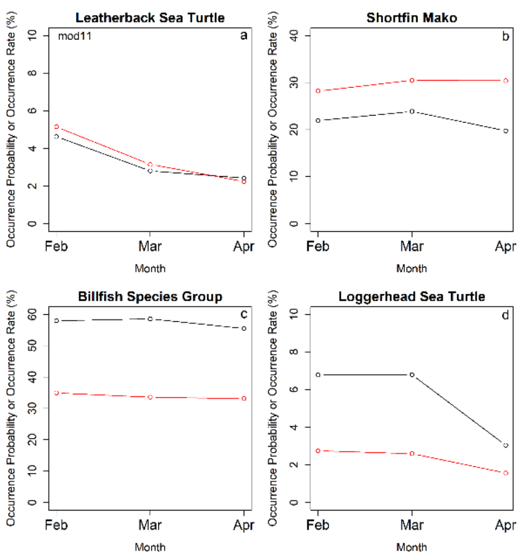
Metric 4



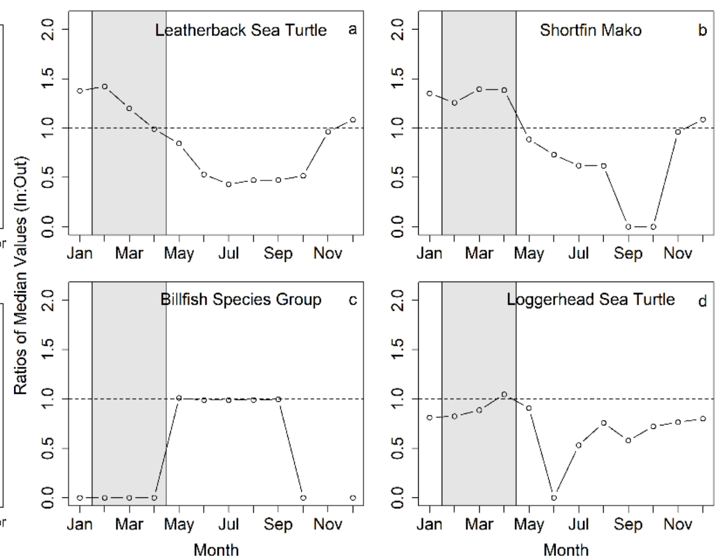
Option 11 - Area extended north; Status quo time



Metric 1

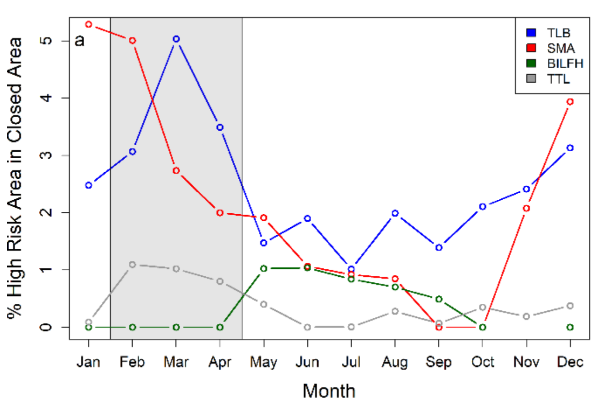


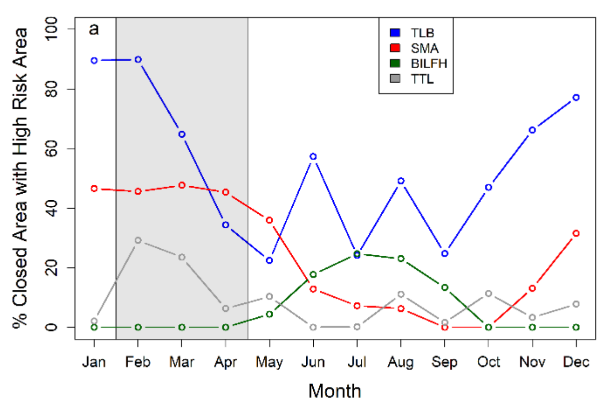
Metric 2



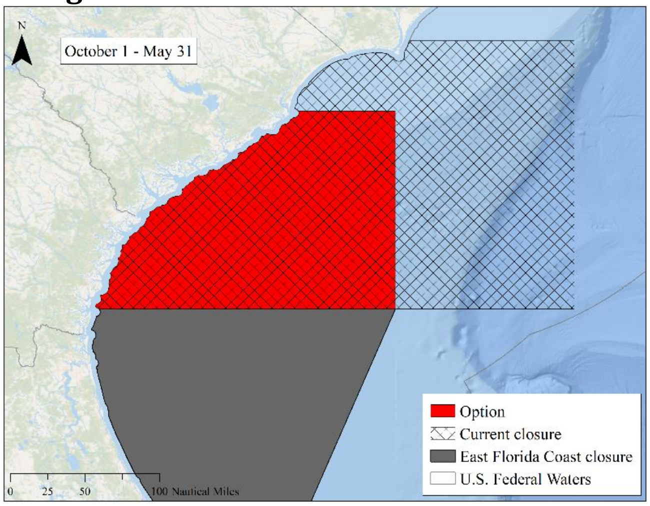
Metric 3

Metric 4

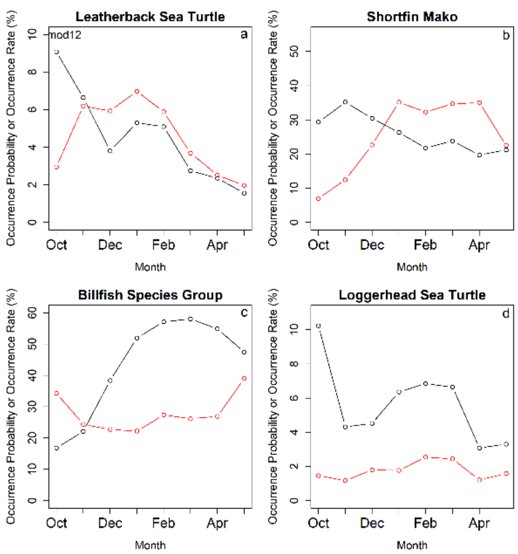




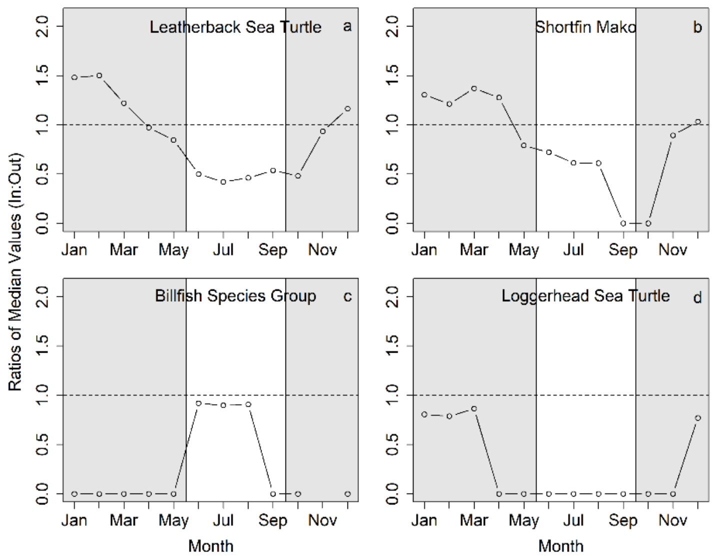
Option 12 (Sub-Alternative) - Area reduced from the east and north; Time extended to eight months



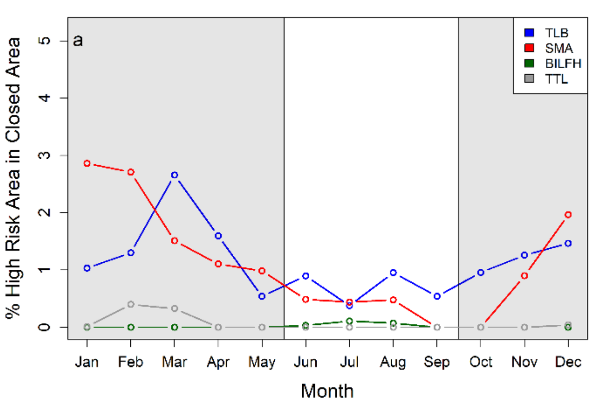
Metric 1



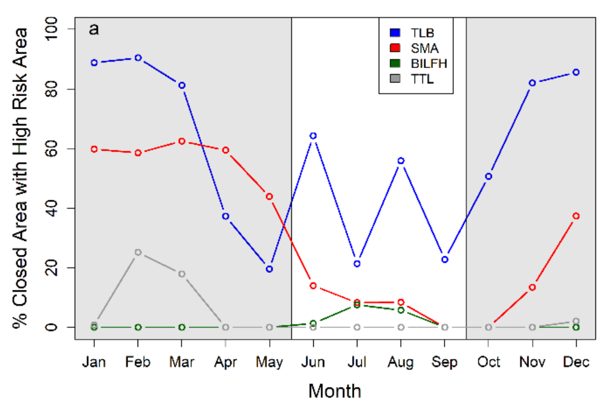
Metric 2



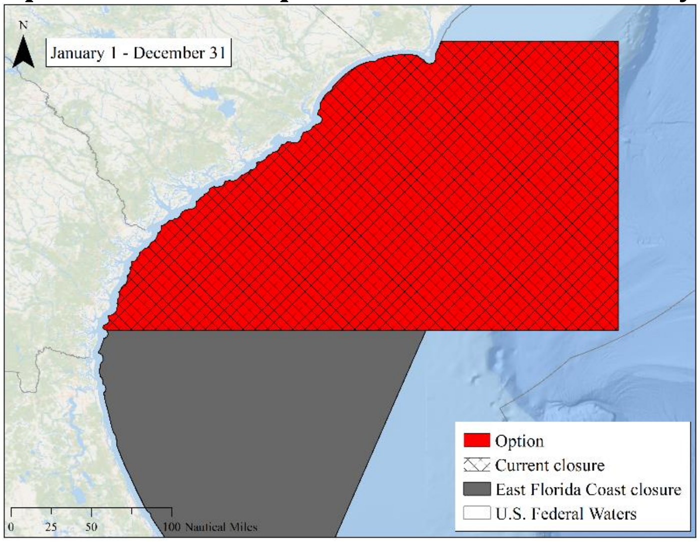
Metric 3



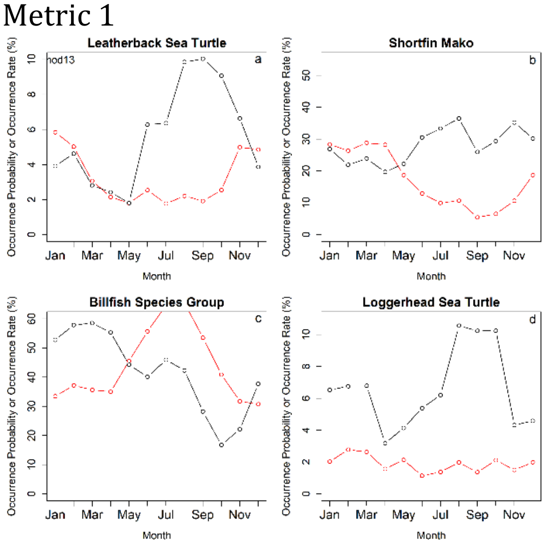
Metric 4



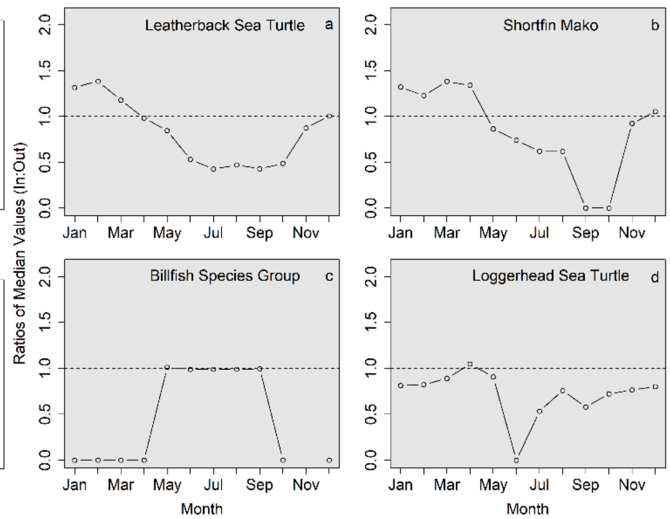
Option 13 - Status quo area; Time extended to year round



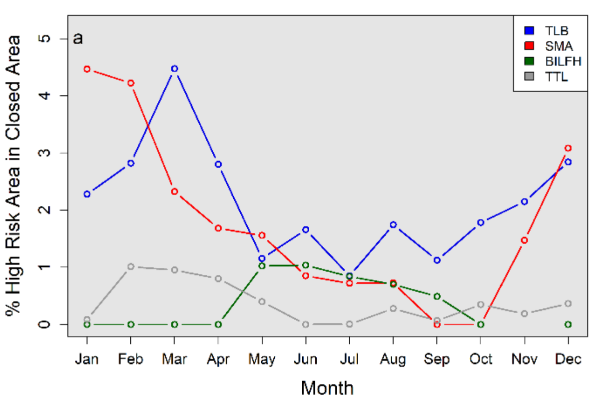
Metric 1



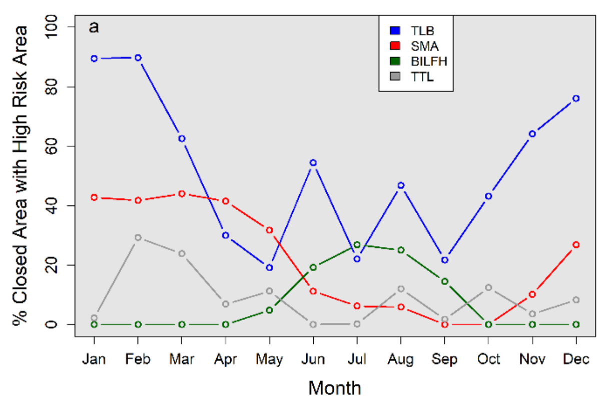
Metric 2



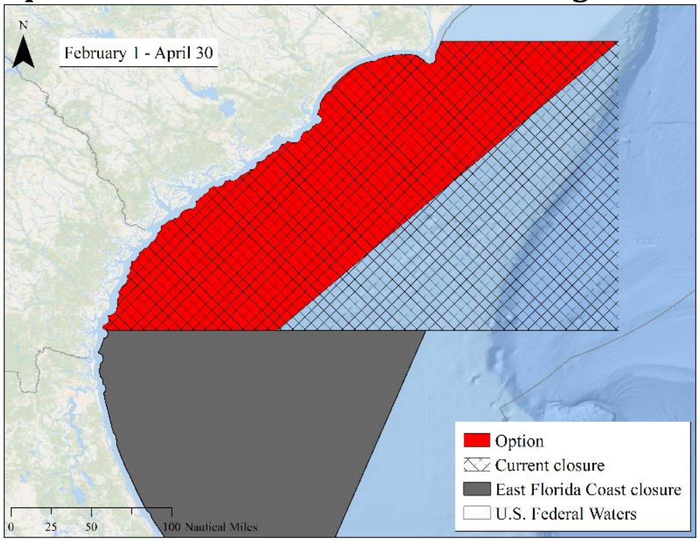
Metric 3



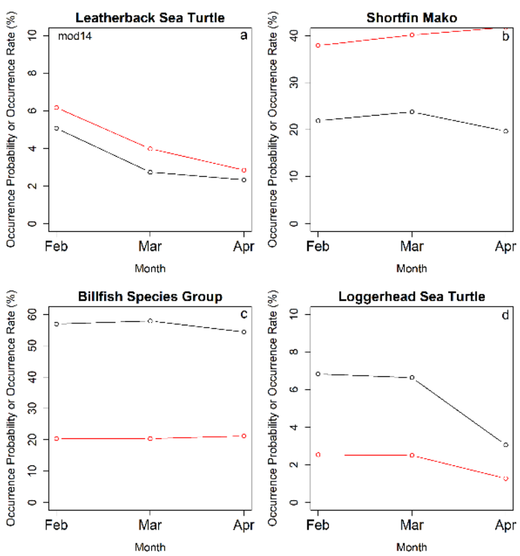
Metric 4



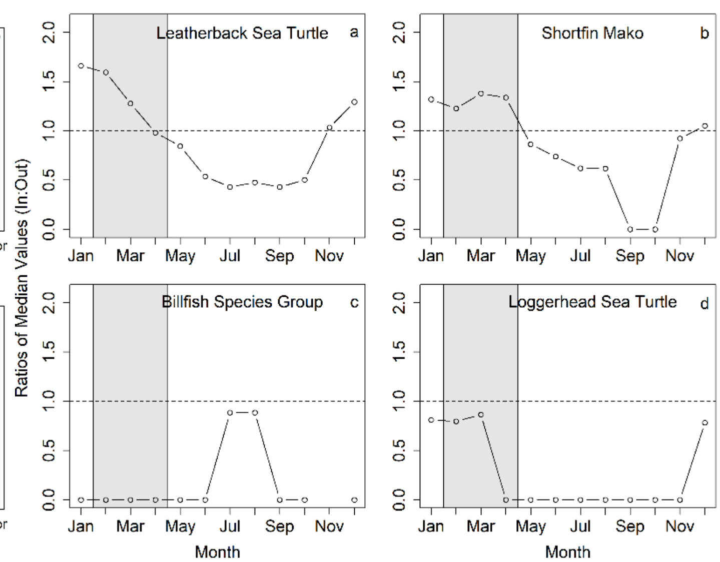
Option 14 - Area reduced to west of diagonal; Status quo time



Metric 1

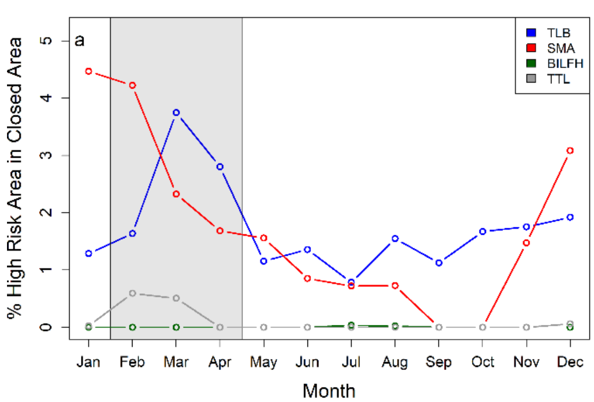


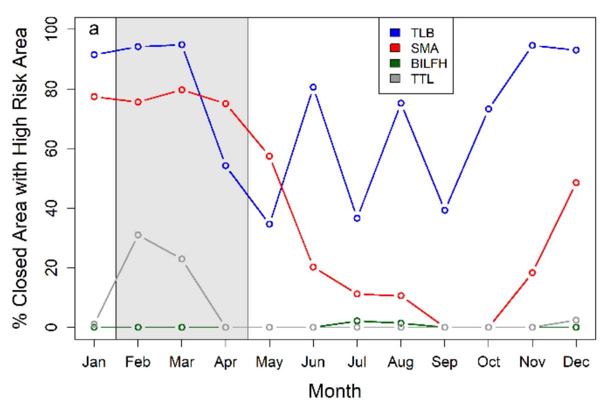
Metric 2



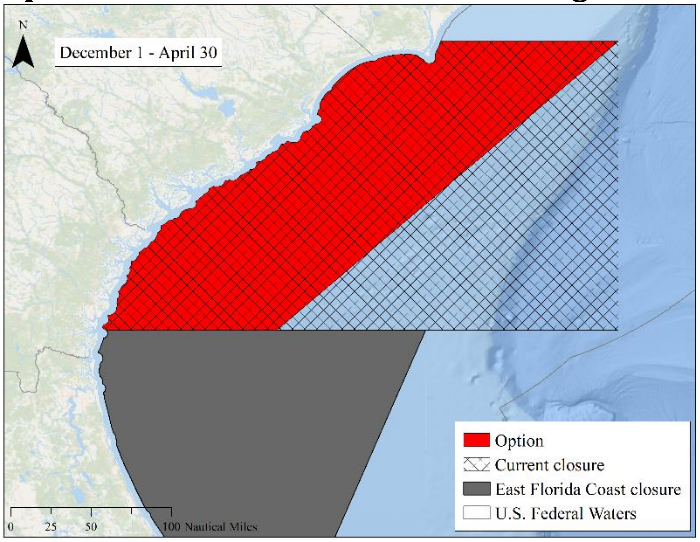
Metric 3

Metric 4

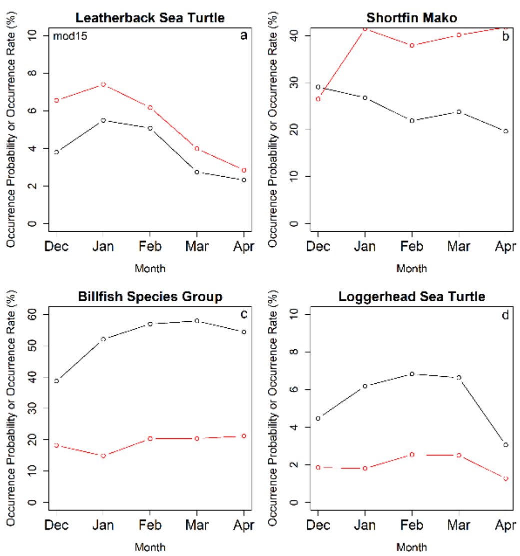




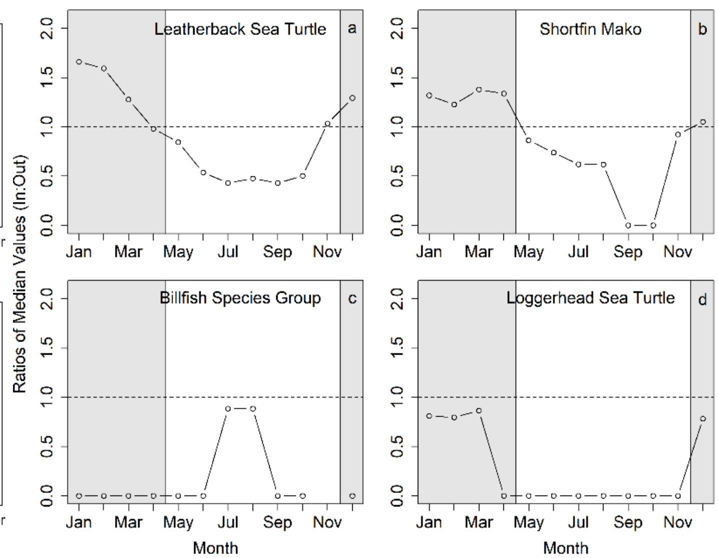
Option 15 - Area reduced to west of diagonal; Time begins two months earlier



