2.0 SUMMARY OF ALTERNATIVES

This section describes the alternatives to update EFH and designate new HAPCs. In addition, NMFS considers fishing gear impacts on EFH and whether any measures to minimize fishing impacts on EFH are necessary. For the purposes of NEPA, the final action is the selection of the preferred alternatives for revising EFH and for designating a new HAPC.

2.1 Essential Fish Habitat Identifications

In addition to using historical data (pre-1999) to identify HMS EFH, NMFS incorporated new information and data on HMS from 1999-2006 to update EFH identifications, descriptions, and resulting boundaries, as appropriate. EFH for HMS was initially designated in the 1999 HMS FMP, and updated in 2003 for five shark species in Amendment 1 to the 1999 HMS FMP. NMFS considered a number of different approaches and alternatives for updating the EFH boundaries as described below and in Chapter 4.

Alternatives for Identifying Essential Fish Habitat

The following alternatives represent a range of potential methods that could be used to update EFH. Since the primary data type used to delineate EFH boundaries is species-specific distribution data, NMFS has identified geographic areas, rather than specific habitat types, that are considered EFH. Where possible, NMFS has included specific habitat requirements for individual species in the text descriptions, however the spatial boundaries described below will define the EFH boundaries. NMFS considered a number of different analytical approaches to mapping and analyzing the data in an effort to develop a methodology that would be reproducible, transparent, and result in specific areas that could be mapped and identified with spatial boundaries. Regardless of the alternative considered, the resulting boundaries were compared to existing EFH boundaries, verified and corroborated, to the extent possible, with NMFS scientists and researchers familiar with the life history, biology, and habitat requirements for particular species, and then modified based on an analysis of the data.

There are no direct environmental consequences associated with identifying and describing EFH, however, the areas subject to consultation would change if the areas are increased or decreased in size. The approach used to establish new EFH boundaries, as described in the alternatives below, would be applied to all HMS species in the FMU. There were some species for which there was insufficient information or data to identify EFH for individual life stages (adult, juvenile, and young-of-the-year/neonate in the case of sharks, or adult, juvenile, and egg/larval/spawning EFH in the case of tunas, swordfish, and billfish). For those species, the data for all life stages may have been combined into one comprehensive data set to allow identification of EFH for all life stages combined. There were other species (primarily sharks) for which there was insufficient information to identify and describe EFH, either spatially or with text descriptions for any lifestage.

Alternative 1 No Action - maintain current EFH boundaries.

EFH was originally identified and described for Atlantic HMS in the 1999 FMP and Billfish Amendment 1 and updated for five shark species in Amendment 1 to the 1999 FMP and changes may not be needed. As described above, there are no direct ecological impacts associated with the identification and description of EFH. Any positive ecological impacts would be the result of measures, if any, taken to minimize fishing impacts. However, no measures are being implemented at this time.

Alternative 2 Establish new EFH boundaries based on the highest concentration of a particular species by selecting high count cells.

This alternative would establish EFH boundaries based on high count grid cells which are the cells that contain the highest number of observations for a given species. The high count cells were created by superimposing individual data points onto a grid covering waters in the Atlantic, Gulf of Mexico, and U.S. Caribbean EEZ. The grid was constructed of 10 x 10 minute squares (or cells) where one minute equals one nautical mile, resulting in squares that represent approximately 100 square nautical miles. The grid and individual data points for individual species and life stages were spatially joined and each cell was given a number representing the sum of all the points that fell within the cell. The counts within the cells were symbolized using classes created with Jenks natural breaks (ESRI, 2007). Jenks natural breaks are based on identifying break points that best group similar values and maximize the differences between classes. The features were divided into four classes whose boundaries were set where there are relatively large jumps in the data values. NMFS then selected the three highest classes of cells (high count cells) and drew boundaries around those cells to delineate EFH boundaries. As a precautionary measure, and due to uncertainty about the exact location of points within a cell, NMFS included a ten nautical mile buffer around high count cells.

There are several disadvantages to using this approach, including a lack of consistency in the classes that are created for different species and life stages, determining the appropriate threshold for high count cells to include in the new boundaries, and greater variability in the boundaries which must be manually created. An example of this type of approach is shown for blacktip sharks (Figure 2.1).