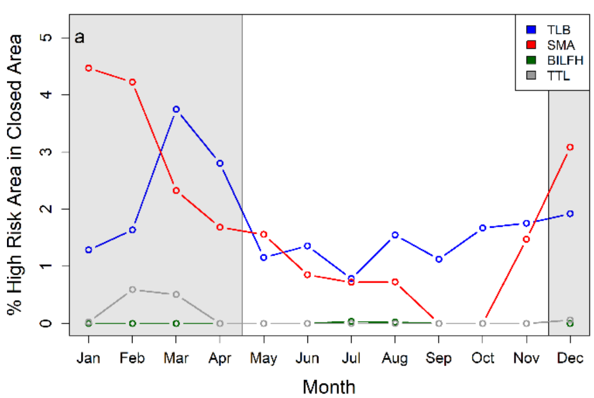
Metric 1



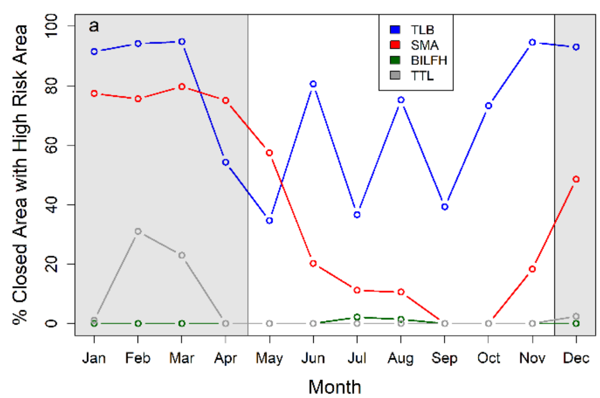
Metric 2



Metric 3

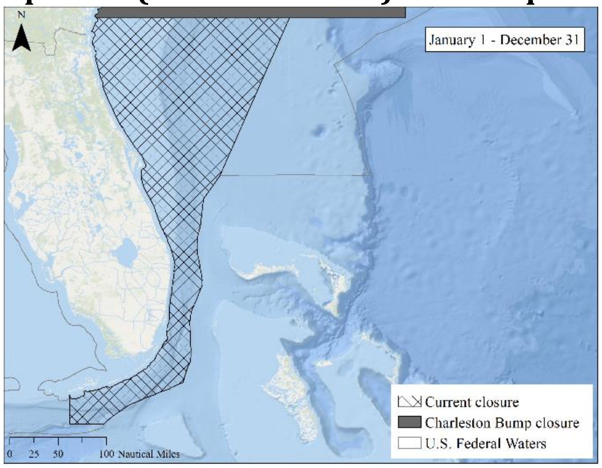


Metric 4

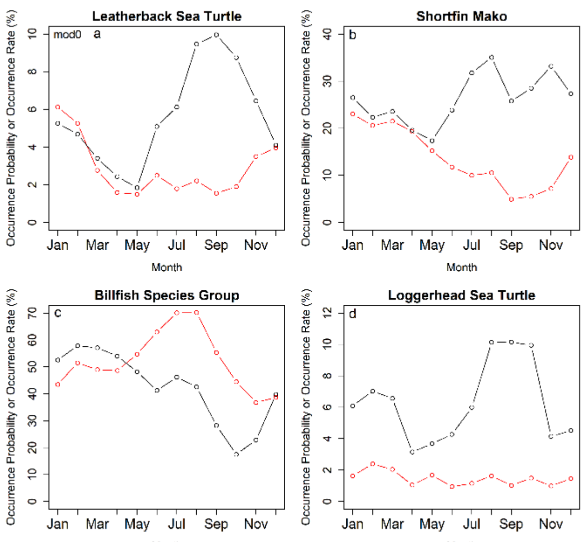


EAST FLORIDA COAST CLOSED AREA

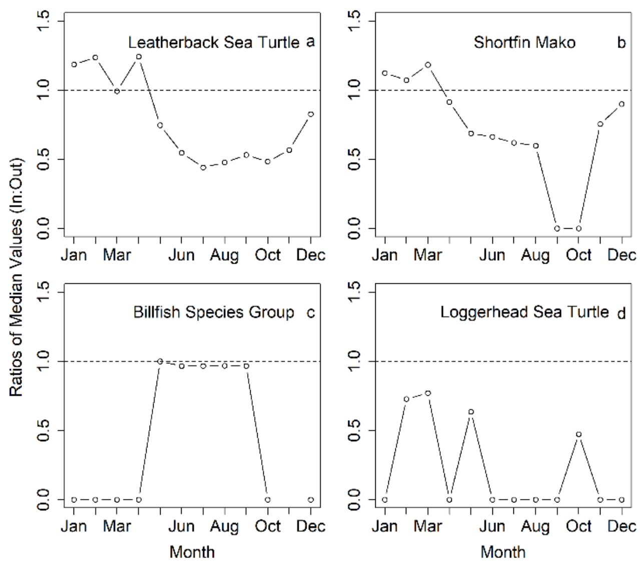
Option 0 (Sub-Alternative) - Status quo area and time



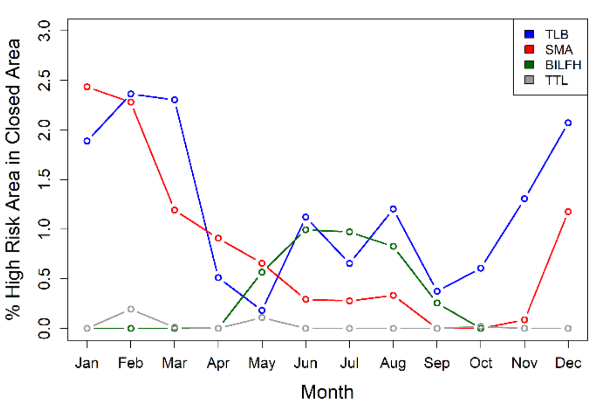
Metric 1



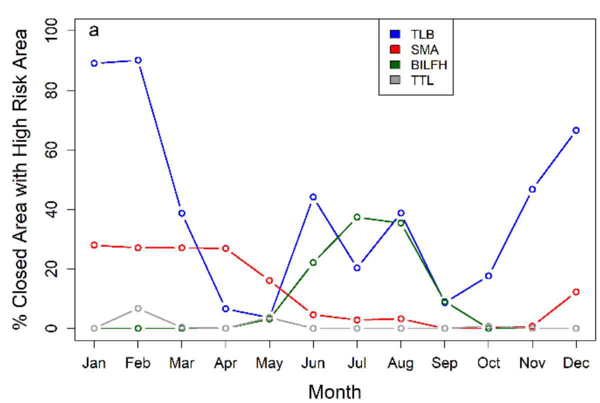
Metric 2



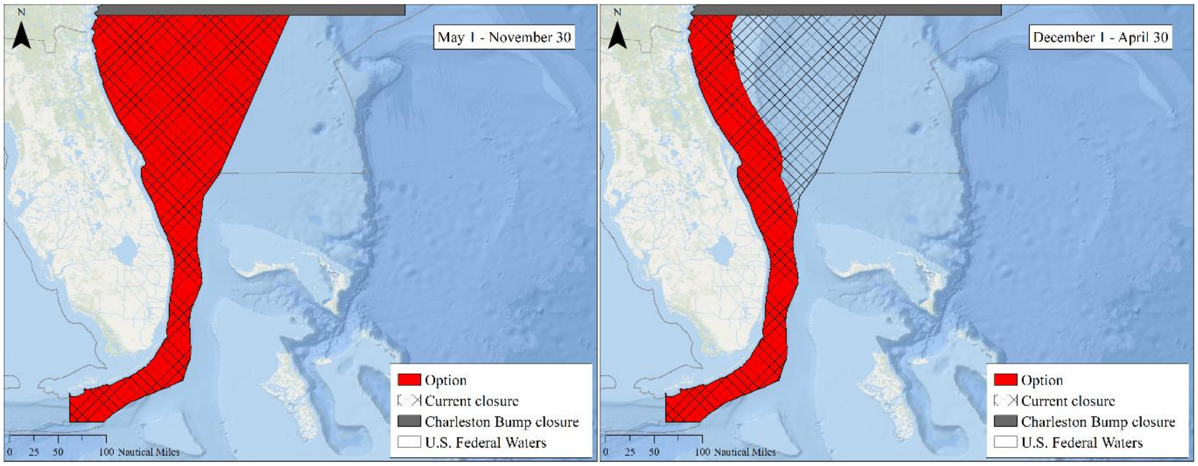
Metric 3



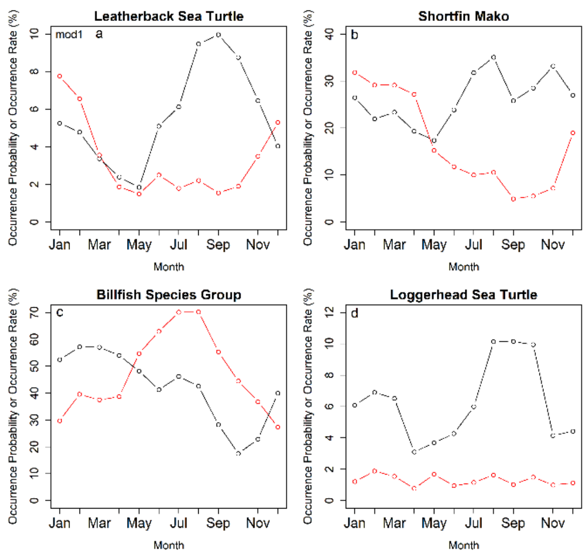
Metric 4



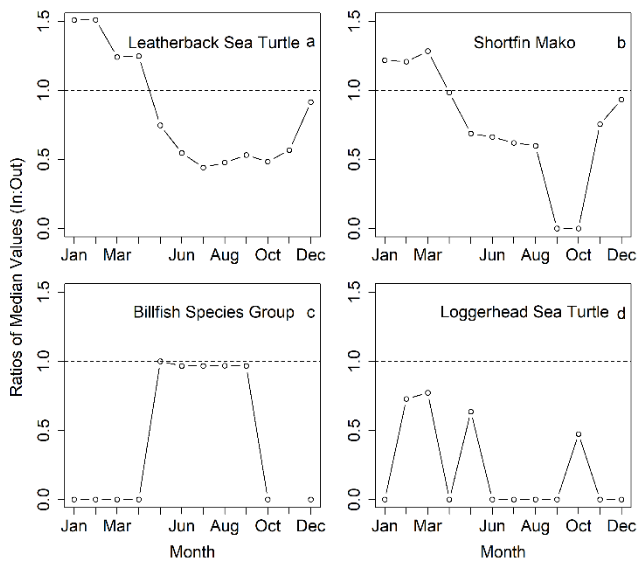
Option 1 (Sub-Alternative) - Area reduced to west of 40 nm from coastline for five months



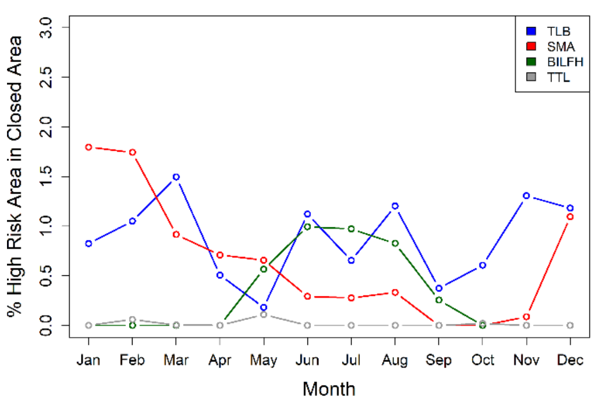
Metric 1



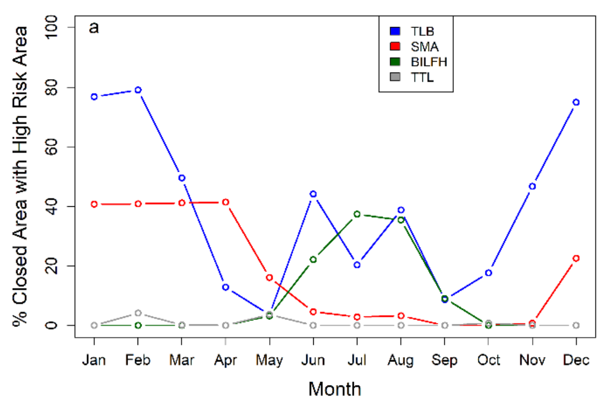
Metric 2



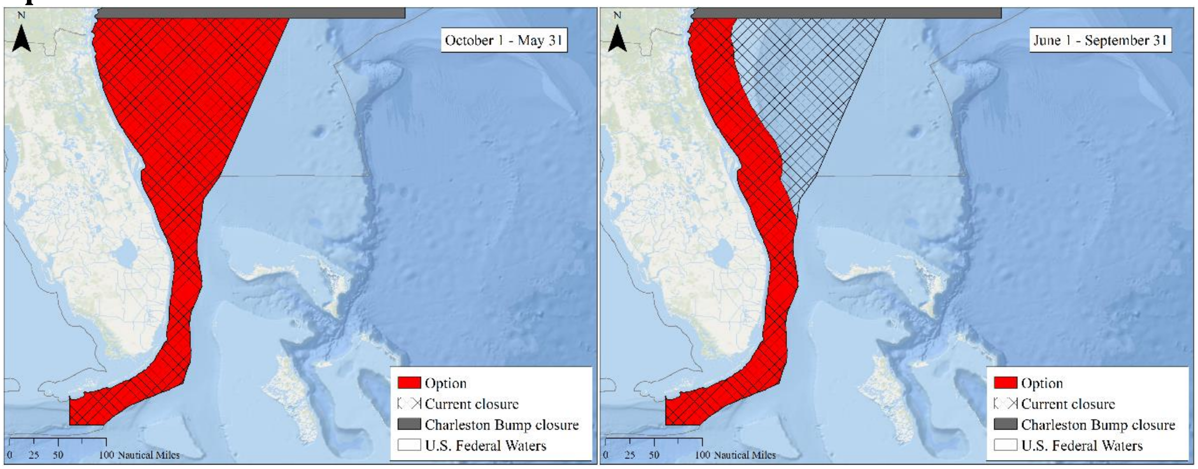
Metric 3



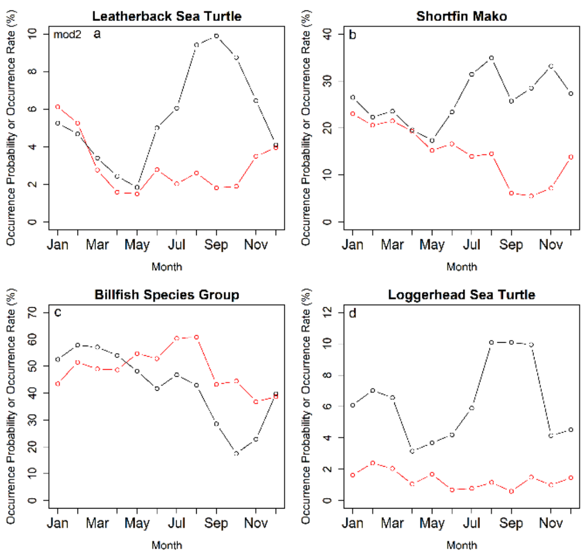
Metric 4



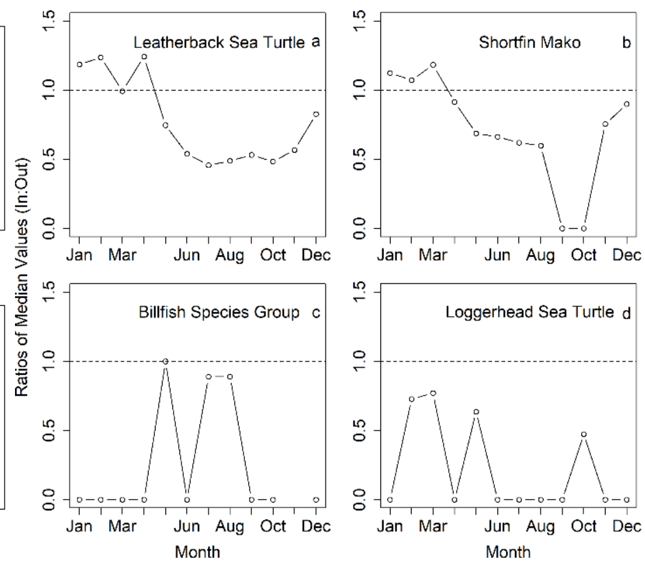
Option 2 - Area reduced to west of 40 nm from coastline for four months



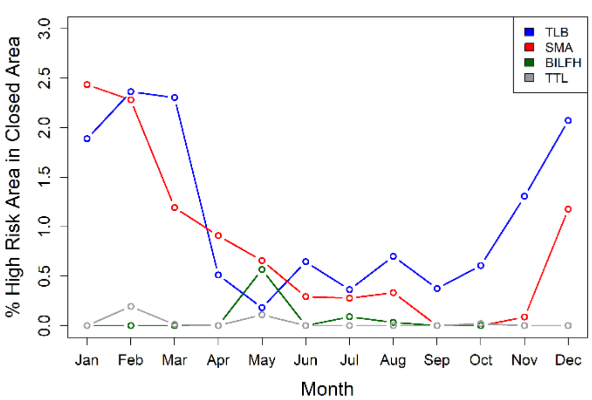
Metric 1



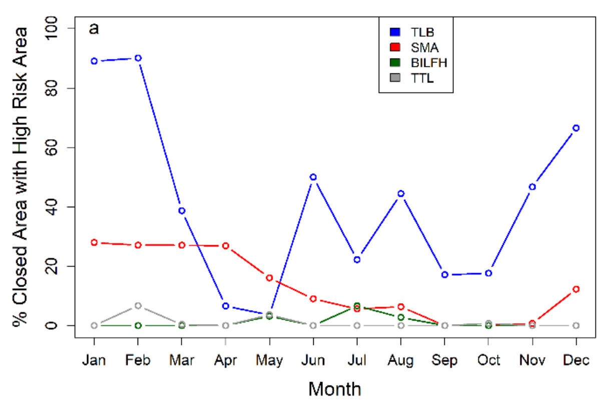
Metric 2



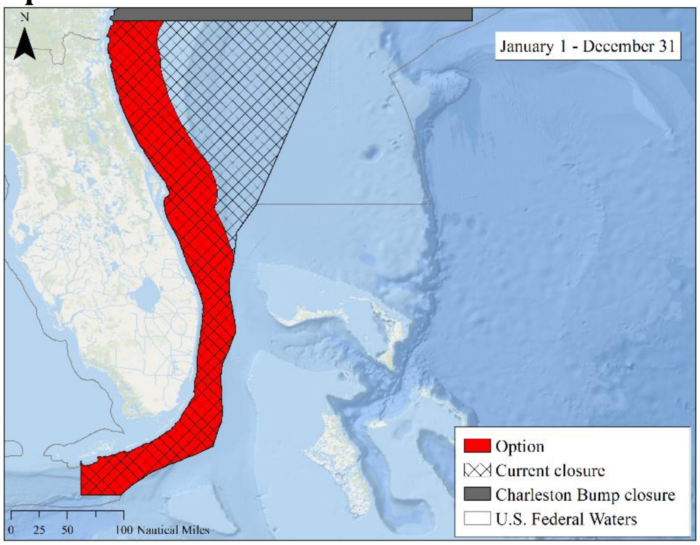
Metric 3



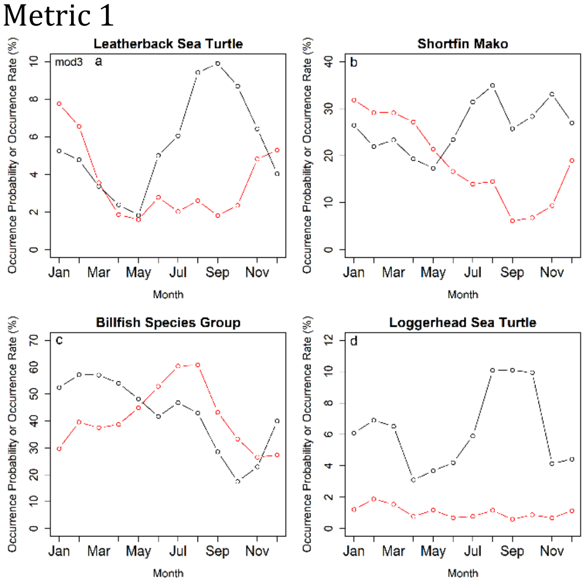
Metric 4



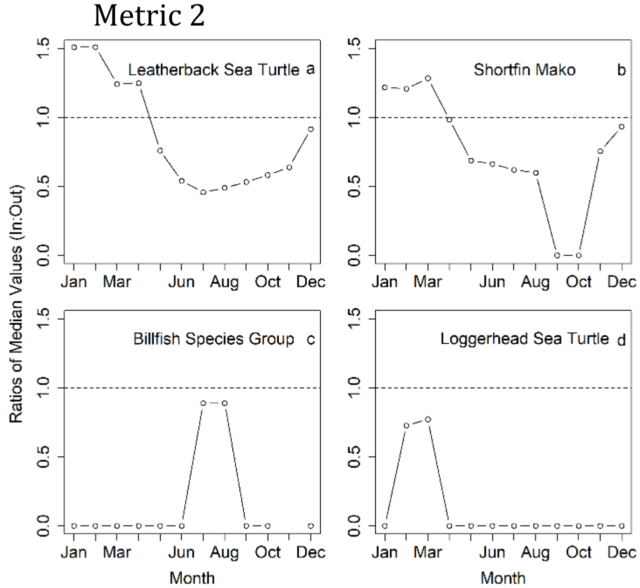
Option 3 - Area reduced to west of 40 nm from coastline; Status quo time



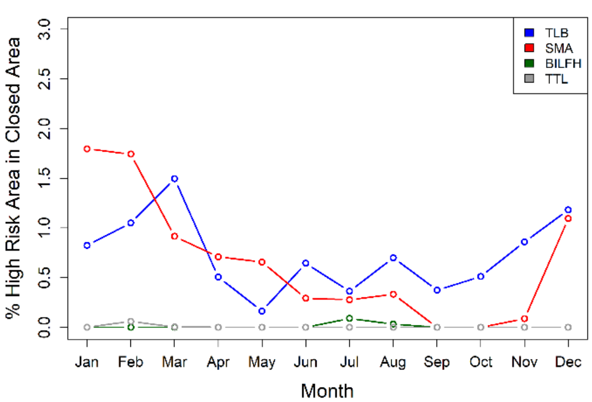
Metric 1



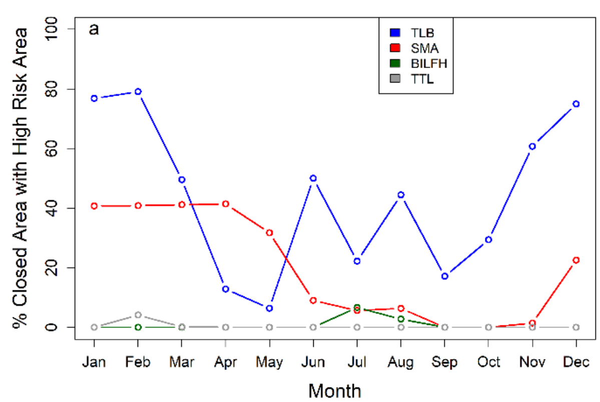
Metric 2



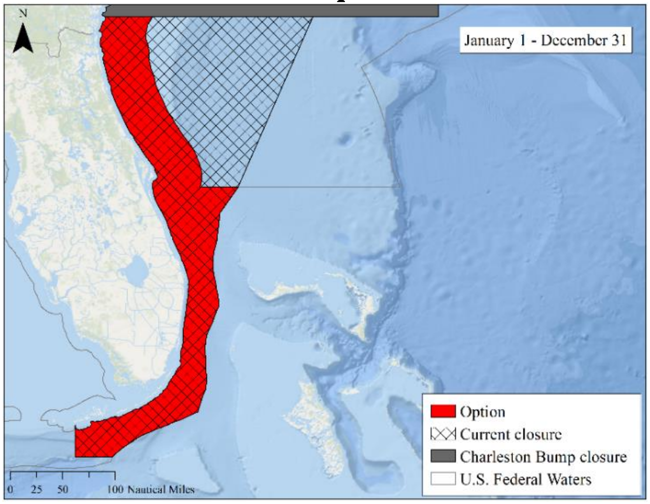
Metric 3



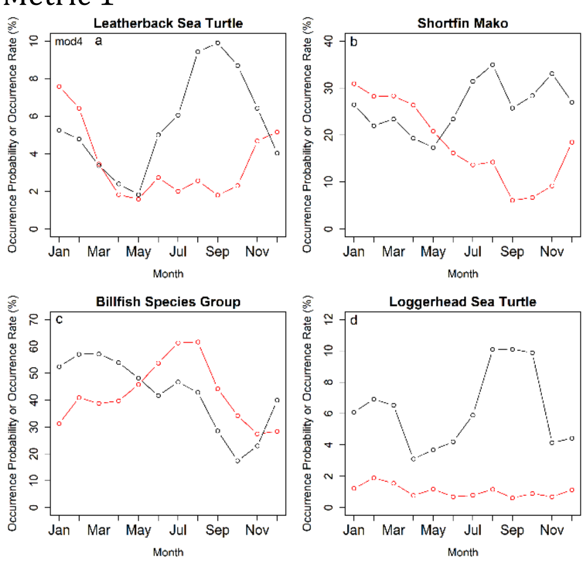
Metric 4



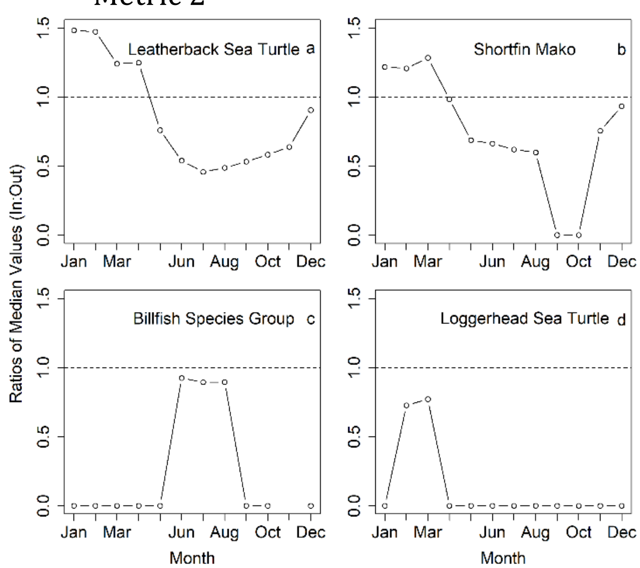
Option 4 (Sub-Alternative) - Area reduced to west of 40 nm from coastline north of Bahamian EEZ; Status quo time



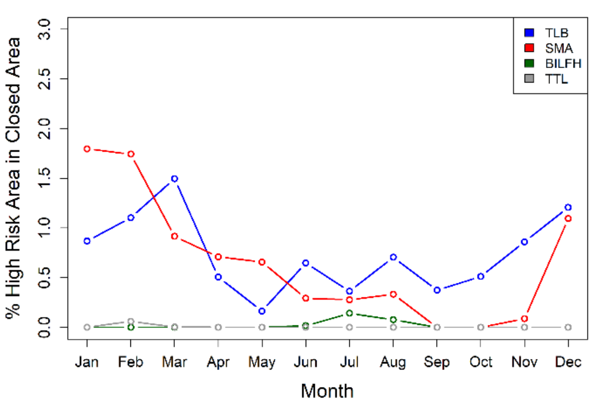
Metric 1



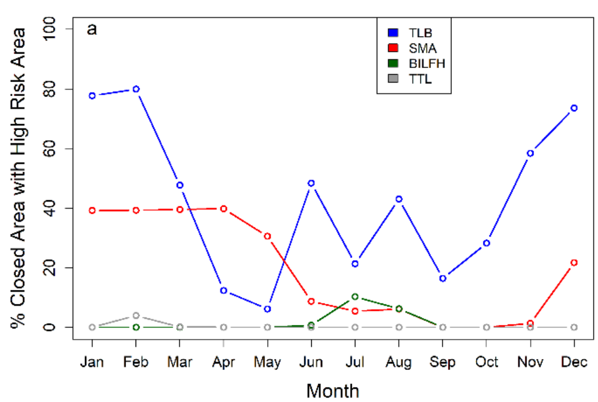
Metric 2



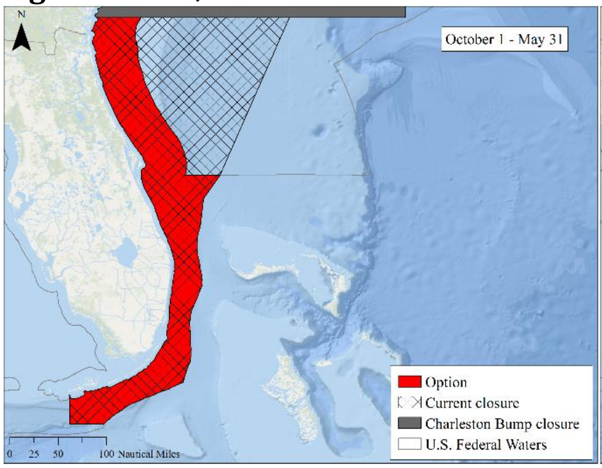
Metric 3

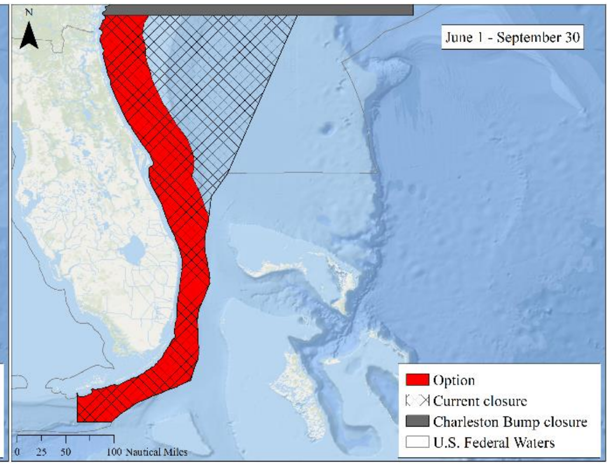


Metric 4

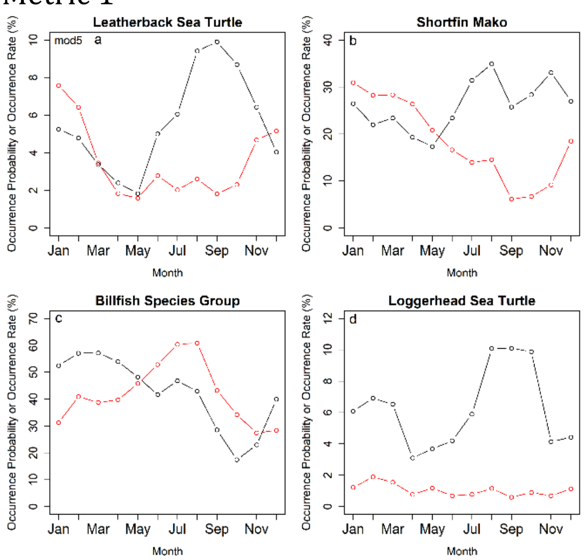


Option 5 - Area reduced to west of 40 nm from coastline north of Bahamian EEZ for eight months; Area reduced to west of 40 nm from coastline for four months

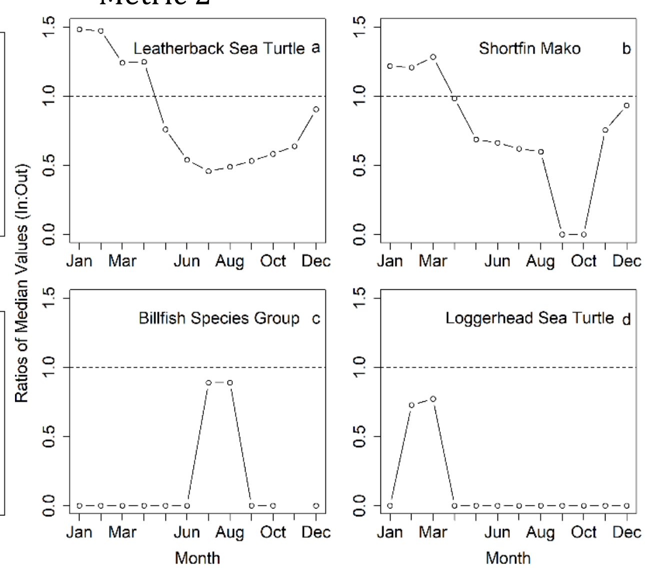




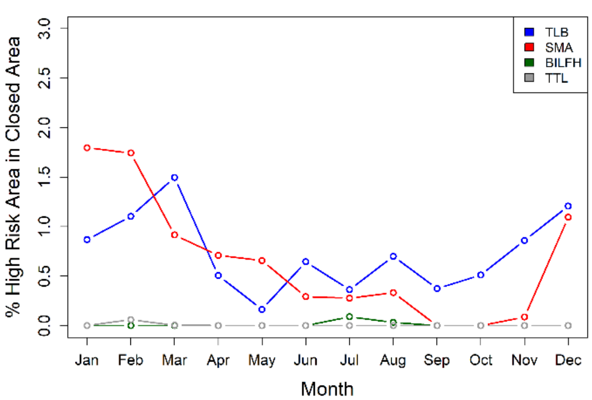
Metric 1



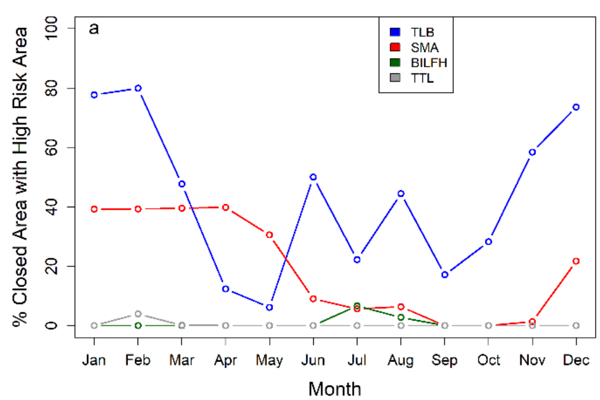
Metric 2



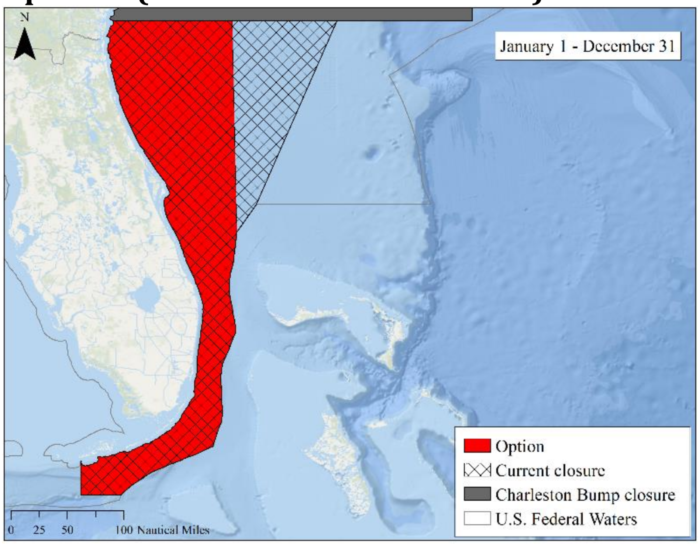
Metric 3



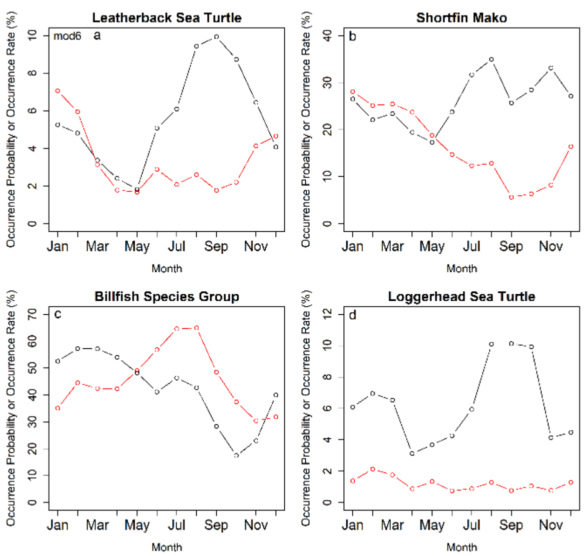
Metric 4



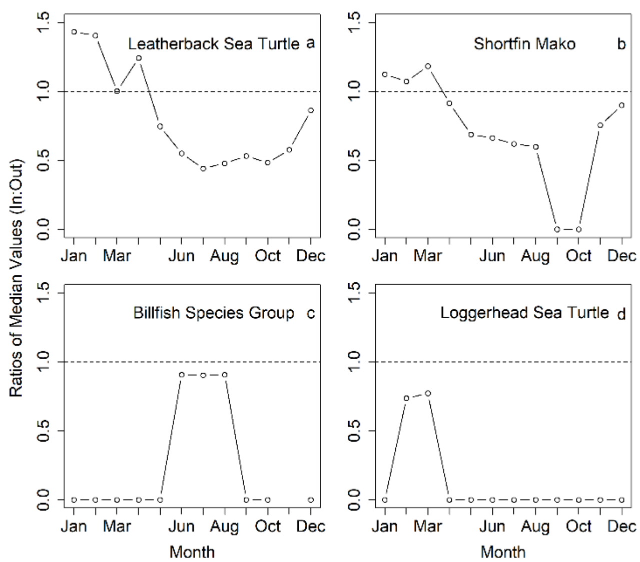
Option 6 (Preferred Sub-Alternative) - Area reduced from the east; Status quo time



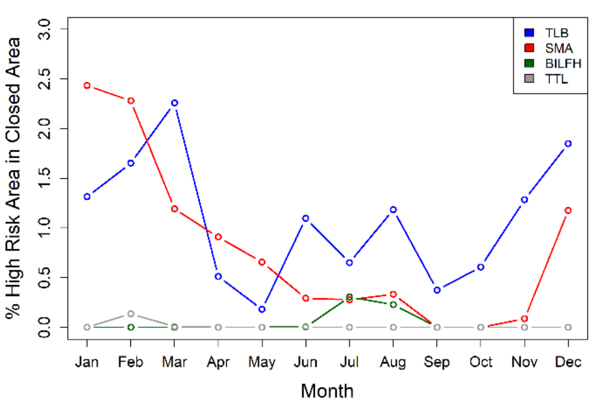
Metric 1



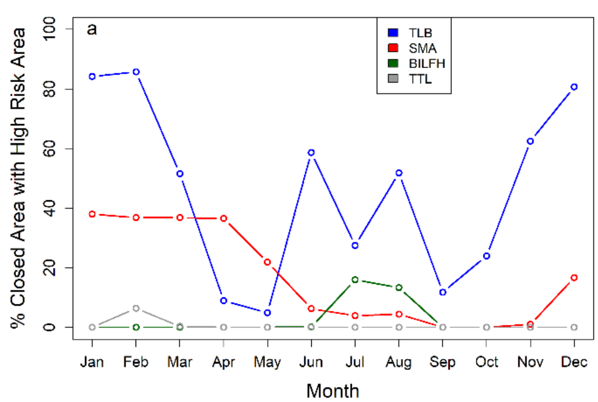
Metric 2



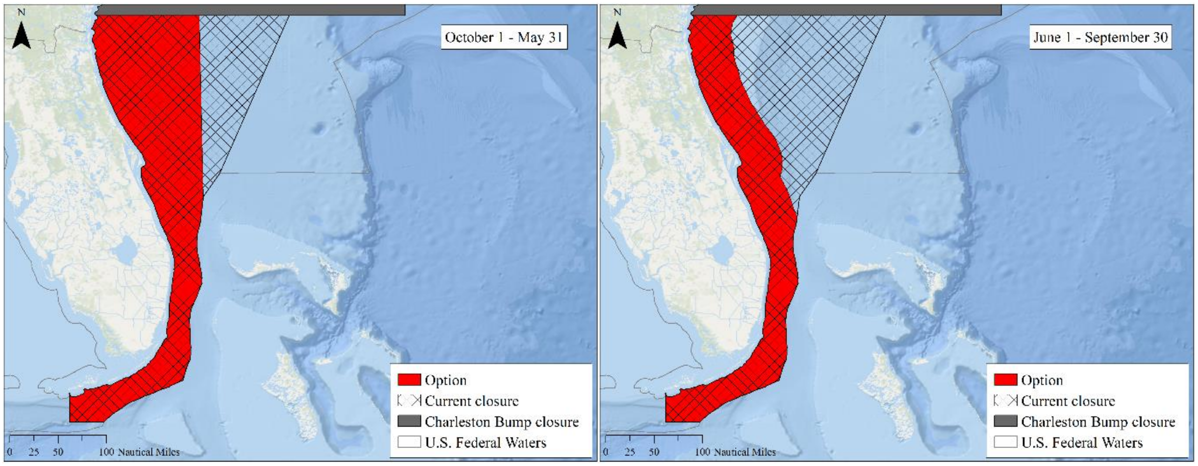
Metric 3



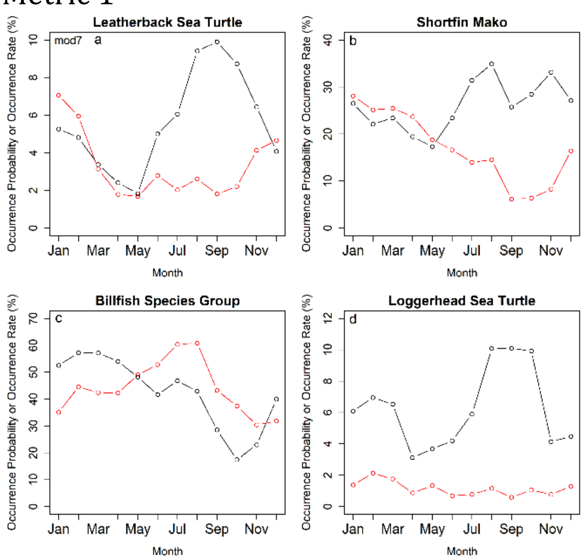
Metric 4



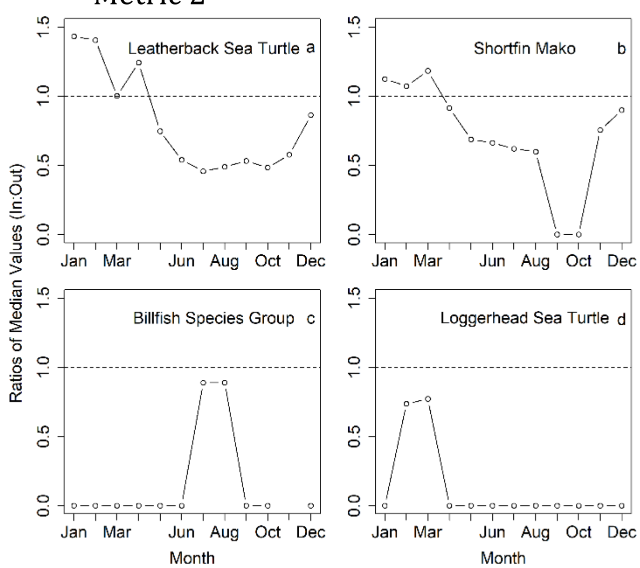
Option 7 (Sub-Alternative) - Area reduced from the east for eight months; Area reduced to west of 40 nm from coastline for four months



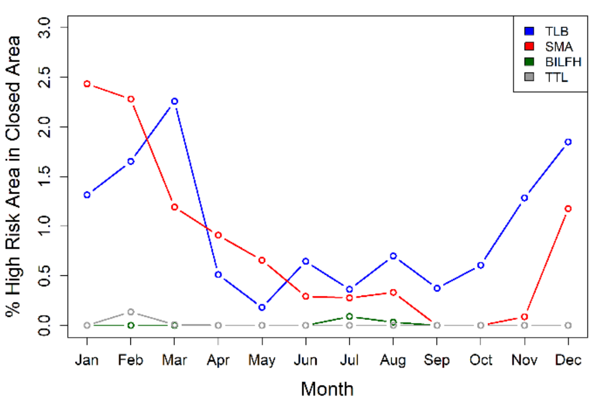
Metric 1



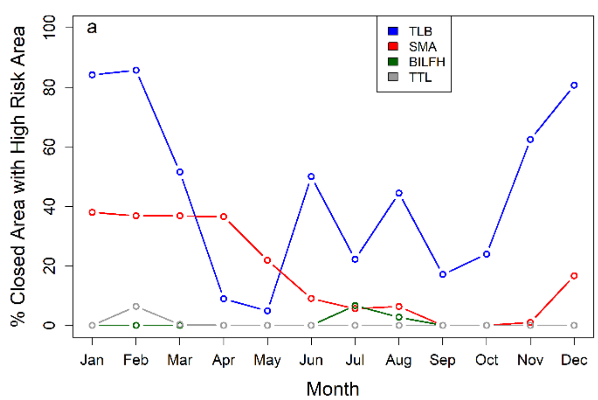
Metric 2



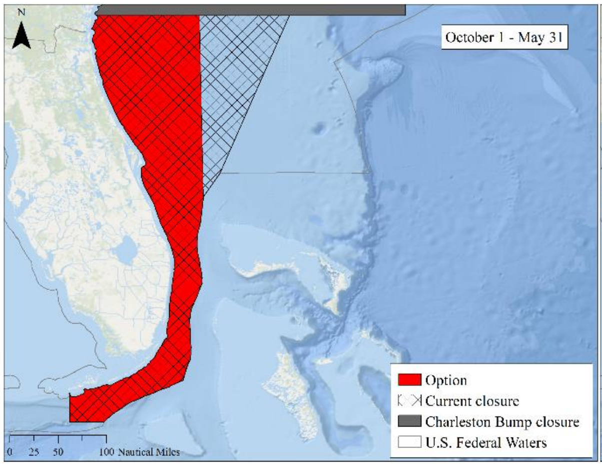
Metric 3

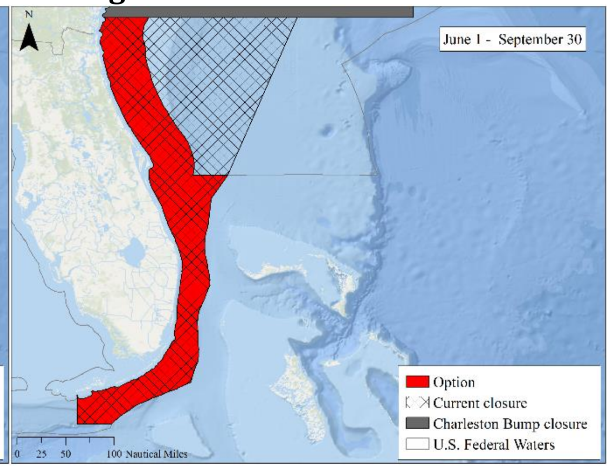


Metric 4

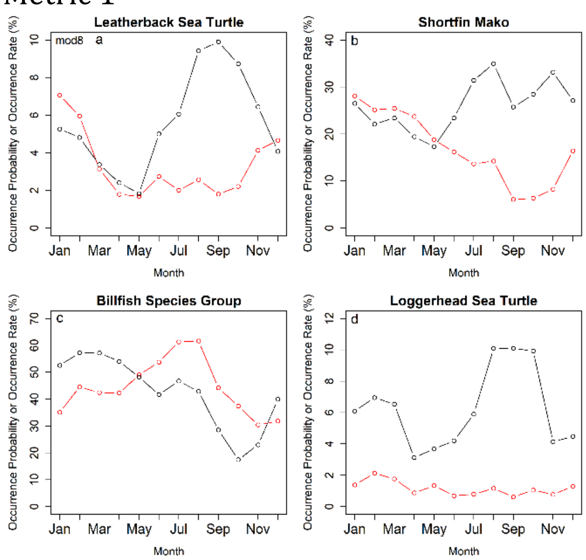


Option 8 - Area reduced from the east for eight months; Area reduced to west of 40 nm from coastline north of Bahamian EEZ for eight months