Alternative 3 *Establish new EFH boundaries based on the 95 percent probability boundary. (Preferred alternative).*

This alternative would establish new EFH boundaries based on the 95 percent probability boundary using ESRI ArcGIS and Hawth's Analysis Tools (www.spatialecology.com). The probability boundary was created by taking all of the available distribution points for a particular species and life stage and creating a percent volume contour (PVC or probability boundary). A detailed description of the tool and the analytical approach used to create the boundary is provided in Chapter 4. For comparative purposes, NMFS also generated the 70, 80, and 90 percent probability boundaries for all species and lifestages. The probability boundary takes into account the distance between each point and the next nearest point, thereby excluding the least dense points (outliers) where the species occurred in relatively low numbers. Although the 70, 80, and 90 percent probability boundaries are shown for comparative purposes, the 95 percent probability boundary is the preferred boundary because it represented the most precautionary approach of the percent probability boundaries analyzed, and corresponded most closely to the 1999 EFH boundaries. The 95 percent probability boundary would include, on average, 95 percent of the points used to generate the probability boundary for a specific species and life stage. Note that the specific EFH boundaries for the preferred alternative are the edited (*i.e.*, clipped) 95 percent probability boundaries. As described in more detail in Chapter 4, in some cases the 95 percent probability boundary may have overlapped with the shoreline due to buffers that are created while generating the probability boundaries. Similarly, the 95 percent probability boundary may have extended beyond the U.S. Exclusive Economic Zone (EEZ) because points were located beyond the EEZ or because the buffer extended the probability boundary beyond the EEZ. Since NMFS cannot designate EFH outside the EEZ, or on land, in some cases the 95 percent probability boundary had to be clipped, or made to match, the existing shoreline or the EEZ boundary, depending on where the overlap occurred.

As described in further detail in Chapter 4, this approach was selected as the preferred alternative because it is based on the actual data points as opposed to points that are merged with a grid as described in alternative 2, provides a standardized and transparent method for delineating EFH, and is reproducible. Disadvantages are that data poor species result in smaller, discontinuous areas than do data rich species. An example of this type of approach is shown for blacktip sharks (Figure 2.2 and Figure 2.3). Figure 2.2 shows the raw, unedited 95 percent probability boundary that results from running Hawth's Analysis tool, whereas Figure 2.3 shows the edited 95 percent probability boundary that was clipped to the shoreline and the 90m contour line as well, as filled in along the coast of Louisiana and Texas, based on comments from scientific reviewers.

For ease of interpretation and viewing, the hardcopy maps included in this amendment only include the preferred 95 percent probability boundary. All of the probability boundaries (70, 80, 90, and 95 percent and 95 percent preferred alternative) were provided during the public comment period for each species and life stage in the electronic pdf version of the DEIS and on the website:

http://sharpfin.nmfs.noaa.gov/website/EFH_Mapper/HMS/map.aspx

The site is referred to as the HMS EFH Evaluation Tool site. During the public comment period, the internet and electronic versions showed all of the probability boundaries and provided the reviewer with the flexibility to turn layers on and off, thus making proposed changes easier to view. For the FEIS, NMFS is continuing the use of the website but will only be posting the final EFH boundary for each species and lifestage and will not be posting all of the probability boundaries considered in the DEIS.

Alternative 4 Establish new EFH boundaries using all points or cells where species are present.

This alternative would use all data points for a particular species to delineate new EFH boundaries. This represents a more precautionary approach than either alternative 2 or 3 and would result in larger EFH areas due to the wide distribution of HMS. Analysis of distribution data indicates that, under this alternative, very large areas could potentially be identified as EFH. In some cases, this could result in EFH including nearly all Federal waters within the EEZ, which may run counter to the intent of identifying areas that are considered essential. Because of this, the alternative was considered but not further analyzed.

Alternative 5 Establish new EFH boundaries using the entire range of distribution for each species and life stage.

This alternative would use the entire known range of distribution for a particular species (rather than specific data points) to define EFH, and as such, would represent the most precautionary approach of all the alternatives. Similar to concerns for alternative 4, this alternative would result in very large areas being identified as EFH, and could include the entire EEZ for some species. Because of this, the alternative was considered, but not further analyzed.