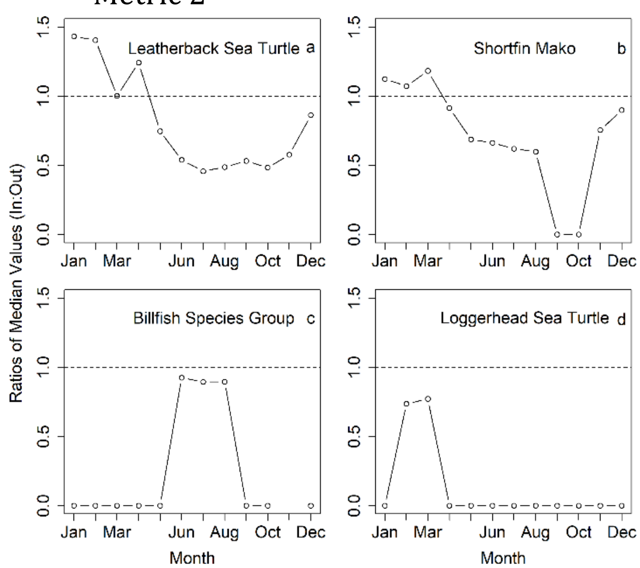




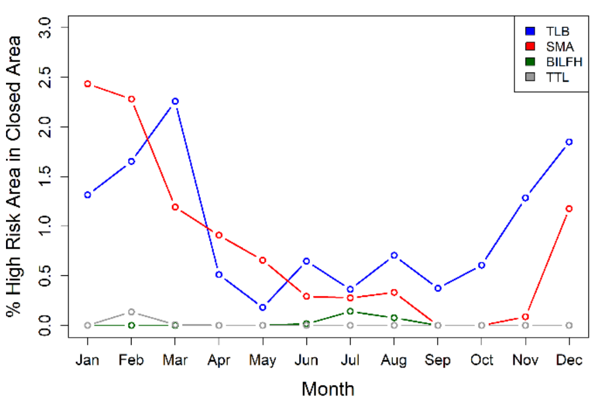
Metric 1



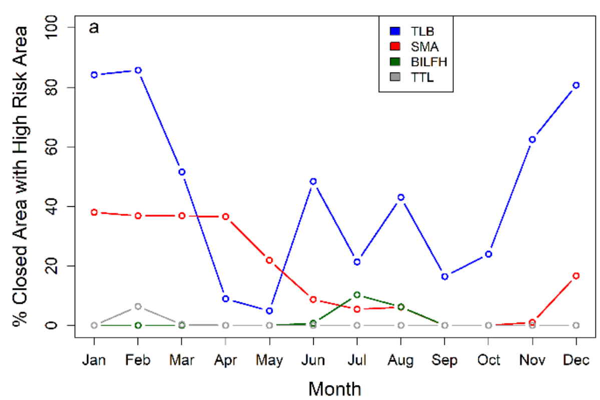
Metric 2



Metric 3

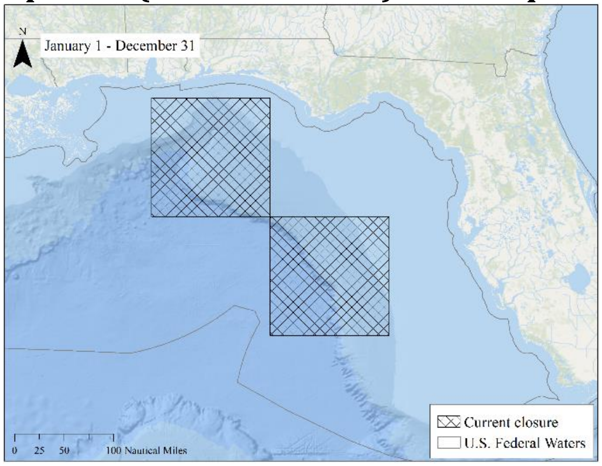


Metric 4

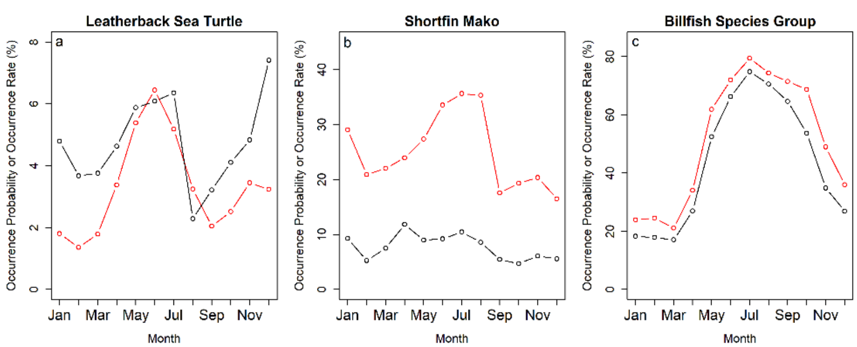


DESOTO CANYON CLOSED AREA

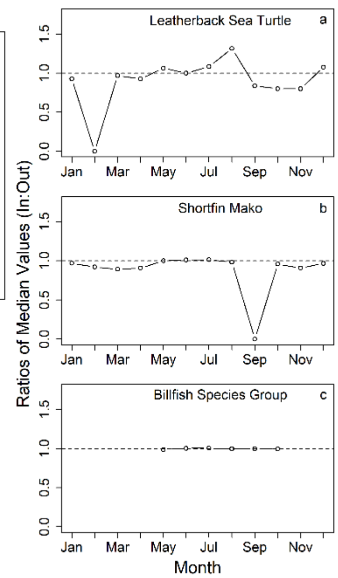
Option 0 (Sub-Alternative) - Status quo area and time



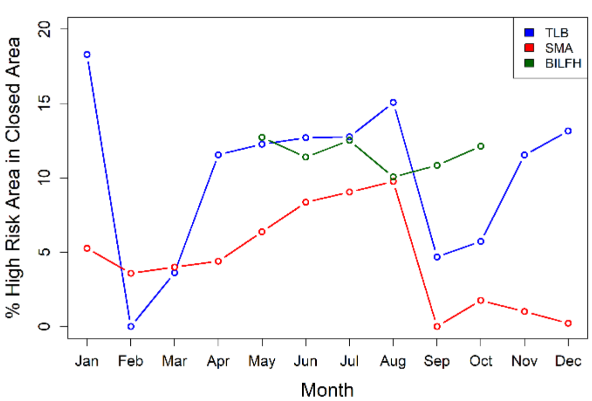
Metric 1



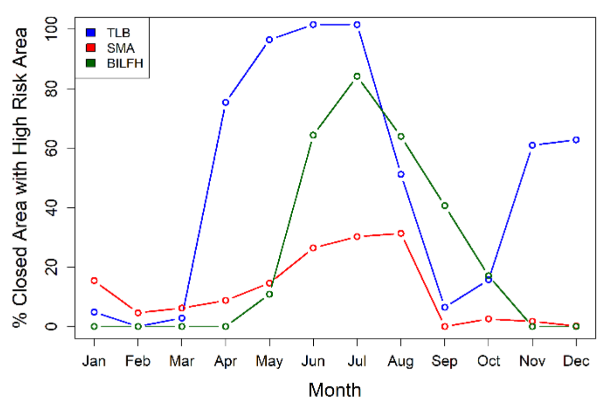
Metric 2



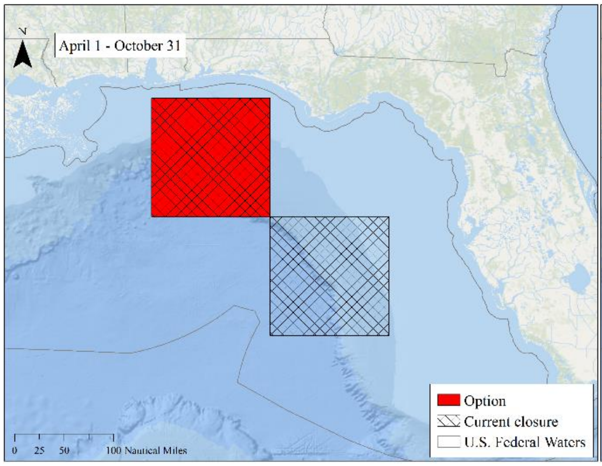
Metric 3

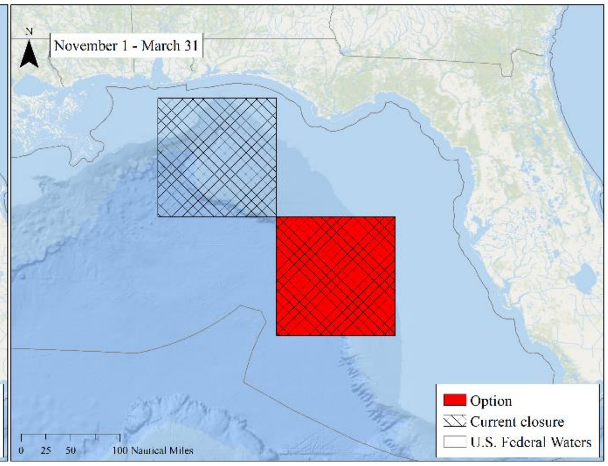


Metric 4

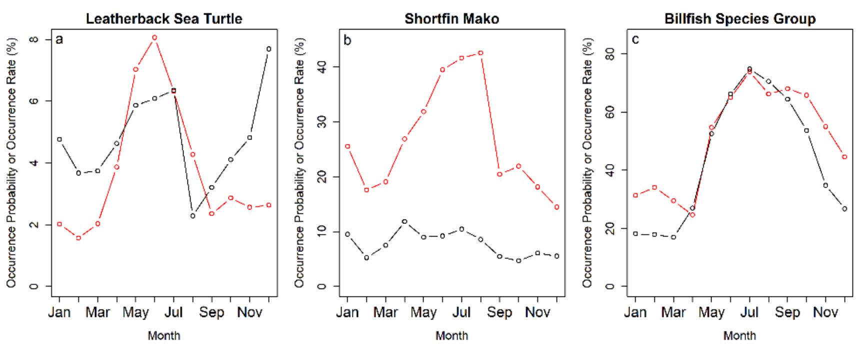


Option 1 - Area reduced to NW box for seven months; Area reduced to SE for five months

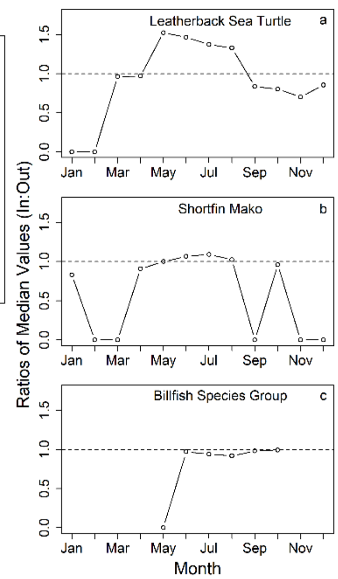




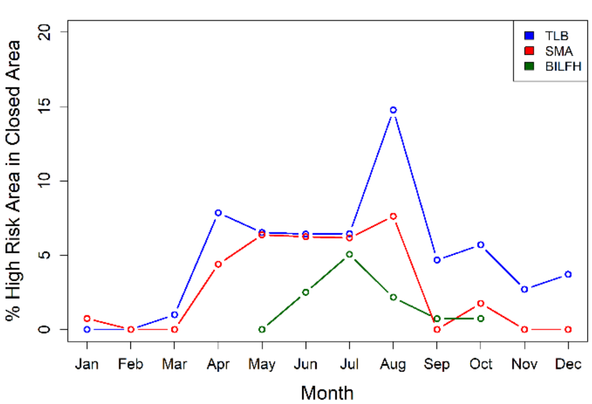
Metric 1



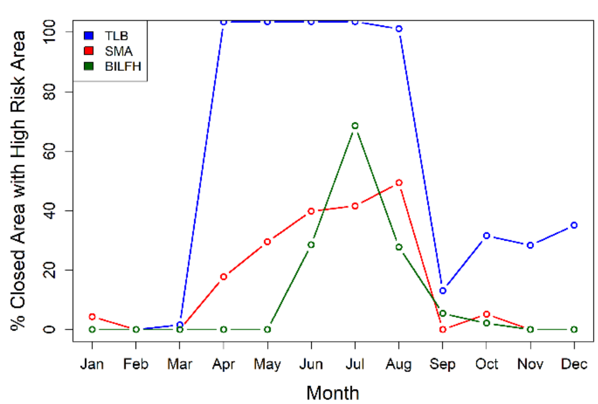
Metric 2



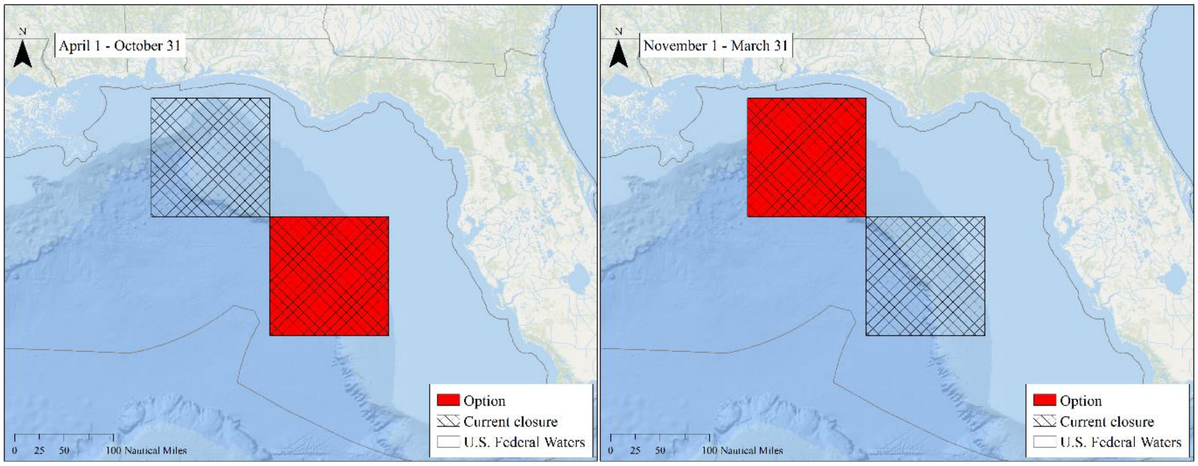
Metric 3



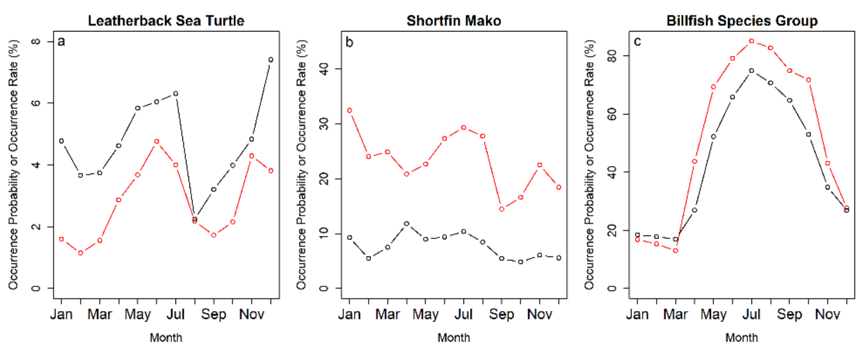
Metric 4



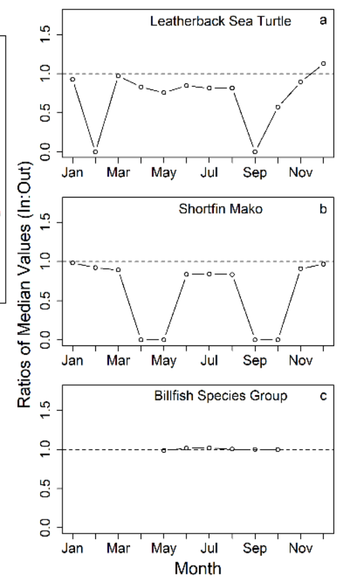
Option 2 - Area reduced to SE box for seven months; Area reduced to NW for five months



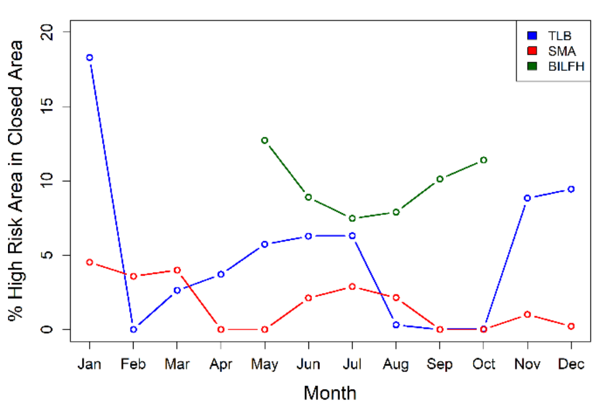
Metric 1



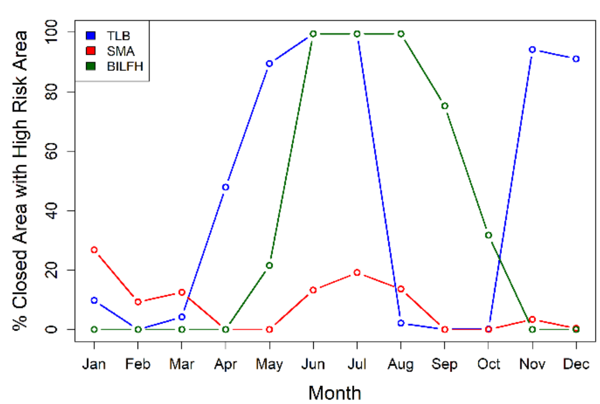
Metric 2



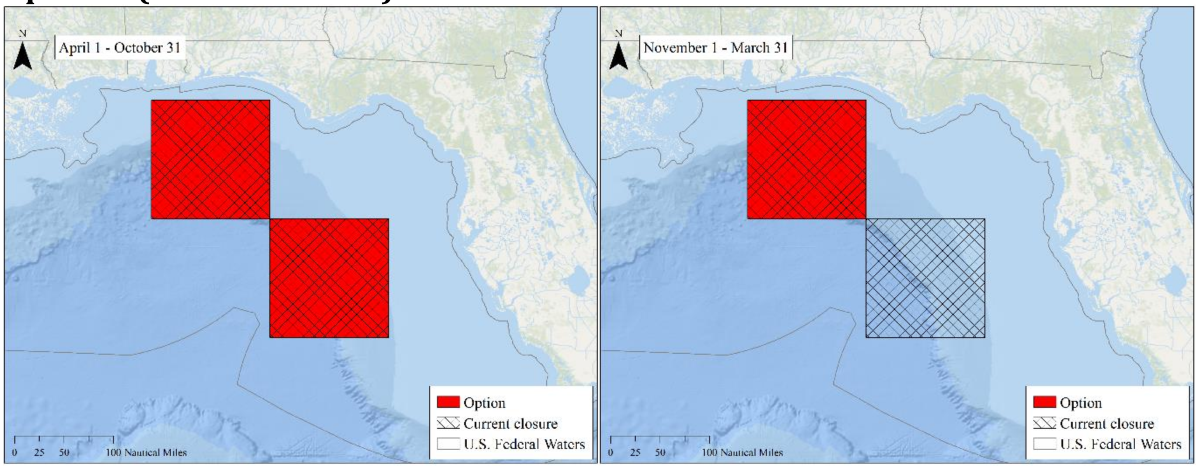
Metric 3



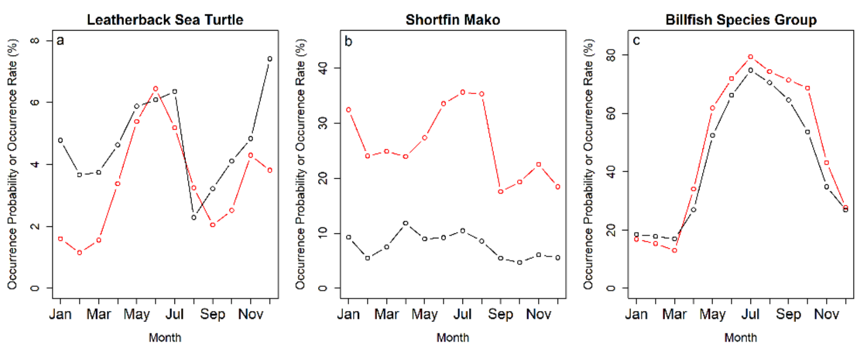
Metric 4



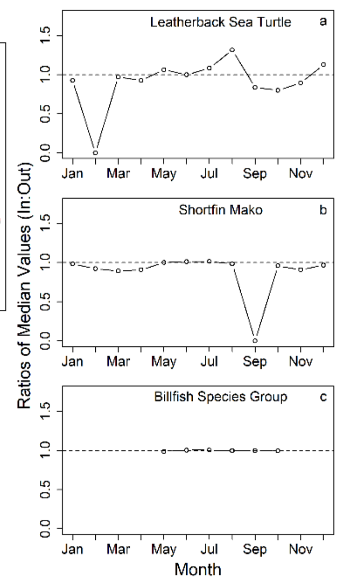
Option 3 (Sub-Alternative) - Area reduced to NW box for five months



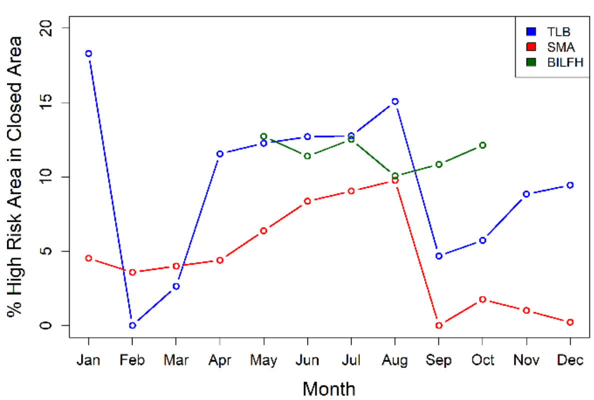
Metric 1



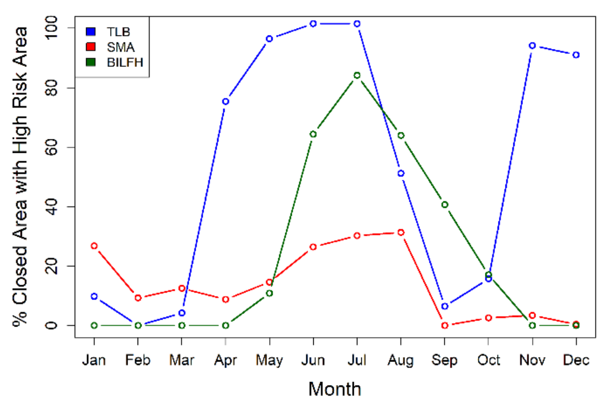
Metric 2



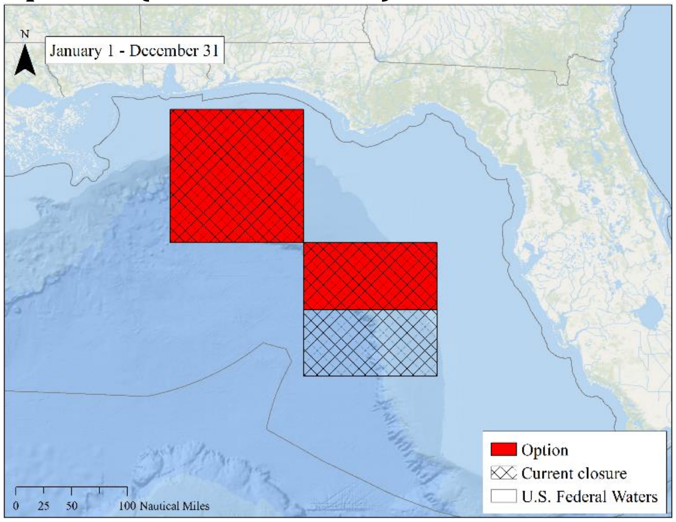
Metric 3



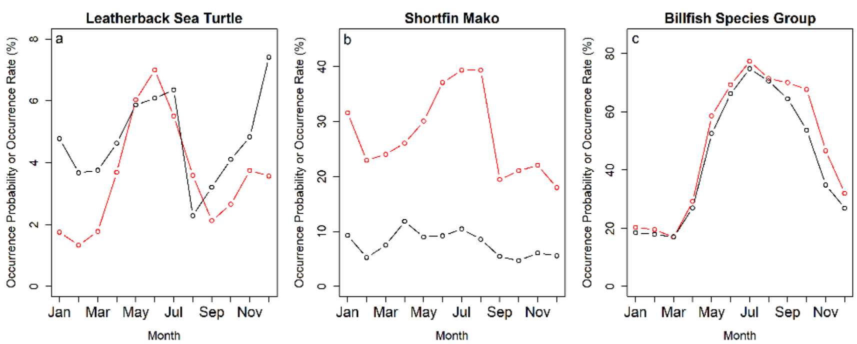
Metric 4



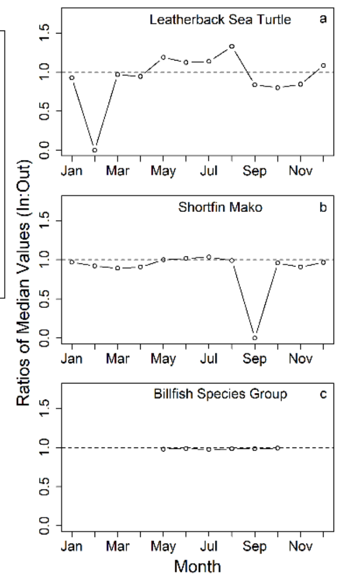
Option 4 (Sub-Alternative) - Area reduced from the south; Status quo time



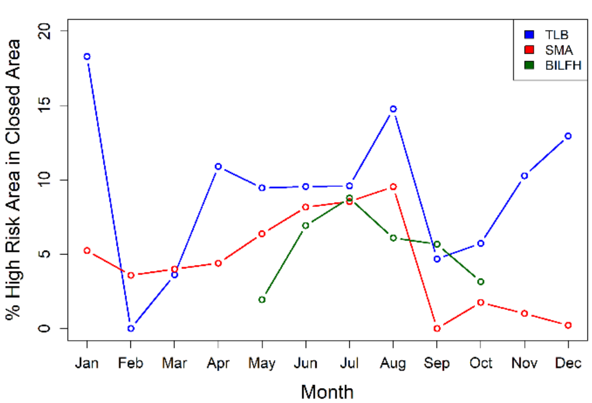
Metric 1



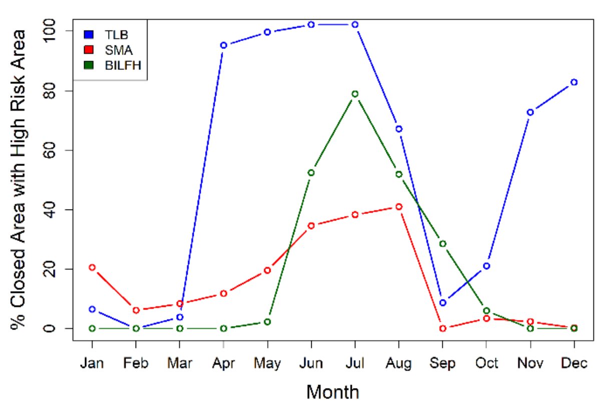
Metric 2



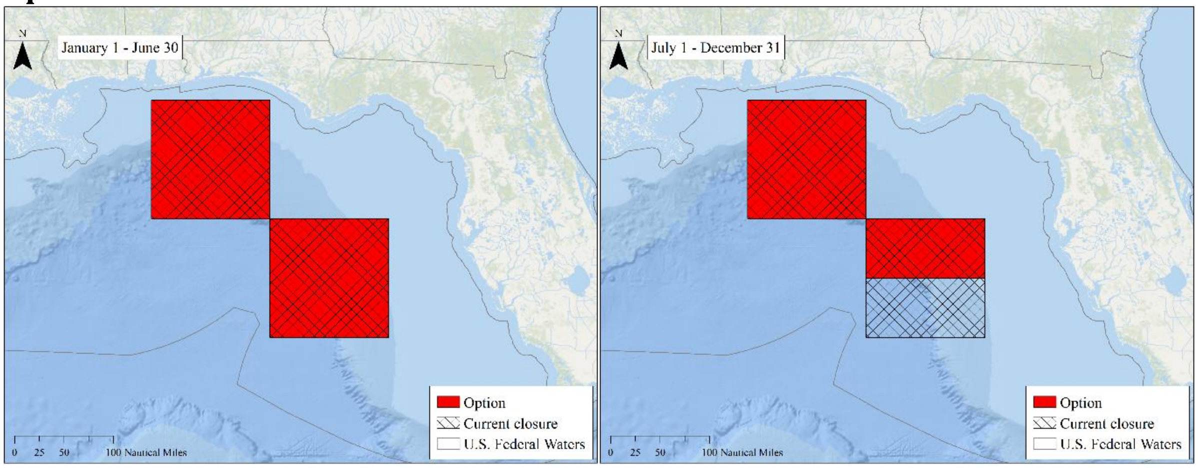
Metric 3



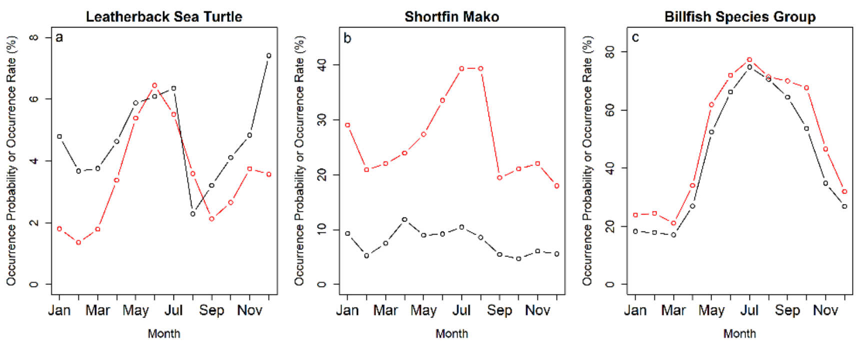
Metric 4



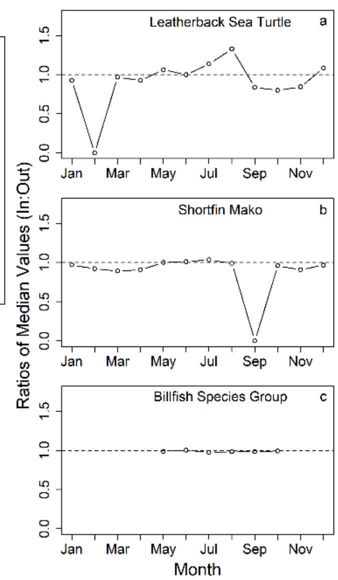
Option 5 - Area reduced from the south for six months



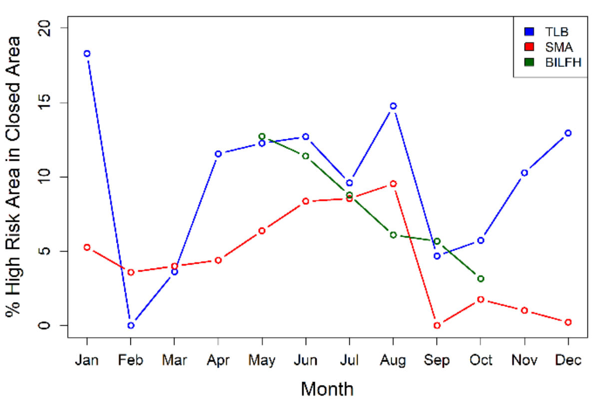
Metric 1



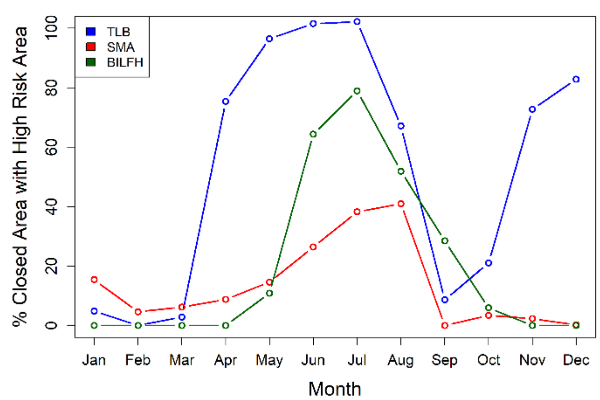
Metric 2



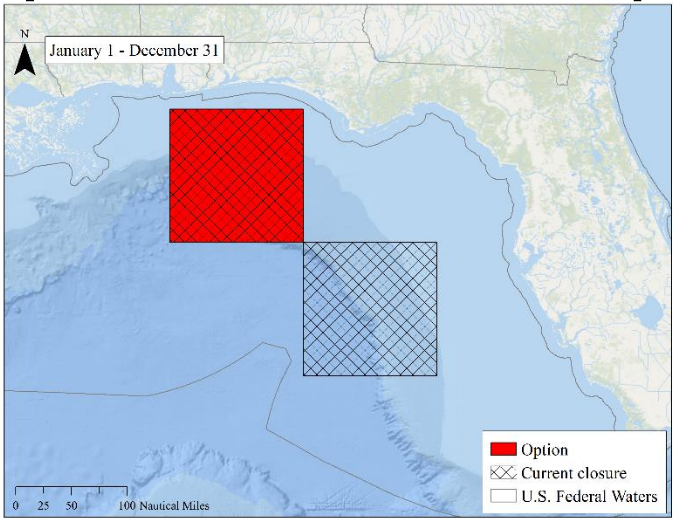
Metric 3



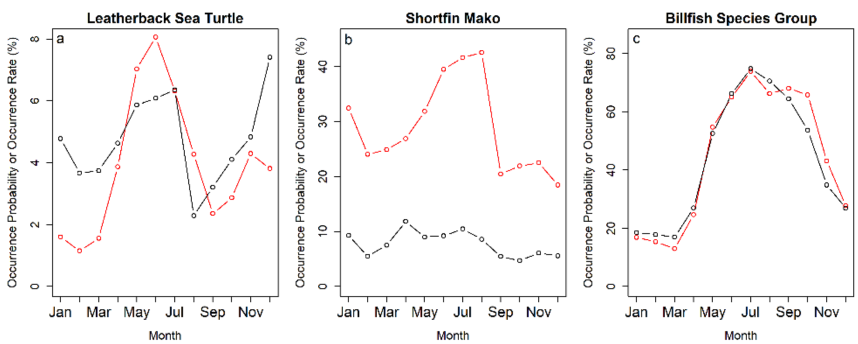
Metric 4



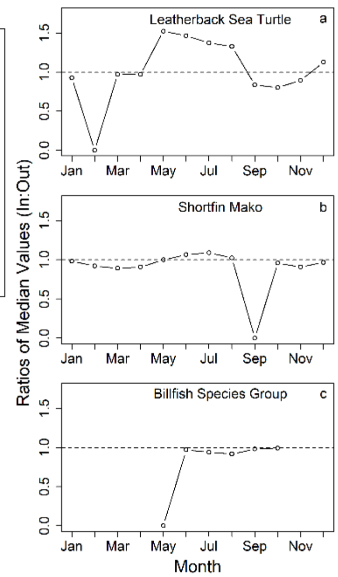
Option 6 - Area reduced to NW box; Status quo time



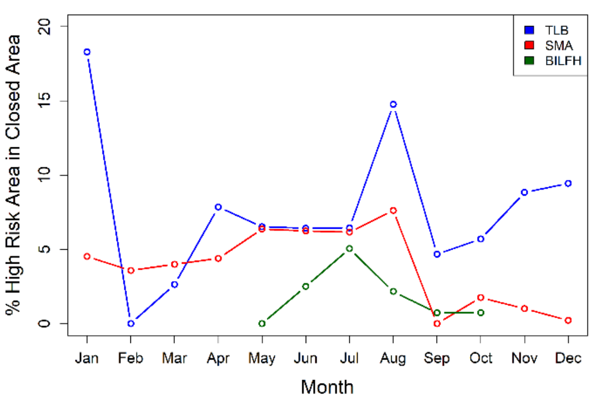
Metric 1



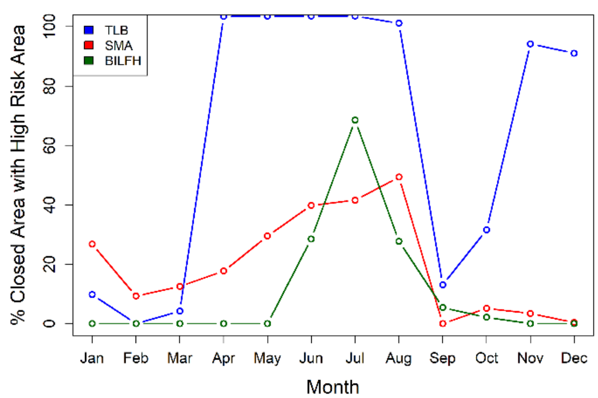
Metric 2



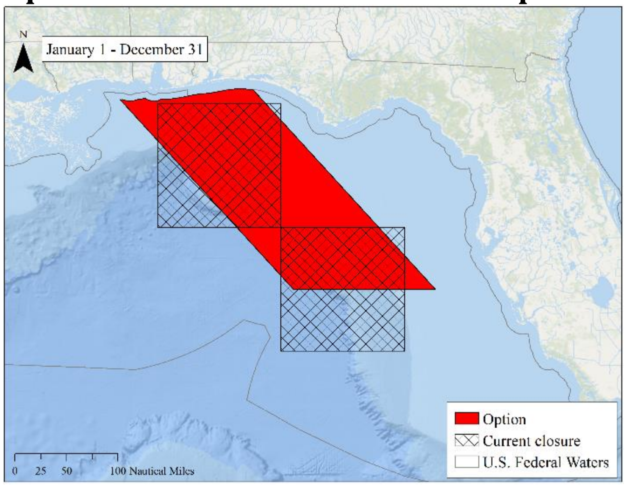
Metric 3



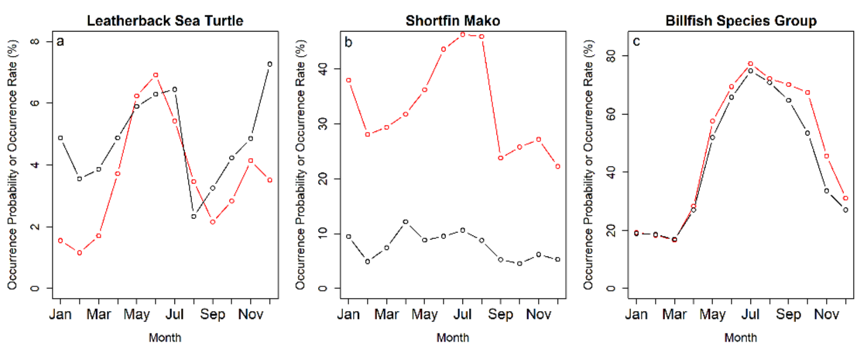
Metric 4



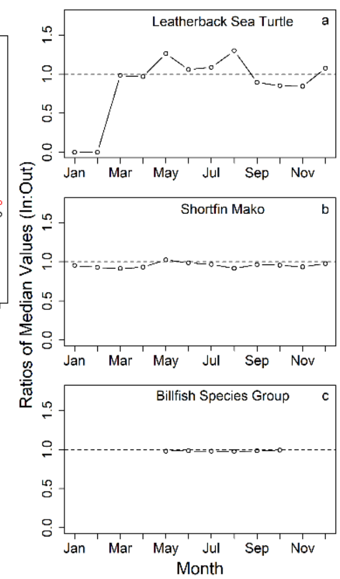
Option 7 - Area shifted to a narrow parallelogram; Status quo time



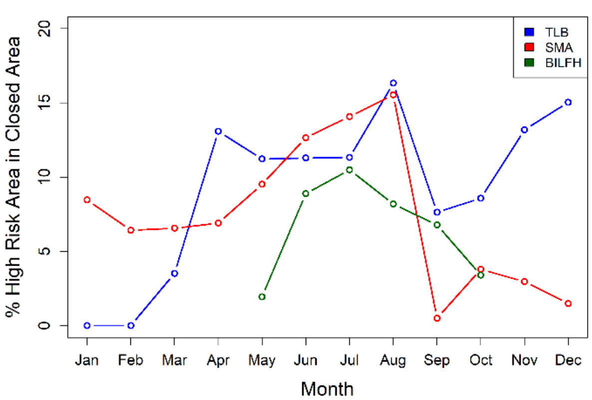
Metric 1



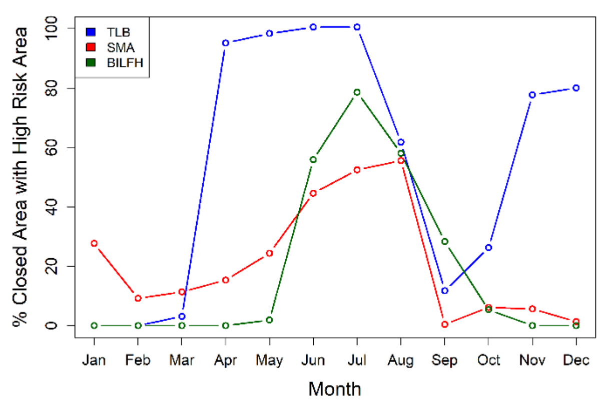
Metric 2



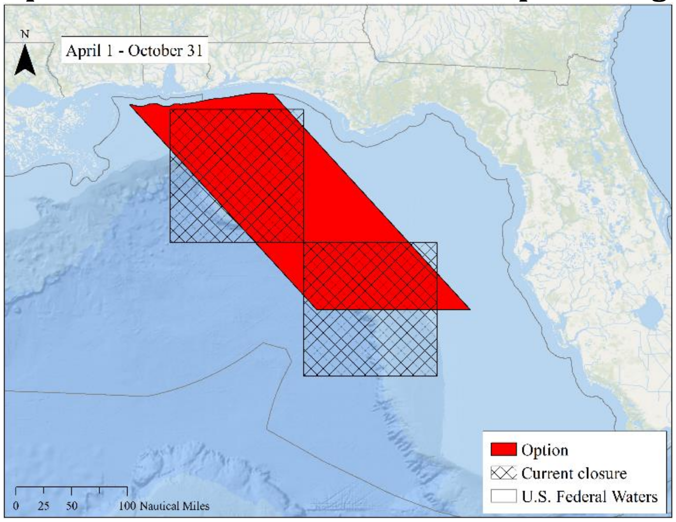
Metric 3



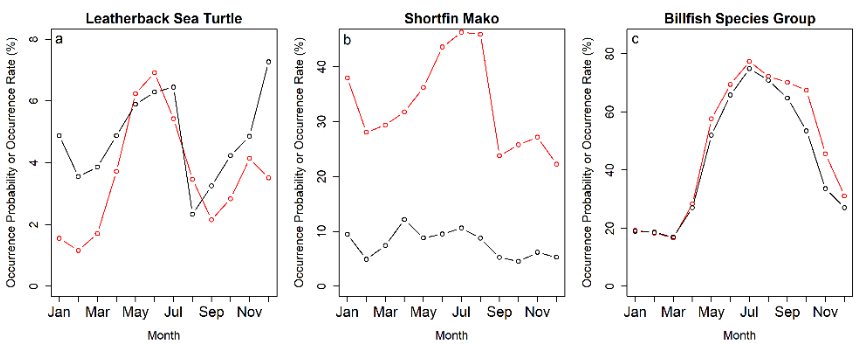
Metric 4



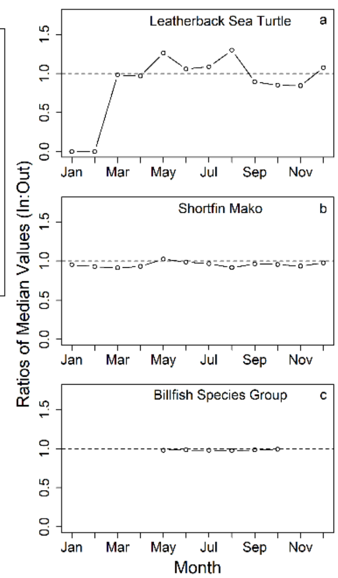
Option 8 - Area shifted to a narrow parallelogram; Time reduced to seven months



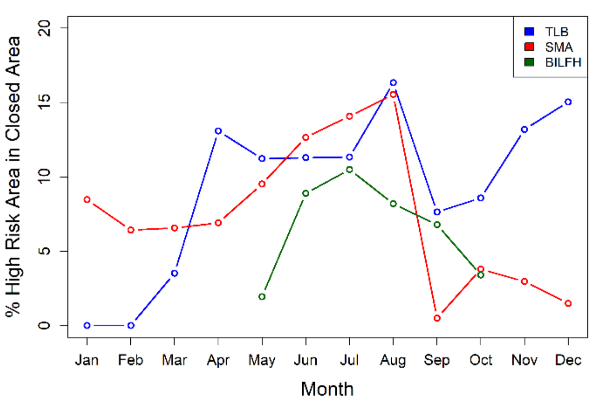
Metric 1



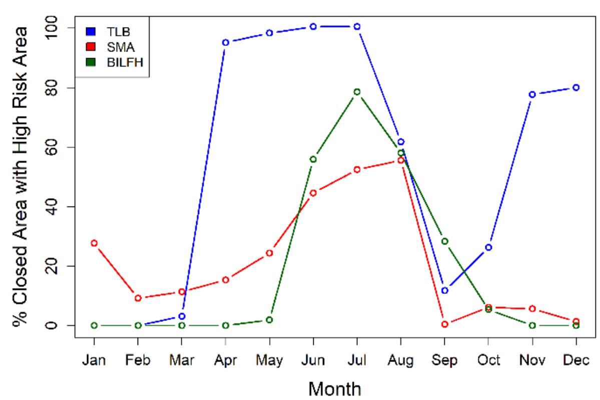
Metric 2



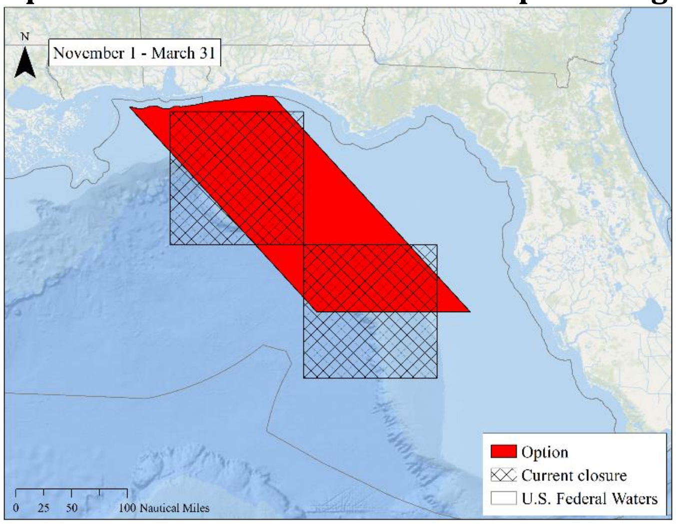
Metric 3



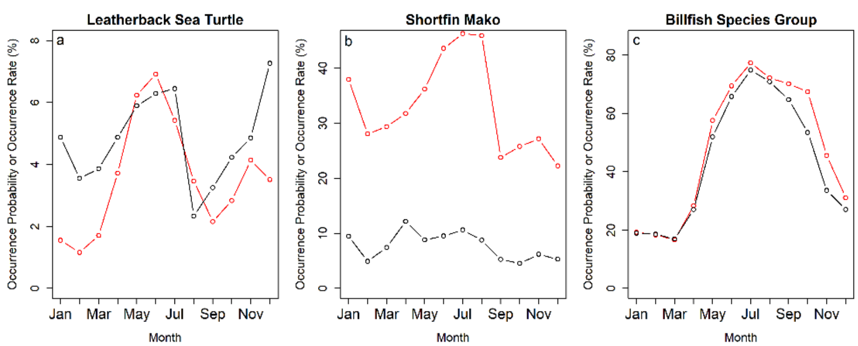
Metric 4



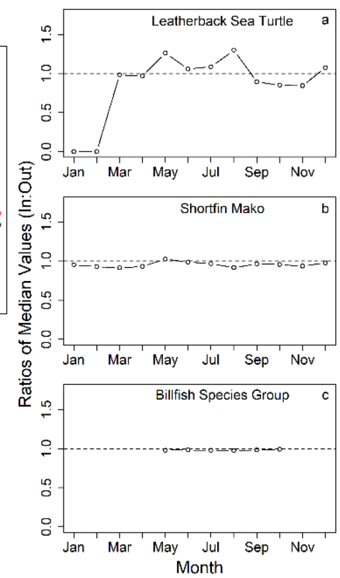
Option 9 - Area shifted to a narrow parallelogram; Time reduced to five months