2.2 Designation of Habitat Areas of Particular Concern (HAPC)

To further the conservation and enhancement of EFH, the EFH guidelines (§600.815(a)(8)) encourage FMPs to identify HAPCs. HAPCs are areas within EFH that should be identified based on one or more of the following considerations:

i) The importance of the ecological function provided by the habitat;

ii) The extent to which the habitat is sensitive to human-induced environmental degradation;

iii) Whether, and to what extent, development activities are, or will be, stressing the habitat type;

iv) The rarity of the habitat type.

HAPCs can be used to focus conservation efforts on specific habitat types that are especially important ecologically or particularly vulnerable to degradation. HAPCs do not require any specific management measures and a HAPC designation does not automatically result in closures or other fishing restrictions. Rather, these areas are intended to focus conservation efforts and bring heightened awareness to the importance of the habitat being considered as a HAPC. HAPCs are a management tool that could be used to inform the public of areas where fishing and/or non-fishing actions could receive increased scrutiny from NMFS regarding impacts to EFH. HAPCs can also be used to target areas for research. Measures intended to reduce impacts on habitat would need to be proposed and analyzed and could include gear restrictions, time/area closures, or other measures to minimize impacts to the habitat at such time as the information indicates such action is necessary to protect the habitat. NMFS is not implementing any measures to protect habitat in this amendment because the majority of HMS gears that are fished in the water column do not have a direct impact on habitat. However, NMFS may consider proposing such measures in a future rulemaking. NMFS has provided a list of conservation recommendations in Chapter 6 that apply to all areas designated as either EFH or HAPCs.

Several areas were identified in the 1999 FMP as HAPCs for sandbar sharks, including waters off Chesapeake Bay, VA and MD, Delaware Bay, DE, Great Bay, NJ, and the Outer Banks off North Carolina (NMFS, 1999). NMFS considered the range of alternatives below for new HAPCs that meet one or more of the criteria, as articulated in the EFH guidelines, based upon information provided by scientific experts, or from other information gathered during development of this amendment. For example, comments received during scoping indicated that NMFS should consider areas in the Gulf of Mexico as HAPCs for bluefin tuna. Recent research indicates the central and western Gulf of Mexico may be important bluefin tuna spawning habitat. NMFS has considered the new information and implemented the preferred alternative for HAPCs described below.

Alternative 1. No Action - maintain current HAPCs.

This alternative would maintain existing HAPCs, all of which have been designated for sandbar sharks along the U.S. Atlantic coast, but would not designate any new HAPCs. One of the areas off North Carolina has also been designated as a seasonal time/area closure to protect sandbar and dusky shark pupping and nursery areas. Current HAPCs provide positive ecological benefits and no new HAPCs may be needed. However, existing HAPCs may not provide the level of habitat protection necessary for certain species or stocks, particularly for overfished stocks, where additional habitat protection may be warranted.

Alternative 2. *Designate a HAPC for spawning bluefin tuna in the Gulf of Mexico while maintaining current HAPCs (Preferred Alternative).*

This alternative would establish a new HAPC in the Gulf of Mexico for spawning bluefin tuna while maintaining the current HAPCs for sandbar sharks along the Atlantic coast. New information and research in recent years indicates that certain areas in the Gulf of Mexico may be important spawning habitat for bluefin tuna. During the scoping process, NMFS received a request from the Tag-a-Giant (TAG) Foundation and the National Coalition for Marine Conservation (NCMC) to consider establishing a new HAPC for spawning bluefin tuna in the Gulf of Mexico that NMFS believed coincided with the area proposed in a petition submitted to NMFS in June 2005. During the public hearing process NMFS learned that the actual area proposed by TAG and NCMC was not bounded by straight lines but rather was intended to follow natural contours. As a result, the area was modified slightly based on comments from both the public and scientific reviewers and after further review of the data. The HAPC would be located west of 86 degrees W. Longitude and seaward of the 100m isobath, extending from the 100m isobath to the EEZ (Figure 2.4). The straight-line boundaries originally proposed in Draft Amendment 1 were modified to follow the 100m isobath along the edge of the continental shelf in order to be more representative of the actual spawning habitat used by bluefin tuna. The area includes a majority of the locations where bluefin tuna larval collections have been documented, overlaps with proposed and existing adult and larval bluefin tuna EFH, and incorporates portions of an area identified as a primary spawning location by Teo *et al.* (2007). The area meets at least one, and possibly more, of the requirements for HAPC designation, including "the importance of the ecological function provided by the habitat," "whether and to what extent, development activities are, or will be, stressing the habitat" and the "rarity of the habitat type." The Gulf of Mexico is the only known spawning area for western Atlantic bluefin tuna, and the HAPC designation would highlight the importance of the area for bluefin tuna spawning. It may also provide added conservation benefits if steps are taken to reduce impacts from development activities through the consultation process. Further discussion of potential impacts, as well as conservation recommendations, are provided in Chapter 6.