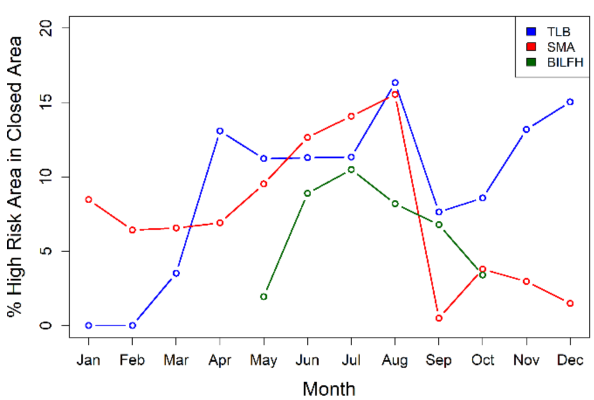
Metric 1



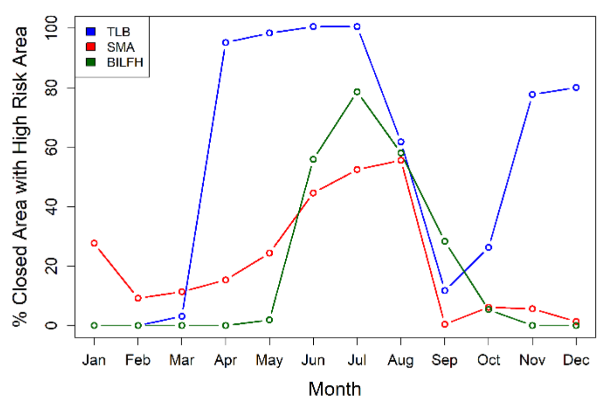
Metric 2



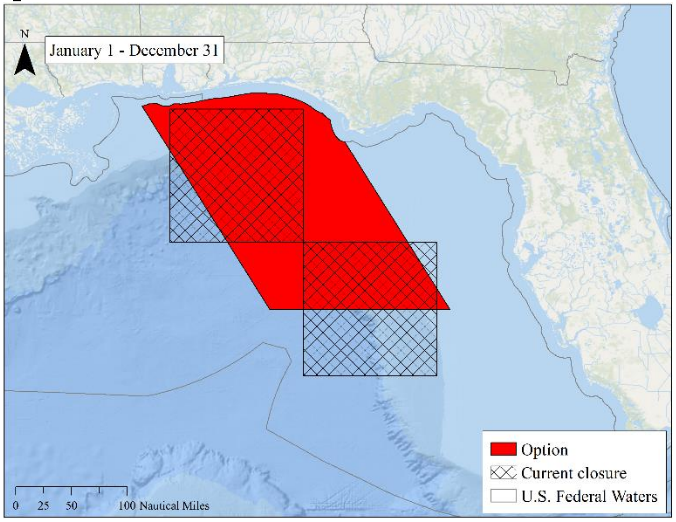
Metric 3



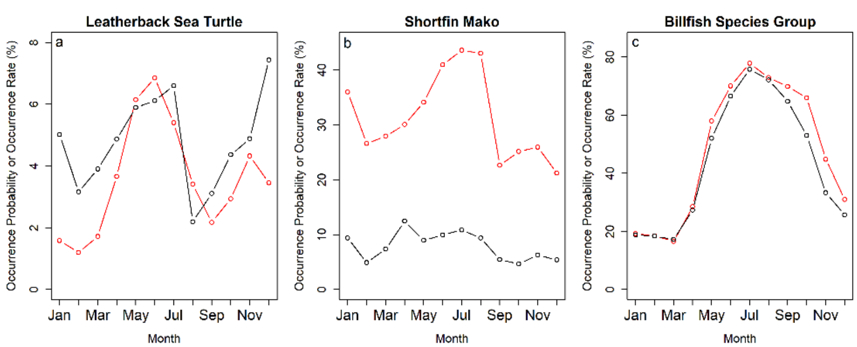
Metric 4



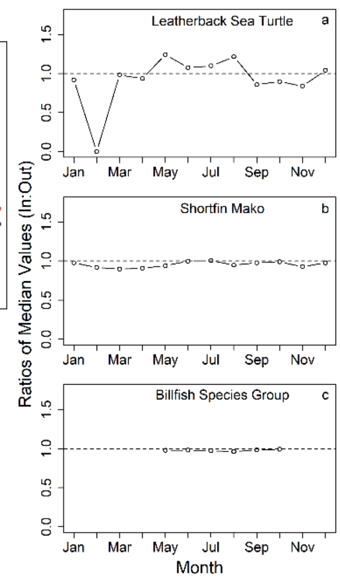
Option 10 (Preferred Sub-Alternative) - Area shifted to a wide parallelogram; Status quo time



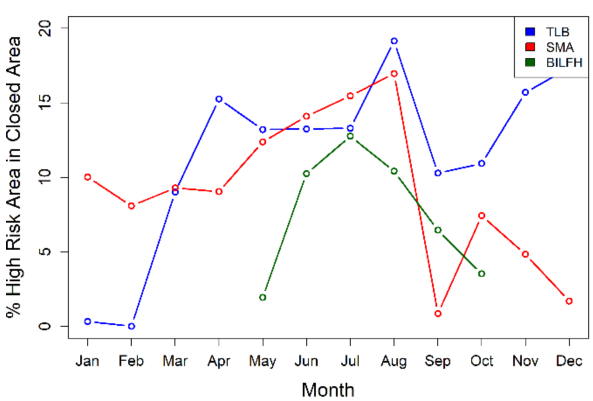
Metric 1



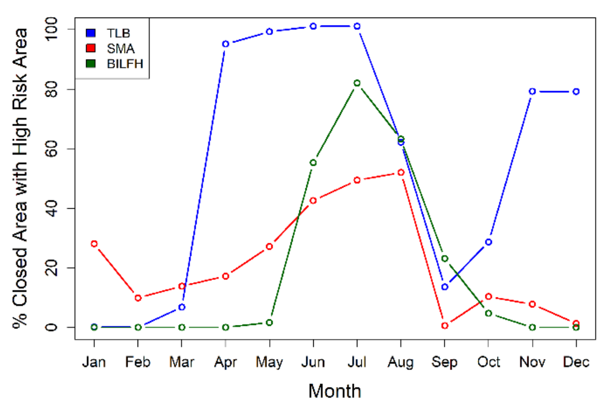
Metric 2



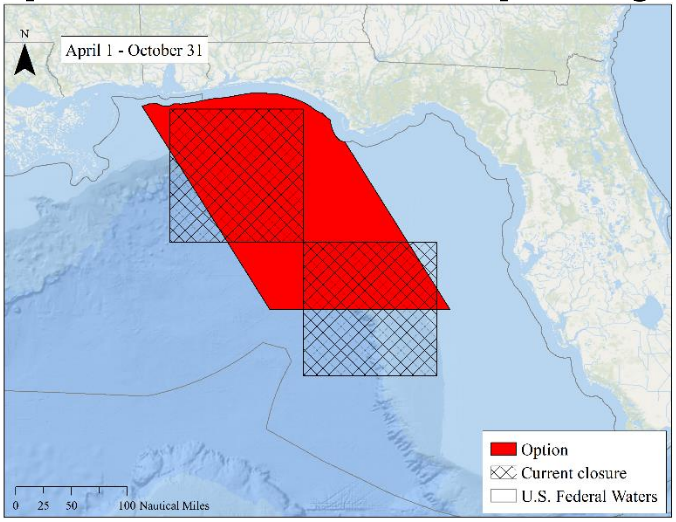
Metric 3



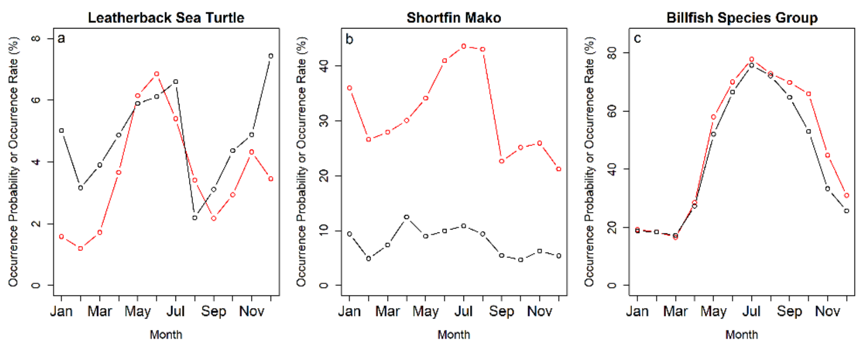
Metric 4



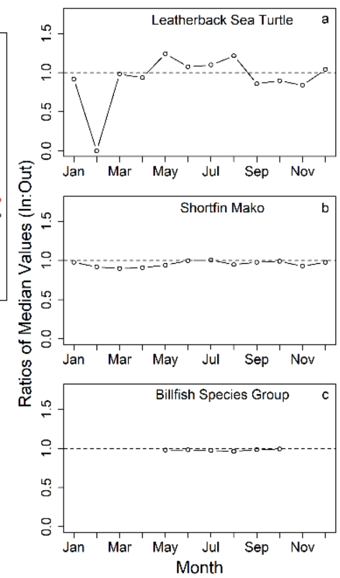
Option 11 - Area shifted to a wide parallelogram; Time reduced to seven months



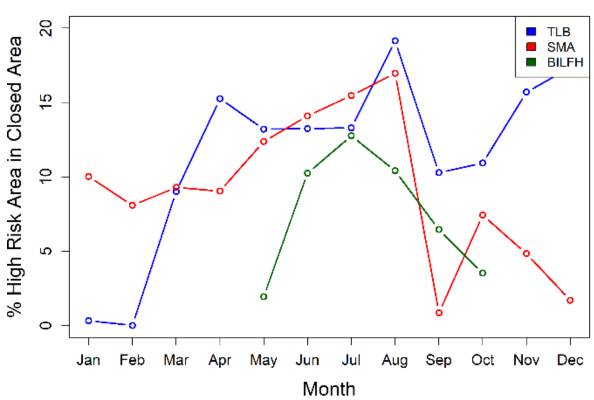
Metric 1



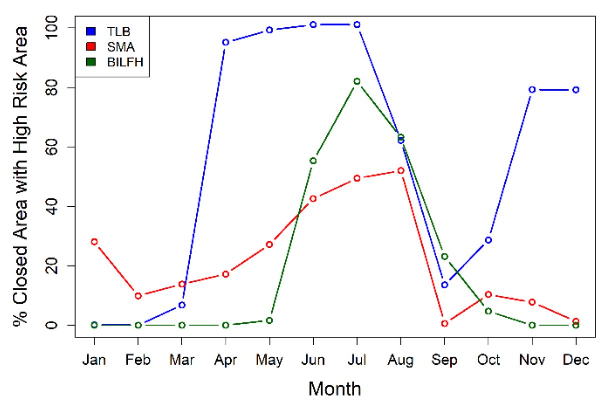
Metric 2



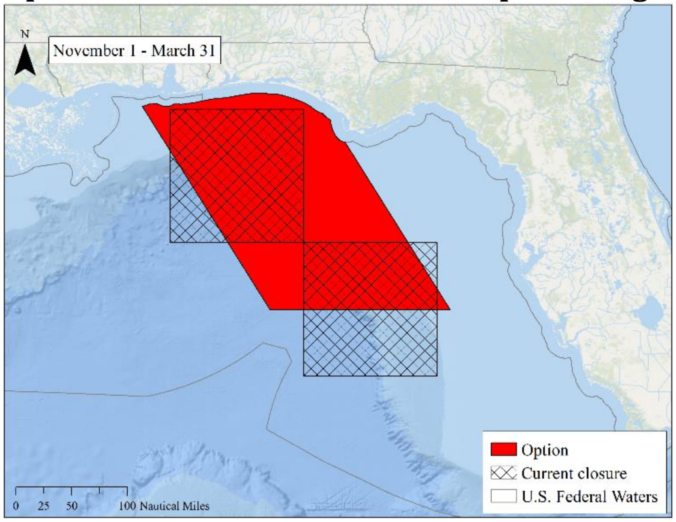
Metric 3



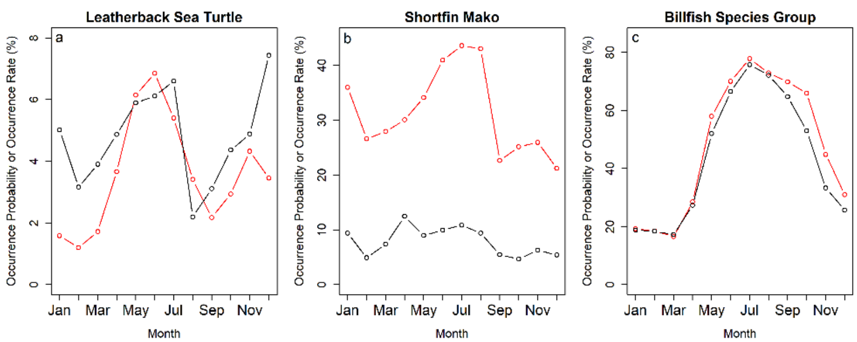
Metric 4



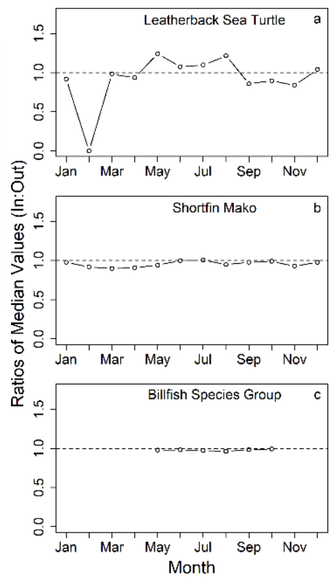
Option 12 - Area shifted to a wide parallelogram; Time reduced to five months



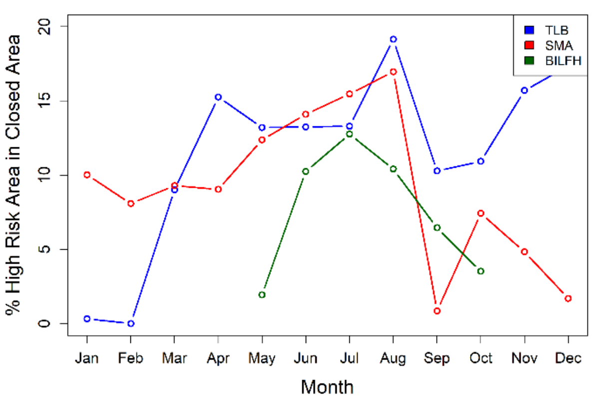
Metric 1



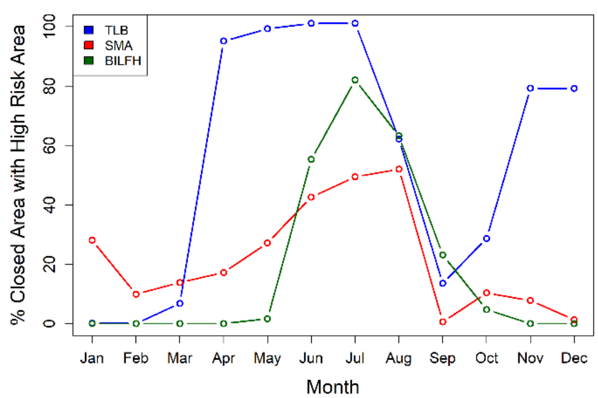
Metric 2



Metric 3



Metric 4



OPTION SCORING

For all sub-alternatives for all closed areas the highest score possible for a single *metric score* and species is 12 and the highest *total metric score* for a species is 48. For the Mid-Atlantic Closed Area and DeSoto Canyon Closed Area the highest *overall metric score* is 144, while for Charleston Bump Closed Area and East Florida Coast Closed Area the highest overall metric score is 192.

MID-ATLANTIC CLOSED AREA

Table 5. The four *metric scores* for each option (O) for each species. The O in front of each column header represents the word *option*, and corresponds to the various options in the Options and Metrics section above. For example, Option 0 (O0) represents status quo. *Overall metric scores* for each option is summed at the bottom. Sub-Alternatives selected from these options appearing in the DEIS are in bold. Species abbreviations are as follows: DS = dusky shark; SB = sandbar shark; SHH = scalloped hammerhead.

Species	Metric	**O0**	O1	**O2**	O3	O4	O5	O6	**O7**	O8	O9	O10	O11	**O12**	O13
DS	1	**4**	5	**6**	5	6	4	4	**6**	5	4	5	6	**7**	8
	2	**7**	7	**7**	7	7	6	6	**7**	7	7	7	7	**7**	12
	3	**4**	5	**6**	4	5	2	4	**5**	4	4	5	6	**6**	6
	4	**4**	5	**6**	4	5	4	3	**5**	5	3	4	4	**6**	6
SHH	1	**7**	7	**7**	7	7	7	6	**7**	7	6	6	6	**7**	12
	2	**4**	3	**3**	6	5	3	1	**5**	4	3	3	3	**5**	4
	3	**0**	0	**0**	2	3	0	0	**0**	0	1	1	1	**3**	0
	4	**2**	2	**2**	3	3	2	2	**3**	3	2	2	2	**3**	2
SB	1	**7**	7	**7**	6	6	7	7	**7**	6	7	7	7	**7**	12
	2	**0**	0	**0**	0	0	0	0	**0**	0	0	0	0	**0**	0
	3	**3**	3	**4**	5	5	3	5	**3**	3	6	6	7	**6**	6
	4	**4**	5	**5**	4	5	4	3	**5**	5	4	5	5	**5**	5
	sum	**46**	49	**53**	53	57	42	41	**53**	49	47	51	54	**62**	73

Table 6. *Total metric scores* where the four metric scores for each species were summed for each option (O). Option 0 (O0) represents the status quo. Overall metric scores for each option is summed at the bottom. Sub-Alternatives selected from these options appearing in the DEIS are in bold. Species abbreviations are as follows: DS = dusky shark; SB = sandbar shark; SHH = scalloped hammerhead.

Species	**O0**	O1	**O2**	O3	O4	O5	O6	**O7**	O8	O9	O10	O11	**O12**	O13
DS	**19**	22	**25**	20	23	16	17	**23**	21	18	21	23	**26**	32

SHH	**13**	12	**12**	18	18	12	9	**15**	14	12	12	12	**18**	18
SB	**14**	15	**16**	15	16	14	15	**15**	14	17	18	19	**18**	23
sum	**46**	49	**53**	53	57	42	41	**53**	49	47	51	54	**62**	73

Table 7. Overall metric score for each option ranked in order from highest to lowest. The highest overall metric score indicates that that option is the most efficient and effective at conserving the bycatch species, while the lowest indicates the least efficient and effective option at conserving the bycatch species. Sub-Alternatives selected from these options are in bold. The *Scope* value is the spatial extent of the relevant area (square nautical miles) multiplied by the number of months. The *Scope Delta* value is the difference between the relevant option and status quo (Option 0).

Option	Overall Metric Score	Scope	Scope Delta
13	73	64884.68	27035.28
12	**62**	**43178.86**	**5329.47**
4	57	43178.86	5329.47
11	54	51232.11	13382.71
2	**53**	**37849.40**	**0.00**
3	53	43178.86	5329.47
7	**53**	**36793.03**	**-1056.37**
10	51	51232.11	13382.71
1	49	37849.40	0.00
8	49	36793.03	-1056.37
9	47	51232.11	13382.71
0	**46**	**37849.40**	**0.00**
5	42	31937.09	-5912.31
6	41	45311.04	7461.64

CHARLESTON BUMP CLOSED AREA

Table 8. The four *metric scores* for each option (O) for each species. The O in front of each column header represents the word *option*, and corresponds to the various options in the Options and Metrics section above. For example, Option 0 (O0) represents the status quo. *Overall metric scores* for each option is summed at the bottom. Sub-Alternatives selected from these options appearing in the DEIS are in bold. Species abbreviations are as follows: TLB = leatherback sea turtle; SMA = shortfin mako shark; BILFH = billfish species group; TTL = loggerhead sea turtle.

Species	Metric	**O0**	O1	O2	O3	**O4**	**O5**	O6	O7	**O8**	O9	O10	O11	**O12**	O13	O14	O15
TLB	1	**2**	3	4	3	**4**	**7**	7	7	**7**	3	4	2	**6**	4	3	5
	2	**2**	3	4	3	**4**	**5**	5	6	**6**	2	3	2	**4**	4	2	4
	3	**3**	4	5	3	**4**	**2**	2	1	**1**	3	1	3	**1**	6	2	2
	4	**2**	3	4	3	**4**	**12**	8	12	**8**	3	4	3	**7**	8	3	5
SMA	1	**3**	4	4	3	**3**	**5**	5	7	**6**	3	4	3	**5**	4	3	4
	2	**3**	4	5	3	**4**	**5**	5	5	**5**	3	4	3	**5**	5	3	5
	3	**2**	3	4	3	**4**	**4**	4	3	**3**	2	2	2	**2**	4	2	4
	4	**3**	4	4	3	**3**	**6**	6	8	**7**	3	4	3	**6**	5	3	5
BILFH	1	**0**	0	0	0	**0**	**5**	1	3	**1**	0	0	0	**2**	7	0	0
	2	**0**	0	0	0	**0**	**0**	0	0	**0**	0	0	0	**0**	1	0	0
	3	**0**	0	0	0	**0**	**0**	0	0	**0**	0	0	0	**0**	0	0	0
	4	**0**	0	0	0	**0**	**0**	0	0	**0**	0	0	0	**0**	0	0	0
TTL	1	**0**	0	0	0	**0**	**0**	0	0	**0**	0	0	0	**0**	0	0	0
	2	**1**	1	1	0	**0**	**0**	0	0	**0**	0	0	1	**0**	1	0	0
	3	**0**	0	0	0	**0**	**0**	0	0	**0**	0	0	0	**0**	0	0	0
	4	**0**	0	0	0	**0**	**0**	0	0	**0**	0	0	0	**0**	0	0	0
	sum	**21**	29	35	24	**30**	**51**	43	52	**44**	22	26	22	**38**	49	21	34

Table 9. *Total metric scores* summed by species for each option. Option 0 (O0) represents status quo. Overall metric scores for each option is summed at the bottom. Sub-Alternatives selected from these options appearing in the DEIS are in bold. Species abbreviations are as follows: TLB = leatherback sea turtle; SMA = shortfin mako shark; BILFH = billfish species group; TTL = loggerhead sea turtle

Species	**O0**	O1	O2	O3	**O4**	**O5**	O6	O7	**O8**	O9	O10	O11	**O12**	O13	O14	O15
TLB	**9**	13	17	12	**16**	**26**	22	26	**22**	11	12	10	**18**	22	10	16
SMA	**11**	15	17	12	**14**	**20**	20	23	**21**	11	14	11	**18**	18	11	18
BILFH	**0**	0	0	0	**0**	**5**	1	3	**1**	0	0	0	**2**	8	0	0

TTL	**1**	1	1	0	**0**	**0**	0	0	**0**	0	0	1	**0**	1	0	0
sum	**21**	29	35	24	**30**	**51**	43	52	**44**	22	26	22	**38**	49	21	34

Table 10. Overall metric score for each option ranked in order from highest to lowest. The highest overall metric score indicates that that option is the most efficient and effective at conserving the bycatch species, while the lowest indicates the least efficient and effective option at conserving the bycatch species. Sub-Alternatives selected from these options are in bold. The *Scope* value is the spatial extent of the relevant area (square nautical miles) multiplied by the number of months. The *Scope Delta* value is the difference between the relevant option and status quo (Option 0).

Option	Option Metric Score	Scope	Scope Delta
7	52	124,068	15,272
5	**51**	**240,372**	**131,576**
13	49	435,182	326,386
8	**44**	**82,712**	**-26,084**
6	43	160,248	51,452
12	**38**	**132,730**	**23,934**
2	35	181,326	72,530
15	34	100,155	-8,641
4	**30**	**145,061**	**36,265**
1	29	145,061	36,265
10	26	66,365	-42,431
3	24	108,796	0
9	22	81,629	-27,167
11	22	118,158	9,363
0	**21**	**108,796**	**0**
14	21	60,093	-48,703

EAST FLORIDA COAST CLOSED AREA

Table 11. The four *metric scores* for each option (O) for each species. The O in front of each column header represents the word *option*, and corresponds to the various options in the Options and Metrics section above. For example, Option 0 (O0) represents the status quo. *Overall metric scores* for each option is summed at the bottom. Sub-Alternatives selected from these options appearing in the DEIS are in bold. Species abbreviations are as follows: TLB = leatherback sea turtle; SMA = shortfin mako shark; BILFH = billfish species group; TTL = loggerhead sea turtle.

Species	Metric	**O0**	**O1**	O2	O3	**O4**	O5	**O6**	**O7**	O8
TLB	1	**2**	**4**	2	4	**4**	4	**3**	**3**	3
	2	**3**	**4**	3	4	**4**	4	**4**	**4**	4
	3	**7**	**6**	5	3	**3**	3	**7**	**5**	5
	4	**9**	**9**	10	10	**10**	10	**9**	**10**	10
SMA	1	**0**	**4**	0	5	**5**	5	**5**	**5**	5
	2	**3**	**3**	3	3	**3**	3	**3**	**3**	3
	3	**4**	**3**	4	3	**3**	3	**4**	**4**	4
	4	**5**	**6**	5	6	**6**	6	**6**	**6**	6
BILFH	1	**7**	**7**	7	6	**6**	6	**7**	**7**	7
	2	**0**	**0**	0	0	**0**	0	**0**	**0**	0
	3	**0**	**0**	0	0	**0**	0	**0**	**0**	0
	4	**3**	**3**	0	0	**0**	0	**1**	**0**	0
TTL	1	**0**	**0**	0	0	**0**	0	**0**	**0**	0
	2	**0**	**0**	0	0	**0**	0	**0**	**0**	0
	3	**0**	**0**	0	0	**0**	0	**0**	**0**	0
	4	**0**	**0**	0	0	**0**	0	**0**	**0**	0
	sum	**43**	**49**	39	44	**44**	44	**49**	**47**	47

Table 12. *Total metric scores* summed by species for each option. Option 0 (O0) represents the status quo. Overall metric scores for each option is summed at the bottom. Sub-Alternatives selected from these options appearing in the DEIS are in bold. Species abbreviations are as follows: TLB = leatherback sea turtle; SMA = shortfin mako shark; BILFH = billfish species group; TTL = loggerhead sea turtle.

Species	**O0**	**O1**	O2	O3	**O4**	O5	**O6**	**O7**	O8
TLB	**21**	**23**	20	21	**21**	21	**23**	**22**	22
SMA	**12**	**16**	12	17	**17**	17	**18**	**18**	18

BILFH	**10**	**10**	7	6	**6**	6	**8**	**7**	7
TTL	**0**	**0**	0	0	**0**	0	**0**	**0**	0
sum	**43**	**49**	39	44	**44**	44	**49**	**47**	47

Table 13. Overall metric score for each option ranked in order from highest to lowest. The highest overall metric score indicates that that option is the most efficient and effective at conserving the bycatch species, while the lowest indicates the least efficient and effective option at conserving the bycatch species. Sub-Alternatives selected from these options are in bold. The *Scope* value is the spatial extent of the relevant area (square nautical miles) multiplied by the number of months. The *Scope Delta* value is the difference between the relevant option and status quo (Option 0).

Option	Overall Metric Score	Scope	Scope Delta
1	**49**	**288,106**	**-74,547**
6	**49**	**266,700**	**-95,953**
7	**47**	**239,047**	**-123,606**
8	47	241,484	-121,169
3	44	183,740	-178,913
4	**44**	**191,053**	**-171,600**
5	44	188,615	-174,038
0	**43**	**362,653**	**0**
2	39	303,015	-59,638

DESOTO CANYON CLOSED AREA

Table 14. The four *metric scores* for each option (O) for each species. The O in front of each column header represents the word *option*, and corresponds to the various options in the Options and Metrics section above. For example, Option 0 (O0) represents the status quo. *Overall metric scores* for each option is summed at the bottom. Sub-Alternatives selected from these options appearing in the DEIS are in bold. Species abbreviations are as follows: TLB = leatherback sea turtle; SMA = shortfin mako shark; BILFH = billfish species group.

Species	Metric	**O0**	O1	O2	**O3**	**O4**	O5	O6	O7	O8	O9	**O10**	O11	O12
TLB	1	**2**	3	0	**2**	**3**	2	3	3	3	0	**3**	3	0
	2	**4**	4	1	**4**	**5**	4	5	5	4	1	**5**	4	1
	3	**8**	1	3	**8**	**8**	8	4	8	6	2	**10**	7	3
	4	**7**	8	6	**7**	**7**	7	8	7	5	2	**8**	6	2
SMA	1	**12**	12	12	**12**	**12**	12	12	12	7	5	**12**	7	5
	2	**3**	4	0	**3**	**3**	3	4	1	1	0	**1**	1	0
	3	**3**	0	0	**3**	**3**	3	0	5	4	1	**8**	5	3
	4	**2**	4	0	**2**	**3**	2	4	3	3	0	**4**	3	1
BILFH	1	**12**	8	9	**9**	**11**	12	5	10	7	3	**11**	7	4
	2	**2**	0	3	**2**	**0**	1	0	0	0	0	**0**	0	0
	3	**6**	0	4	**6**	**1**	3	0	3	3	0	**3**	3	0
	4	**4**	2	5	**4**	**4**	4	2	4	4	0	**3**	3	0
	sum	**65**	46	43	**62**	**60**	61	47	61	47	14	**68**	49	19

Table 15. *Total metric scores* summed by species for each option. Option 0 (O0) represents status quo. Overall metric scores for each option is summed at the bottom. Sub-Alternatives selected from these options appearing in the DEIS are in bold. Species abbreviations are as follows: TLB = leatherback sea turtle; SMA = shortfin mako shark; BILFH = billfish species group.

Species	**O0**	O1	O2	**O3**	**O4**	O5	O6	O7	O8	O9	**O10**	O11	O12
TLB	**21**	16	10	**21**	**23**	21	20	23	18	5	**26**	20	6
SMA	**20**	20	12	**20**	**21**	20	20	21	15	6	**25**	16	9
BILFH	**24**	10	21	**21**	**16**	20	7	17	14	3	**17**	13	4
sum	**65**	46	43	**62**	**60**	61	47	61	47	14	**68**	49	19

Table 16. Overall metric score for each option ranked in order from highest to lowest. The highest overall metric score indicates that that option is the most efficient and effective at conserving the bycatch species, while the lowest indicates the least efficient and effective option at conserving the bycatch species. Sub-Alternatives selected from these options are in bold. The *Scope* value is the spatial extent of the relevant area (square nautical miles) multiplied by the number of months. The *Scope Delta* value is the difference between the relevant option and status quo (Option 0).

Option	Overall Metric Score	Scope	Scope Delta
10	**68**	**319,249**	**14,207**
0	**65**	**305,042**	**0**
3	**62**	**240,914**	**-64,128**
5	61	266,398	-38,644
7	61	273,758	-31,284
4	**60**	**227,754**	**-77,288**
11	49	186,229	-118,813
6	47	151,134	-153,908
8	47	159,692	-145,350
1	46	152,290	-152,752
2	43	152,752	-152,290
12	19	133020.4	-172021
9	14	114065.8	-190976

APPENDIX 6. CENTER OF INDEPENDENT EXPERTS REVIEW

The application of HMS PRiSM in Amendment 15 is an innovative approach to address challenges in assessing the effectiveness of existing spatial management areas for commercial HMS bottom and pelagic longline fisheries. To ensure that the approach is sound, NOAA Fisheries formally consulted with outside experts at two points in the process, each providing valuable insight and assurances. First, the HMS PRiSM methodology was submitted for peer-review and publication in the scientific journal Marine Biology. Details are provided in Section 2.1. Second, portions of the DEIS were submitted to the Center of Independent Experts (CIE) for review.

To ensure that NOAA Fisheries is using the best available scientific information for management considerations, CIE was established in 1998 to routinely provide external, independent, and expert reviews of the Agency's science used for policy and management decisions. The CIE process satisfies peer review standards as specified in the Magnuson-Stevens Act provision National Standard 2 guidelines. These guidelines specify that peer review is an important factor in the determination of best scientific information available, and the selection of reviewers must adhere to peer review standards such as high qualifications, independence, and strict conflict of interest standards. The CIE is a proven process that strengthens the quality and credibility of the agency's science, and has improved stakeholder's trust that the agency is basing policy decisions on the best scientific information available.

On July 8, 2022, NOAA Fisheries submitted portions of the Amendment 15 DEIS to CIE for review by three independent experts. These portions primarily were related to the use of PRiSM in developing alternatives. NOAA Fisheries requested that the reviewers provide comments on the description and communication of the spatial management alternatives and the application of the analytical approach including HMS PRiSM's use in developing the alternatives and analyzing impacts. Because the HMS PRiSM methodology had already been peer-reviewed and published in the scientific journal Marine Biology, we requested that reviewers not focus on the specific HMS PRiSM methodology. However, NOAA Fisheries did provide background material and answer questions to ensure the reviewers had a complete understanding of the spatial modeling tool. EM cost allocation alternatives were not included in the CIE review.

On August 24, 2022, NOAA Fisheries received review reports from the three CIE-selected independent experts. In general, all three reviewers were supportive of the analytical approach and indicated that it is appropriate for management. Each reviewer also found that the approach was well-described and communicated. In addition to the overall supportive findings, each reviewer provided suggestions for near-term and long-term improvements in the approach and communication of the alternatives. Most of the suggestions were incorporated into the DEIS. This appendix provides responses and/or action taken to address each of the comments, suggestions, or questions in the reviewer reports. The three original review reports can be accessed online at the NOAA Fisheries CIE Repository.

RESPONSES TO REVIEWERS COMMENTS AND QUESTIONS

GENERAL/OTHER COMMENTS

Comment 1: The approach of combining alternatives of a particular spatial management area ("A" Alternatives) with a data collection and monitoring alternative ("B" Alternatives), and timeline for evaluation ("C" Alternatives) into packages is a good and pragmatic way of getting manageable alternative options. Doing so prevents a many-dimensional analysis and will likely make discussions and decisions of the way forward easier.

Response: We thank the reviewer for this comment.

Comment 2: There could be more information presented on the current state of these stocks before and now, and of bycatch species. If the situation is better now, this would influence the decision about increasing or decreasing the closed areas.

Response: Chapter 4 of the DEIS provides information regarding current stock status of target and bycatch species. This information was considered when determining the bycatch species to focus on with each spatial management area (Section 2.3) and again when describing the impacts of the various alternatives (Chapter 5). Additionally, as noted in the DEIS, the assessment of closed areas focuses on current conservation and management goals rather than those that existed at the time of implementation. Additionally, benchmarks, assessment tools, ESA listings, and legislative stock status definitions have changed since implementation, complicating direct comparison of historical and current stock health. For this reason, Amendment 15 focuses on current conservation and management goals, including taking into account the current stock health of bycatch species.

Comment 3: One reviewer asked if there are any international agreements regarding biodiversity that should be considered or if U.S. laws already address global biodiversity issues. The reviewer noted that the western North Atlantic and Gulf of Mexico has many iconic species (six species of sea turtles, many whale species, many shark species, and many billfish).

Response: Domestic HMS management requires consideration of the Magnuson-Stevens Act, the Atlantic Tunas Convention Act (ATCA), and other statutes. Under ATCA, the Secretary of Commerce promulgates regulations as may be necessary and appropriate to carry out recommendations by the International Commission for the Conservation of Atlantic Tunas (ICCAT). ICCAT is an international regional fisheries management organization comprised of 52 Contracting Parties including the United States, and Cooperating non-Contracting Parties, Entities, and/or Fishing Entities (CPCs). ICCAT manages tuna and tuna-like species in the Atlantic Ocean and its adjacent seas and also conducts research. Many of the species considered in this Amendment are subject to Recommendations issued by ICCAT including all four billfish species, shortfin mako sharks, bluefin tuna, and swordfish. Thus, management measures considered in Amendment 15 are consistent with binding international agreements issued through ICCAT.

Comment 4: One reviewer suggested including more information about the catch occurring in the Mid-Atlantic shark closed area in Chapter 4 to make it consistent with the information provided for the other monitoring or closed areas.

Response: We added this description for the Mid-Atlantic shark closed area in Section 4.11.6.

Comment 5: Multiple reviewers provided suggestions for improved socioeconomic impact analyses. One reviewer suggested improving the language in Chapter 4 where median net earnings are discussed. The reviewer was also unsure of the purpose of that section. For example, the reviewer stated, "if [the goal of the section] is to provide a thorough background to the practice and economics of the fisheries, then it succeeds admirably. However, it is not in any way integrated into the sections of proposing and analyzing the proposed changes to the closed areas." Another reviewer noted that generally, the ecological and socioeconomic analyses supporting the alternatives were logical and documented appropriately, but there seems to be a lack of an analysis of the fishing activity impaired when a new area/month (next to the existing one) was suggested to be closed in a revision of a closed area/month.

Response: The data and discussion provided in Chapter 4 are meant to provide the current state of the fisheries. This information provides a starting point that can aid the reviewer in understanding the overall impact of the alternatives. Chapter 5 contains the impact analysis and, as such, includes additional economic impact analyses. These analyses directly assess impacts due to proposed changes in spatial area management.

Comment 6: One reviewer suggested considering population modeling to identify the actual percentage of bycatch risk necessary to determine high/low bycatch risk instead of expert judgment. They mentioned that as a first iteration using expert judgment may be appropriate but to consider population modeling in future iterations/revisions of our approach to tune the "allowable" bycatch risk.

Response: The "expert judgement" used in setting high/low bycatch risk threshold included some population modeling performed in stock assessment for the bycatch species considered. Thresholds were set based on stock status, as determined by stock assessments. However, in future iterations of HMS PRiSM, population modeling specific to bycatch risk could be incorporated.

Comment 7: Multiple reviewers suggested that any new data collected through research fishing/monitored fishing as a result of this action should be included to help further review/refine/adapt the PRiSM model and the areas.

Response: We are and had planned to use the data from the various data collection programs to help further revise PRiSM and the areas in future iterations.

Comment 8: Reviewers provided multiple comments on the successful communication of work in the DEIS.

- The NOAA Fisheries Report was well-written and easy to evaluate. The trade-off between socio-economics and conservation objectives are clearly presented.
- The NOAA Fisheries Atlantic Highly Migratory Species Management Division prepared a report that was carefully constructed and edited, making the job of providing an external review much easier. Specifically, figure and Table captions in chapter 3.1 "A Alternatives: Evaluation and Modification of Spatial Management Areas" and "Appendix 4 – Options, Metrics, and Scoring" are complete, and informative. Congratulations and thanks to the NMFS team for the effort made to facilitate the reading of the report for reviewers and probably for stakeholders' non-specialists of the scientific jargon.
- The score metrics used to compare the time-area management alternatives with the current closed areas are clearly described.

Response: We thank the reviewer for these comments.

Comment 9: One reviewer asked which aspects of the HMS spatial management plan are specific to highly migratory species. Specifically, the reviewer asked how the plan would be different for less mobile species.

Response: If the plan were for different species, the type of fisheries data used in PRiSM would change (e.g., pelagic longline vs bottom trawl) and, for a less mobile species, the spatial management areas would likely be smaller in area. Furthermore, variables to predict fishery interaction probabilities may not include the same dynamic ocean conditions such as currents, and would likely include more static variables such as bottom type. However, because this Amendment focuses on HMS, less mobile species are not the focus of supporting analyses.

Comment 10: One reviewer stated that the consideration of how to incorporate different types of stakeholder input, specifically non-economic social data, into decision making leading into spatial management processes is missing. The reviewer suggested that the guideline introduced by Murphy et al. (2022) could provide a framework for the integration of stakeholder perspectives to help inform the trade-offs of alternative regulatory options for the spatial management of the Northwest Atlantic fisheries. The reviewer also said that given that the HMS Advisory Panel is composed of members of environmental groups, fishery administration, academics, and representatives of recreational and commercial fisheries, it could be the ideal place to define which qualitative indicators could be combined to the ecological metrics used by PRiSM.

Response: Before we began working on PRiSM, we collected stakeholder input via a scoping document (May 16, 2019; 84 FR 22112). We held five public hearings and received both verbal and written comments. All of the comments collected were considered when developing Amendment 15. Once the proposed rule and draft Amendment are public, we plan to share the documents with the HMS Advisory Panel, state partners, Fishery Management Council partners, and the public to ensure we incorporate perspectives of all user groups and interested parties when making decisions on the spatial management processes. While stakeholder input was not formally incorporated into the PRiSM model, the rule planning and the rulemaking process provide multiple avenues for public input.

Comment 11: One reviewer stated that the conclusions of the report are that three communities have greater than normal dependence on the recreational and commercial fishing sectors for jobs and economic support and four other communities are very dependent on the recreational sector. Compared to vulnerability indicators, six communities are classified as communities which would likely experience greater difficulty recovering from economic hardships caused by job losses in the recreational and commercial fishing sectors. This work of identifying communities that could be weakened by a modification of the spatial management areas is necessary, but the impact it could have on each socio-economic indicator is not explained.

Response: Limited expansion of fishing access is likely to increase opportunities for communities in the vicinity of current spatial management areas. Additional economic impacts analyses are included in each Section of Chapter 5. These analyses directly assess impacts due to proposed changes in spatial area management.

Comment 12: One reviewer asked how changes in closed areas affect sport fishing activities, and consequently the communities that depend on it. The reviewer stated that the document clearly indicates that several sub-alternatives would allow a potential increased access to target species, but this seems limited to the longline surface fishery and in the lack of more detailed information this is difficult to evaluate the socio-economic impact of the different alternatives on the communities.

Response: We added further consideration of recreational fishing impacts in Section 5.4.6.

A ALTERNATIVES/PRISM METHOD

Comment 13: Reviewers complimented PRiSM in the following comments.

- The PRiSM model provides a sound approach to designing protected areas.
- This first attempt at producing a justified "best available science" approach to moving beyond the often *ad hoc* designation of marine protected areas clearly succeeds and the review commends the scientists on being able to advance the scientific basis for managing closed areas for difficult widely distributed species.
- Keeping in mind the limits due to the gap in fishery-dependent data and given the current state of knowledge for the different bycatch species, the report represents the best available science.
- The application of PRiSM and related analyses is sound, reasonable, and logical, based on the data presented and relevant scientific information. In

the light of the metric scores resulting from the comparison of the predicted occurrence rate from PRiSM inside the closed area to the occurrence rate from the fishery outside the closed area, we deduce that the current time-area strata are largely improvable.

- Keeping in mind the limits due the gap in fishery-dependent data, the application of PRiSM and related analyses is sound and reasonable.
- The development and use of the PRiSM model is a very innovative, scientific sound, and (it seems) a robust way of obtaining inferences of the issue in question, the likelihood of unwanted by-catch in closed areas.
- The methods are described in a clear and understandable language. It is clear how the PRiSM was applied. The caveats, limitations, and uncertainties in the approach are clearly described.
- The PRiSM framework and the other analytical approach were applied in a logical and justifiable manner to develop the range of alternatives presented. When PRiSM was used to characterize the impacts of each alternative, the characterization of ecological impacts was consistent with the PRiSM results.
- Given the caveats mentioned above I think the PRiSM and other analytical approaches like the bluefin tuna considerations were applied in a logical and justifiable manner to develop the range of alternatives.
- The overall process of evaluating between the model alternatives is valid. The scoring system has been applied appropriately and represents an objective method to evaluate different proposed changes. The description of the different options and the outcome of the scoring is well presented and relatively clear.

Response: We thank the reviewer for these comments. We are aware of limitations of the data and hope to continue to further advance these techniques in the future.

Comment 14: Reviewers had multiple suggestions to incorporate and/or model species distribution or abundance, including suggestions to incorporate tagging data for more information on species distribution.

- The proportion of locations within a region where the bycatch species is present was used as a surrogate for species abundance. Nevertheless the use of presence/absence data in SDM [spatial distribution modeling] might present the risk of misinterpreting absence (e.g., false negative, Royle and Link, 2006). An observed absence may be due to the fishing gear configuration failing to detect the presence of the species that is actually resident at the fishing location. Suggested: To correct under-detection (the species is present but not observed) and bias (i.e., when variation in abundance induces variation in detection probability), maybe repeated measures in the same location could help to estimate the detectability of the bycatch species (Royle and Nichols, 2003; MacKenzie, 2005, among others). If I am not wrong for each bycatch species, the occurrence probability was calculated at the scale of grid cell with sides equal to 1/12°. Is there no way to estimate detectability?

- There are some potential areas for improvement in future use of the PRiSM model as well as research recommendations on the usefulness of integrating tagging data information and on the integration of non-economic social data into decision making leading into spatial management processes.
- Can the social behavior of a species (i.e., solitary animals, living in small groups, schooling) bias the interpretation of the score metrics? Is it accounted for in the random cross-validation procedure? (e.g., non-independence of residuals, if the presence of an individual is correlated with the presence of another individual). How will presence/absence data and the score metrics help to identify the potential effectiveness of the closed area? I know that this is an extreme situation but how can one be sure that the results are not group structure dependent?

Response: As this is the first iteration of PRiSM, we assume improvements will be made in the future when the reassessment of the spatial management areas occurs, particularly based on the recommendations of the reviewers. We purposely focused on individuals interacting with the gear. The model is not trying to predict species distribution. If we were trying to predict species distribution, we would consider using fishery independent data in addition to fishery dependent data. Because the intention of this action is to assess closed areas of a specific fishery, not all types of fishing, it only matters to us whether a species actually interacts with the specific gear. Therefore, instances where the species was present but did not interact with the gear is not of concern. For example, a species may be at a specific depth in a specific region that allows a species to not interact with fishing gear or the size of the hook used by the fishermen may reduce the chances of a species interacting with the gear. Based on these reasons, we specifically used data from that type of fishing (e.g., pelagic longline) to develop PRiSM. It is likely the interaction rate developed from fishery dependent data and species distributions developed from tagging data will produce relatively similar outputs. However, those outputs could differ slightly because of the reasons mentioned above. Additionally, the maps produced by PRiSM shared similar trends to studies where tagging was done to understand HMS distribution. The tagging studies conducted on HMS are described in Crear et al. 2021. We also provided additional text in Section 2.4 providing some of the information stated above and to show that studies that used different data types had similar distribution outputs.