Alternative 3. Designate a HAPC for spawning bluefin tuna in the Gulf of Mexico based on the 95 percent probability boundary from bluefin tuna larval data collections.

This alternative would establish a new HAPC for spawning bluefin tuna based on the 95 percent probability boundary for bluefin tuna larvae in the Gulf of Mexico, identical to the approach that was used to identify proposed EFH boundaries (Figure 2.5), while maintaining current HAPCs. Ichthyoplankton collections have documented the presence of larval bluefin tuna throughout the Gulf of Mexico with higher abundances in some areas. This alternative would be smaller than the area proposed in alternative 2 and may not encompass all areas where bluefin tuna spawning may occur.

Alternative 4. Designate a HAPC for spawning bluefin tuna based on the 95 percent probability boundary for adult bluefin tuna in the Gulf of Mexico.

This alternative would establish a new HAPC for spawning bluefin tuna based on the 95 percent probability boundary for adult bluefin tuna in the Gulf of Mexico, identical to the approach that was used to identify proposed EFH boundaries (Figure 2.6), while maintaining current HAPCs. This alternative relies on data collections for adult bluefin tuna which show widespread distribution throughout the Gulf, but with the highest concentrations in the northwestern portions. This alternative would be smaller than the area selected in alternative 2 and would not encompass all areas where bluefin tuna spawning may occur.

2.3 Analysis of Fishing Impacts on EFH

The Magnuson-Stevens Act and the EFH regulations require NMFS to identify fishing activities that may adversely affect EFH. If there are fishing activities that may have an adverse effect on EFH, then steps must be taken to minimize these effects to the extent practicable. 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, NMFS must propose measures to minimize fishing impacts if there is evidence that a fishing practice is having more than a minimal and not temporary adverse effect on EFH.

In deciding whether fishing gears are having a negative effect on EFH, and if minimization of an adverse effect from fishing is practicable, NMFS must consider: (1) whether, and to what extent, the fishing activity is adversely impacting EFH and the fishery; (2) the nature and extent of the adverse effect on EFH; and, (3) whether the management measures are practicable, taking into consideration the long and short-term costs as well as the benefits to the fishery and its EFH, along with other appropriate factors consistent with the National Standards of the Magnuson-Stevens Act. The best scientific information available must be used as well as other appropriate information sources, as available.

Since most HMS EFH is comprised of the water column, of which the characteristics of temperature, salinity, and dissolved oxygen are unlikely to be affected by fishing gears, NMFS concluded that fishing gears were not having a negative effect on most HMS EFH. Similarly, most HMS gears are not expected to impact other fisheries' EFH, with the possible exception of bottom longline (BLL) gear, depending on where it is fished. Each HMS gear, along with all other state and federally managed fishing gears, the means by which they are fished, and their potential impacts on HMS and other species' EFH, were described in the Consolidated HMS FMP. A preliminary determination was made that HMS gears, with the exception of BLL, were not having a negative impact on EFH. Similarly, other state and federally managed gears do not appear to have an impact on HMS EFH, with the possible exception of some bottom-tending gears in shark nursery areas in coastal bays and estuaries. Thus, the impacts of shark BLL gear and other bottom tending gears on shark nursery areas are analyzed in Chapter 6 of this amendment. After further analysis of the overlap of BLL gear and EFH in Draft Amendment 1, NMFS concluded that while BLL gear in general may have an effect on EFH, shark BLL gear as currently used in the shark fishery was not having more than a minimal and temporary effect on EFH. As a result, NMFS did not propose or finalize any measures to regulate shark BLL fishing in association with EFH. In Chapter 6, NMFS provided a list of conservation recommendations for fishing and non-fishing activities that have the potential to impact EFH in the FEIS.

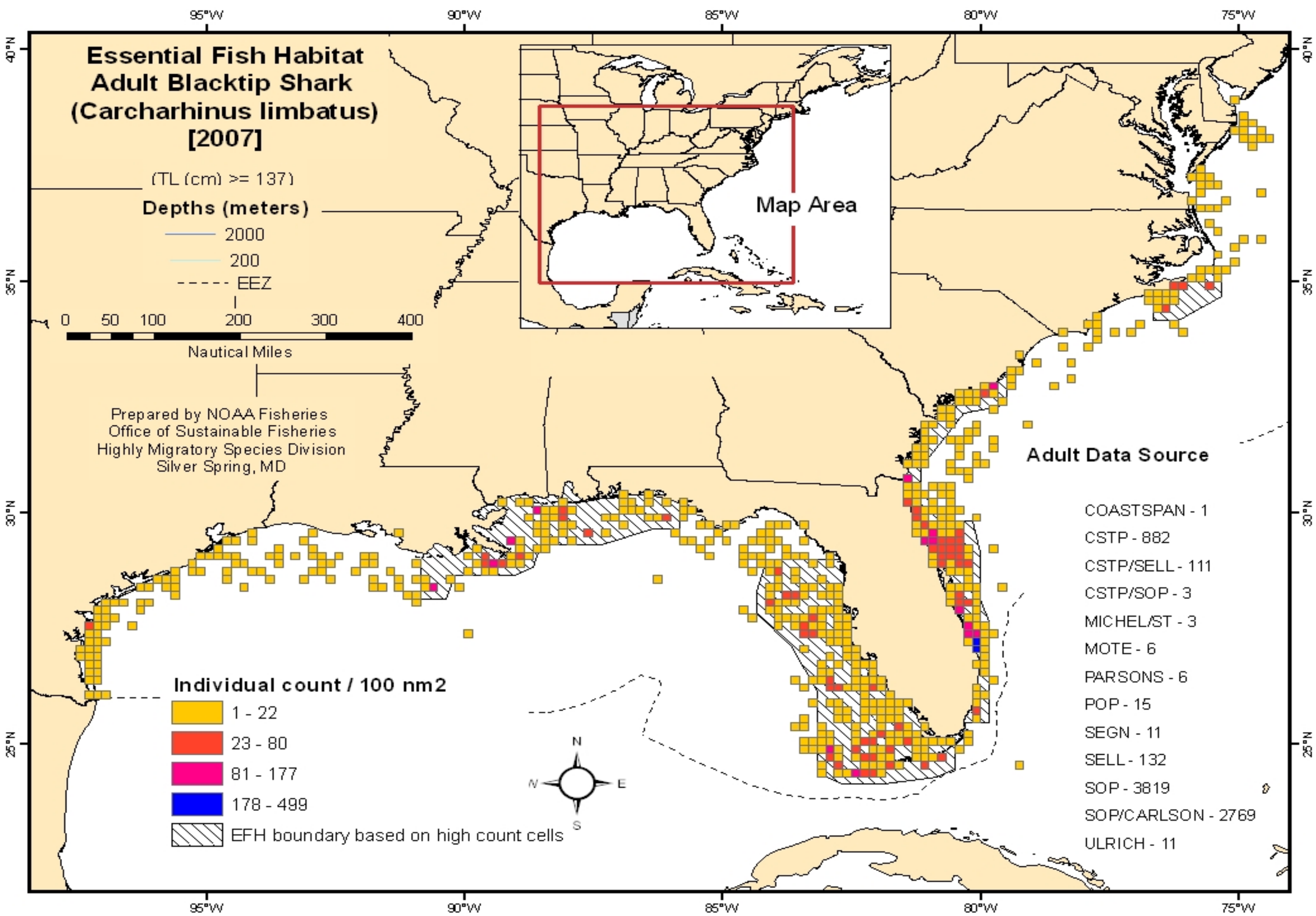

Figure 2.1 Essential fish habitat for blacktip shark based on high count cells. In this case, the highest three classes of cells with >23 observations per cell were used to delineate the EFH boundary (Alternative 2).