The sample size of fishery dependent data is large and spans multiple years. This means the same location was likely sampled often, and repeated measures would not need to be done. The reviewer is correct that the scale of occurrence probability was 1/12°.

Because the model is presence/absence, it does not take into account abundance/density. For example, the low density species that is evenly distributed may score higher than the high density patchy distributed species. The fact that the low density species that is evenly distributed may score higher would be considered a limitation due to the fact that we chose a presence/absence model instead of an abundance model. Despite this, there were many reasons why we chose presence/absence such as the difference in data quality and amount of individuals caught for different bycatch species collected by observers. Managers were also more interested in predicting interaction rate, which aligned more easily with the presence/absence modeling approach.

Comment 15: One reviewer requested clarification on collinearity of covariates used in creating the HMS PRiSM model. Specifically, the DEIS notes that some covariates were removed if they were collinear with another variable. Since collinearity can occur on a spectrum, the reviewer requested information of the threshold used to determine if enough collinearity existed to remove a covariate.

Response: To prevent including too much detail and to make the DEIS as approachable to the general public as practicable, we did not provide additional text describing this method, but have described it in more detail here. To clarify we used a threshold of 0.6 or greater to indicate if two covariates were collinear.

Comment 16: One reviewer stated that it is not good practice to take a standard model like a generalized additive model and just add in covariates randomly and afterward sort out the best model with Akaike information criterion (AIC).

Response: The process we used is called model selection, which is a commonly used approach in identifying the best covariates to include in a model. We used literature to determine appropriate covariates used for specific species. Knowledge of the importance and effect of covariates on species contributed to the various combinations of covariates for each candidate model. We therefore ensured that all models were thoroughly thought through and followed the best available science and literature.

Comment 17: One reviewer indicated that they would like to see the validations of the models, although the validations in the published PRiSM paper were quite convincing. In addition, they mentioned that it is even more important than normal that diagnostics are well presented for the analysis because the public doesn't have access to confidential data.

Response: We added all diagnostic information such as the validation information to the DEIS in Section 2.4 and Appendix 2.

Comment 18: One reviewer indicated that fishery-induced changes to habitat were not considered in HMS PRiSM and that the assumption that habitat inside and outside closed areas are the same may not be correct. The reviewer stated that changes to bottom habitat could occur with gears that interact with the ocean bottom or changes in the number of higher-trophic level fish could impact forage fish numbers. Either of these instances would result in habitat that is different inside the closed area relative to outside due to differences in fishing effort.

Response: PRiSM does take into account the varying physical conditions (covariates) inside and outside the closed area, none of which would change due to a change in fishing effort. NOAA Fisheries completed reviews of fishing gear impacts in the 1999 HMS FMP, Amendment 1 to the 1988 Billfish FMP, the 2006 Consolidated HMS FMP, and Amendments 1 and 10 to the 2006 Consolidated HMS FMP. These analyses determined that the majority of HMS gears are fished within the water column and do not make contact with the sea floor. Because of the magnitude of water column structures and the processes that create them, there is little effect expected from the HMS fishing activities with pelagic longline gear undertaken to pursue these animals. Deployment of pelagic longline gear is not anticipated to permanently affect the physical characteristics that define HMS EFH such as salinity, temperature, dissolved oxygen, and depth. Because pelagic longline gear is fished in the water column and does not come in contact with the benthic environment, the pelagic longline fishery is anticipated to have minimal to no impact on EFH (for Atlantic HMS or for other species managed under Council FMPs) associated with the benthic environment. While bottom longline can touch the bottom, most fishermen do not set the gear on any habitat, such as coral, that would interact with the gear or cause the gear to be torn. These gears are not similar to other bottom fishing gears such as trawls. Further, the activities authorized under this action would occur in areas that include essential fish habitat (EFH) for species managed by the Mid-Atlantic Fishery Management Council and New England Fishery Management Council in addition to the HMS Management Division of NOAA Fisheries. NOAA Fisheries does not anticipate that this action would have any adverse impacts on EFH because pelagic longline, rod and reel, and harpoon gear would not contact the substrate. Therefore, no consultation is required. EFH is also described in more detail in Chapter 5. We acknowledge a change in fishing effort could lead to a change in bycatch interactions (higher trophic level species), which in turn could impact forage fish numbers, but we think those potential changes will be minimal and non-quantifiable, especially since the change in fishing effort would not dramatically increase.

Comment 19: One reviewer suggested including consideration of the amount of fishing taking place in the areas to be included in the potential revisions of the closed areas. The reviewer noted that if it is a highly fished area that is going to be closed, it would shift the balance between conservation and fishing differently than if it is a lightly fished area. The reviewer felt it would be important to know how much fishing can and will take place in reopened areas. This latter issue however is difficult to predict but maybe the PRiSM approach could be used also for this issue.

Response: This concept is discussed in detail Chapter 5 of the DEIS. The preferred alternatives do not close any areas that would be considered highly fished. The preferred alternatives would actually lead to increases in longline fishing under some data collection program. When temporal and spatial changes were made to each closed area we assumed that effort would be redistributed based on effort in adjacent months inside or outside the spatial management area or percent of effort over historical periods prior to the closures going into effect.

Comment 20: One reviewer noted that the so-called scope, i.e., the area of the closed area times the number of months it is closed, seems to give higher scores in the combined scoring metric the higher the scope is. As the question is to find the right or optimal balance between conservation and fishing, the reviewer felt this seemed like a weak point in the aggregate score metric that it automatically gives a higher score the larger the closed area.

Response: The scope value is not combined with the metric scores. Both the scope value and overall metric scores tell us different pieces of information, both of which were used with other qualitative information to determine the preferred alternatives. Scope also ensures that size of the area is not the only consideration, it also has a temporal component (i.e., number of closed months).

Comment 21: One reviewer felt we could be clearer that the scoring system was focused on conservation aspects and not about a balance between fishing and conservation, and that impact on fishing will be a separate consideration.

Response: The DEIS has been updated to clarify that proposed measures were designed to avoid jeopardizing conservation and management goals, and that increased fishing access is ancillary to the goal of increased data collection.

Comment 22: One reviewer noted that the predictions were limited to the <u>fishery domain</u>, which is the area where 95 percent of the fishery occurs, and that the way the fisheries domain is obtained is not described in detail. The reviewer said that, "It seems to be by use of some type of spline-smoothing over sea surface area, but how is it done precisely remain uncertain. The description in Crear *et al.* (2021) says *"This was done using the 95% kernel utilization distribution (KUD) …*", but gives no reference and it is not a method so well-known that a reference is not needed."

Response: To prevent including too much detail and to make the DEIS approachable to the general public, we did not provide additional text describing this method, but have described it in more detail here. The method uses the "kernelUD" function in the "adehabitatHR" package in R. Typically this method is used to calculate the home range of a given species. In R, the utilization distribution is defined as "the bivariate function giving the probability density that an animal is found at a point according to its geographical coordinates." The approach is described in more detail in Worton 1995 (Worton, B.J. 1995. Using Monte Carlo simulation to evaluate kernel-based home range estimators. Journal of Wildlife Management, 59, 794–800). By applying this method to fishing locations, we can get an estimate of the area where 95 percent of fishing occurs for a specific fishery.

Comment 23: One reviewer stated that it is not clear whether any kind of smoothing was done for the predictions or if it was just the raw squares of 1/12°, which would likely contain a mosaic of "holes" with non-risk squares among risk squares.

Response: We did not use smoothing when we predicted over the environmental surface. However, the environmental surfaces are generated from oceanographic models in which smoothing and interpolation is used, so that would be reflected in the occurrence probabilities. Therefore, a mosaic of holes was not very common.

Comment 24: One reviewer stated that "probability thresholds" are implicitly linked to a certain effort unit. The reviewer felt it was not clear what that unit was, and asked if the mean effort was by day, the mean set size and soak time, or something else.

Response: During predicting, effort in each grid cell was assumed to be mean set effort across the observer dataset.

Comment 25: Multiple reviewers commented on the clarity of the metric descriptions.

- The approach is quite complicated with four different metrics that each need some "digestion" by the reader. I wonder whether simple illustrations of each of them would be useful for the reader.
- In the table in Section 2.7, several of the explanations are unclear. For instance, for Metric 1 it is stated as the number of months (which can be from 0 to 12, or 0 to 36 if it is not being averaged over 2017-2019), but the underlying metric is "average occurrence probability …". If we look at Appendix 4, it seems that it should be understood as the mean over 2017-2019. Some editing and tidying up seems to be needed to make it easier for the reader to understand the system. Maybe moving the text about "underlying metric" to the column "Metric" would help making it easier to understand.
- For the metrics it might be helpful for the authors to state that it is a mean over 2017-2019 for a given month (if that is the case).
- Adjust wording of Metric 2 to better describe what it is doing.
- A more detailed description of the procedure and rationale of the four metrics would be helpful.

Response: We expanded our description and rationale of the four metrics in Sections 2.5 and 2.7 to help the readers understand the differences and uses of each metric.

Comment 26: One reviewer noted that the DEIS report states: "…bluefin tuna fishery interaction probability maps were taken into consideration separately due to the unique nature of bluefin tuna as an incidental species in the pelagic longline fishery, which is successfully managed through the Individual Bluefin Quota (IBQ) Program." The reviewer suggested expanding the explanation.

Response: We have expanded our explanation of the IBQ program in the DEIS in Section 4.10.2.

Comment 27: One reviewer referenced "Figure 3" which shows the histogram example graphs in Section 2.5. The reviewer stated that the figure is a bit imprecise even as just an illustration. The 50% median is not the peak of the curve in two of the cases, and the 25% in the right most curve seems rather like a 10% one.

Response: We corrected Figure 3 in Section 2.5 based on the reviewer's input and note that it is simply for demonstration purposes to help the reader understand the described principle.

Comment 28: One reviewer indicated that we would not be using the full scope of the occurrence probabilities (actual risk estimates from PRiSM) by using those values to generate binary (high/low) risk areas. The reviewer stated that we would be losing more detailed information provided in the occurrence probabilities. The reviewer also noted that the binary scheme succeeds in highlighting the top 25 and 50 percent of regions with bycatch risk, which most closely aligns with our management objectives.

Response: Two of the four metrics utilized the occurrence probabilities rather than just binary (high/low) risk. We believe the variation in information provided across all metrics addressed the variety and specific aspects scientists and managers thought should be considered when fully assessing a closed area in terms of bycatch protection. High-bycatch-risk/core habitat/area use calculations which all created binary values, are very common approaches to identify hotspots/key areas in many peer reviewed habitat modeling and movement ecology studies.

Comment 29: One reviewer had multiple comments about including the full occurrence probability maps for each bycatch and also comparing these maps to the binary maps and the preferred alternative monitoring and high risk areas in the DEIS.

Response: We have included the full occurrence probability maps for each bycatch species in the DEIS in Appendix 3. We also added a discussion of the full occurrence probability maps, the binary maps, and the preferred alternative spatial management areas for each bycatch species was added to the DEIS in Sections 2.8 and 3.4.

Comment 30: One reviewer suggested including a species-by-species analysis of metrics rather than just discussing the summed values.

Response: We included a more extensive discussion of the species-by-species metrics in Chapter 5 of the DEIS.

Comment 31: One reviewer noted that the metric score figures in the DEIS do not have figure captions.

Response: In Appendix 4, the metric score figure captions are above all figures. Instead of repeating the same text each time for each figure, we put the caption for each metric before all figures.

Comment 32: One reviewer stated that it is not clear if an increase or decrease of metric score is good or bad.

Response: Additional text was provided to more clearly indicate that an increase in a metric score represents an increase in conservation value while also increasing conservation efficiency.

Comment 33: One reviewer suggested a greater description of the limitations and uncertainties of the approach.

Response: A description of the limitations and uncertainties of the model are provided in Crear et al. 2021. We also provided additional information in the DEIS describing the limitations of the scoring system in Section 2.4.

Comment 34: One reviewer recommended that we consider changes to some of the metric scoring system in future iterations of PRiSM after the action is implemented.

- Consider simplification (high/low) of risk areas be done using cumulative risk rather than based on percentiles of the distribution of bycatch risk.
- Evaluate the appropriateness of using binary risk areas instead of the full heatmaps.
- Conduct sensitivity testing on the 25%/50% used to determine high risk to see if management options are sensitive to these values.
- Recommends the summing of all metrics across all species be re-evaluated in future iterations.
- Suggested to continue forward with the current approach but to re-evaluate the approach as new data comes in.

Response: PRiSM is meant to be iterative and flexible, therefore, we will consider these ways to improve and adapt PRiSM in future iterations/revisions when the reassessment of the spatial management areas occurs.

Comment 35: One reviewer noted that the number of candidate options (i.e., sub-alternatives) that are compared with each spatial management measure in force is high (Table 2), and that makes the analysis more complicated since surfaces and months can be different. The reviewer suggested that to partially overcome this aspect, the authors could propose to use a single standardized value that incorporates both spatial and temporal extents for comparing different spatial management areas. The reviewer further noted that it should be kept in mind that summing the surface of a small area throughout a year can produce the same value as a large area closed for only one month, but the global impact in terms of protection of bycatch is probably different.

Response: We appreciate this comment and took into account this difference when designing the varying options. In addition, the scores are reflected based on the amount of time an area would be closed for and the size of the given area so these concerns were considered and addressed in the development of PRiSM.

Comment 36: One reviewer noted that it is unclear how the spatial groups cross-validation procedure account for the offshore-inshore gradient as, except for the DeSoto Canyon closed area, coastal waters are always included in the closed areas of the sub-alternative spatial management (and consequently not sampled, i.e., not included in a training set).

Response: As mentioned in Crear et al. 2021, the spatial blocks were generated over the domain of the fishery and systematically assigned a group number. For example, if there were four groups and five blocks which consisted of three blocks in one row and two blocks in the next row, the corresponding group assignments would be 1, 2, 3, 4, 1. By doing this and visually inspecting the blocks over the fishery domain we ensured all groups were represented throughout different regions of the domain, including depth gradients. Although Figure 1 in Crear et al. 2021 does not show all sets due to confidentiality concerns, sets did occur in coastal waters (at a lower frequency), therefore the coastal areas were still sampled and included in training data sets.

Comment 37: One reviewer noted that in regard to the bycatch species analyzed in the DEIS, several of the species have an unbalanced number of absences compared to the number of presences. The reviewer noted this was the case for Leatherback sea turtle (only 6 percent of presence) with the lowest deviance explained (14 percent) among the best PLL models (see table 2 in Crear et al, 2021). Further, the reviewer assumed that the occurrence of the event is better predicted when having larger proportions of ones in the data and on the other hand, non-occurrence of the event is better predicted when having larger proportions of zeros in the data. Lastly, the reviewer noted that the proportion of presence/absence affects the variance of the estimated parameters of the fitted logistic regression model, ultimately potentially leading to a wrong selection of the significant predictor variables.

Response: We are aware of this concern and note that this issue is a limitation of doing an analysis across multiple species. To address it to the extent practicable, we used bootstrapping to generate uncertainty around the important covariates' marginal means to take into account the variance of estimated parameters. We also used the standard error of the predictions to qualitatively assess the upper and lower confidence intervals of the predicted occurrence probabilities on the map to ensure they did not differ too much away from the mean occurrence probabilities.

Comment 38: One reviewer stated that a balanced subset of data was created for the spatial cross-validation procedure (see Crear et al 2021, p. 5: "*The size of the spatial blocks and the number of groups (i.e., folds) were selected so that the amount of presences and absences were similar among the groups*."). The reviewer asked if the presence/absence ratio was considered only in the spatial cross-validation, and whether there would be a possibility of creating a balanced set of data 0/1 to review the selection procedure of GAM models for the Leatherback sea turtle.

Response: The meaning of text was to indicate that the number of presences were similar among groups and the number of absences were similar among groups, not that the number of presences and absences with each group were similar. That would not work given the large difference in the number of presences and absences particularly for species like leatherback. For example, if there are 2000 total sets (1500 with no occurrences [absence] and 500 with at least one occurrence [presence]) and the number of groups (folds) was three, we tried to generate a size for a spatial block where a similar number of absences (~500) and presences (~165) occurred in each group. This was done by dividing 1500 and 500 by 3.

Comment 39: One reviewer noted that the choice to give an equivalent weight to each species or each score metric probably provides the decision-makers some flexibility. The reviewer felt that this flexibility is acceptable, but noted that (1) some species are in a more undesirable situation (e.g., mako shark and large coastal sharks) than others and (2) some score metrics could be more in relation to the search for effective strata than others (e.g., metric 4 measuring what percentage of the closed area protects high-bycatch-risk areas).

Response: We considered weighing species differently, however, the management importance of a species is already represented in the high-bycatch-risk area value (25 or 50 percent), where a species with a higher value would mean that more high risk area would likely be generated. We also considered weighing the metric scores, but ultimately decided to go with weighing them equally because we could not come up with a reason why one metric should be more important than another.

Comment 40: One reviewer suggested that, in the future, it might be interesting to estimate the decrease in fishing mortality of target species (curiously virtually absent from the DEIS) and bycatch species associated with some candidate closed areas, at least when the new strata configuration is compatible with the closed area in force. The reviewer noted that this estimate would assume catch/discard per day data is available and not only presence/absence data. The reviewer also asked if observers report catch per day data, and, with at-haulback and post-release mortality estimates for bycatch, whether it is possible to estimate how many individuals are protected by the portion of the new closed area (or new months) previously fished.

Response: Unfortunately, we are limited to the observer data, which only cover approximately 10 to 15 percent of total pelagic longline sets. Because all sets are not covered, it is not possible to get an accurate estimate of catch per day data during normal fishing operations. However, within a monitoring area we would have 100 percent observer coverage or electronic monitoring. Therefore, in those instances, we should have mortality numbers at haulback. There have been some studies done to understand the post-release mortality of some of these bycatch species. There are already measures put into place to reduce mortality in bycatch species such as the implementation of circle hooks. The hope is that changes in the spatial management areas will decrease the interaction rate.

Comment 41: One reviewer stated that although the report suggests that several sub-alternatives could reduce interactions between the pelagic longline fishery and the recreational billfish fishery, it is hard to verify the statement. The reviewer suggested that spatial effort distribution maps could make it possible to identify conflict hotspots areas between pelagic longline fisheries and other resource users.

Response: Unfortunately, we do not have data on the distribution of the recreational billfish fishery south of Virginia (e.g., Large Pelagics Survey spans from Maine to

Virginia). We have knowledge of general locations of where HMS recreational fishermen prefer to fish as well as the coastal communities where many recreational fishermen depart from. We will also be considering comments relating to this from the recreational fishermen during the public comment period.

Comment 42: One reviewer noted that hook type and bait type are important explanatory variables that were included by the PRiSM modelers in the logistic GAM models. The reviewer noted that several recent studies have focused on the impact of hook types on at-haulback mortality, post-release mortality, and catch rates of different bycatch species (Reinhardt et al, 2017; Keller et al, 2020; Diaz, 2020; Santos et al, 2020; Ochi et al, 2021). The conclusions do not converge, but it is admitted that bait type, gear configuration, targeted species and environmental factors, may interact with hook type. Although the present review does not target the SDM model used in the DEIS, I suggest adding an interaction term between hook type and bait type in future (after rule is in place) PRiSM analyses.

Response: As shown in the papers cited by the reviewer, hook and bait type can change the species that are caught and the mortality rates of those species. Since implementing the closed areas, we have changed the hook and bait restrictions for the pelagic and bottom longline fisheries. In short, we have already implemented the best scientific information available. In future iterations of PRiSM after the action is implemented, we will consider interactions among covariates, and, if the scientific information indicates that our current hook and bait restrictions need to be modified, we would implement new regulations as needed.

B Alternatives

Comment 43: One reviewer recommended initially only allowing the more limited (Alternative B2) proposal for research fishing across the entirety of the closed areas, and not allowing higher (Alternative B3) fishing pressure in those areas assessed as low risk for research fishing. The reviewer felt that any move to partially open an area should be evidence based. The reviewer also stated the effort cap option B3a would provide a viable approach to limited re-opening of the fishery and providing tuning data as a byproduct, provided that careful monitoring was in place and the ability to step in and curtail the fishery in the event of high bycatch levels was maintained. The reviewer felt that in that case the fishery would be "different" from the full commercial fishery, given the lower effort levels and greater monitoring.

Response: Alternative B2 (Research Fishery) may be able to collect data in a more organized manner leading to more useful analyses in a shorter amount of time since data collection would occur under a planned research program. Despite these advantages, it would likely be the most complex to implement and administer. Alternative B3 would implement monitoring areas which provide a similar level of control (e.g., effort caps as noted by the reviewer) over adverse ecological impacts and, while not necessarily collecting data in an organized way under a research plan, would likely provide a large amount of data to assess the effectiveness of closed areas. For this reason, as described in more detail in Chapter 5, NOAA Fisheries prefers monitoring areas over a research fishery in some spatial management areas.

Comment 44: One reviewer did not recommend using the bycatch cap option (B3b) for gathering research data on bycatch levels without further analysis, although the reviewer also noted that that option may be a viable method for allowing limited commercial fisheries. The reviewer felt that a "bycatch limit" to the fishing is problematic from a scientific data collection point of view, and that such a limit would place high pressure on fishermen to avoid bycatches, and potentially to avoid reporting them, in order to be able to continue fishing. The reviewer felt that the reporting issues could be better addressed through monitoring schemes, however potential changes in fishers' behavior to reduce their bycatch below that which they would normally expect would be problematic in the context of data collection (although obviously desirable in a commercial fishery).

Response: As described in Chapter 5, NOAA Fisheries does not prefer Sub-Alternative B3b to implement bycatch caps in any of the monitoring areas.

Comment 45: One reviewer noted that a "sunset clause" on the closed areas would go directly against the precautionary principle of fisheries management, in that it would imply an increase in fishing pressure due to the absence of data. Instead, the reviewer recommended a commitment to periodic reviews.

Response: As described in Chapter 5, NOAA Fisheries does not prefer Alternative C5 to implement a sunset clause in any of the spatial management areas.

C Alternatives

Comment 46: In regard to the C alternatives on the evaluation timing of spatial management areas, one reviewer noted that alternative C2 (evaluate once three years of catch and effort data are available) makes sense considering the risks of climate change. The reviewer stated that the feasibility of this short timing should be tested against the workload it represents.

Response: We appreciate this comment.

Comment 47: One reviewer noted that the results of PRiSM and data collection results, if reinforced by other tagging analyses, would militate in favor of a dynamic ocean management approach, which can allow the implementation of mobile closures smaller than the existing static closed areas while still providing adequate protection of bycatch (Hazen et al., 2018).

Response: Dynamic ocean management with changing management measures and/or locations based on species distribution and migrations could provide a more flexible approach to protecting bycatch species while minimizing impacts on fishery operations. Although HMS PRiSM was not built for such a purpose, the environmental inputs could be modified and process automated to support dynamic ocean management. However, NOAA Fisheries is still considering ways to apply a dynamic approach, consistent with current legislative mandates and Federal policies to provide notice to the affected public about management changes and ways to communicate such changes to the public in a timely manner. Although Amendment 15 does not include alternatives for dynamic ocean management, such a program could be considered in the future.

Comment 48: One reviewer noted that the further into the future that management relies on PRiSM predictions in the design of spatial management areas, the more inaccurate those predictions will become in space and time because the data would be based on continuously earlier years.

Response: We agree with this statement, and hope to have future iterations/revisions of PRiSM when the reassessment of the spatial management areas occurs.