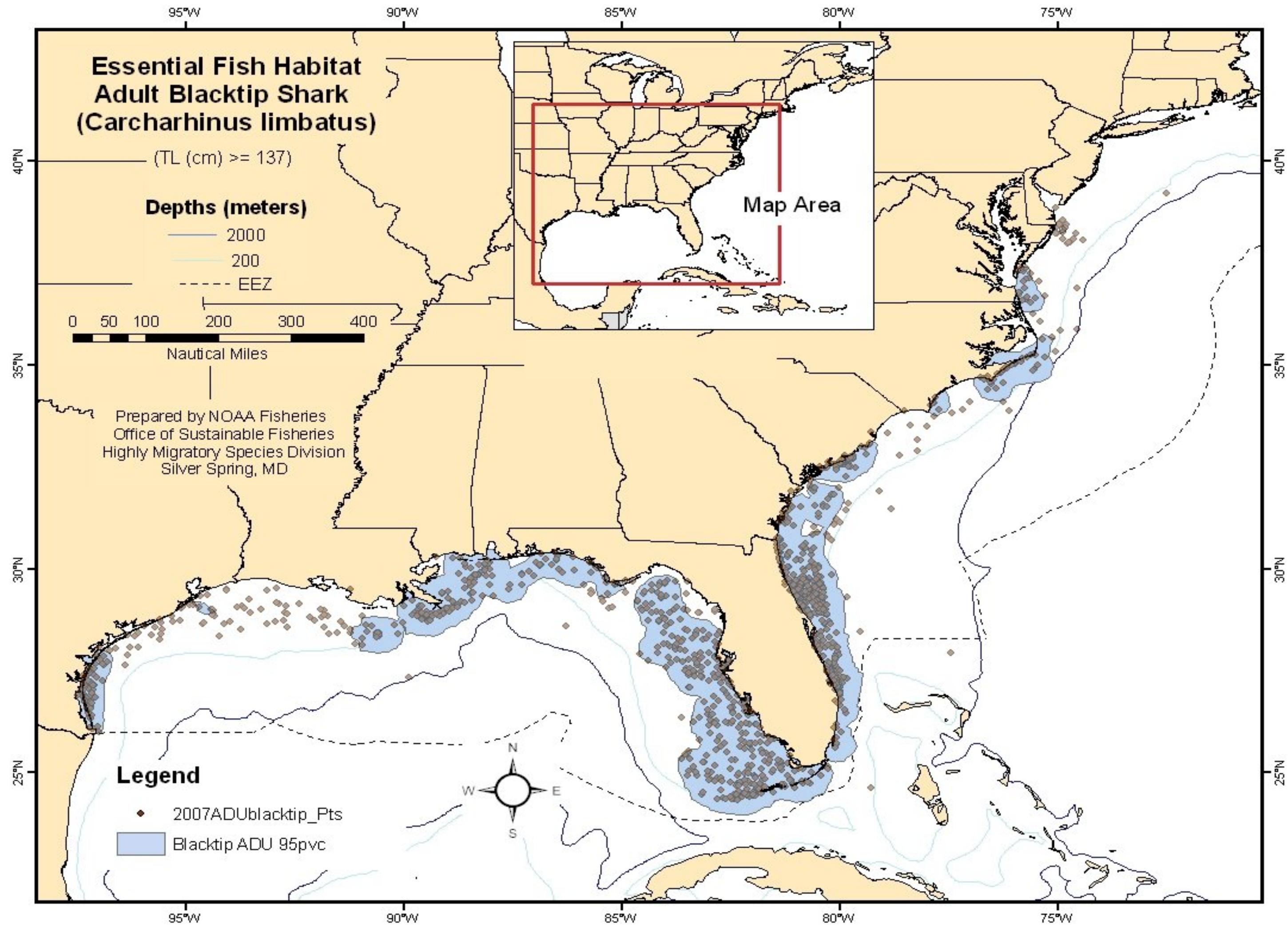

Figure 2.2 Essential fish habitat for blacktip sharks based on probability boundaries. In this case, the individual datapoints were used to generate the 95 percent probability boundary (Alternative 3 - preferred).

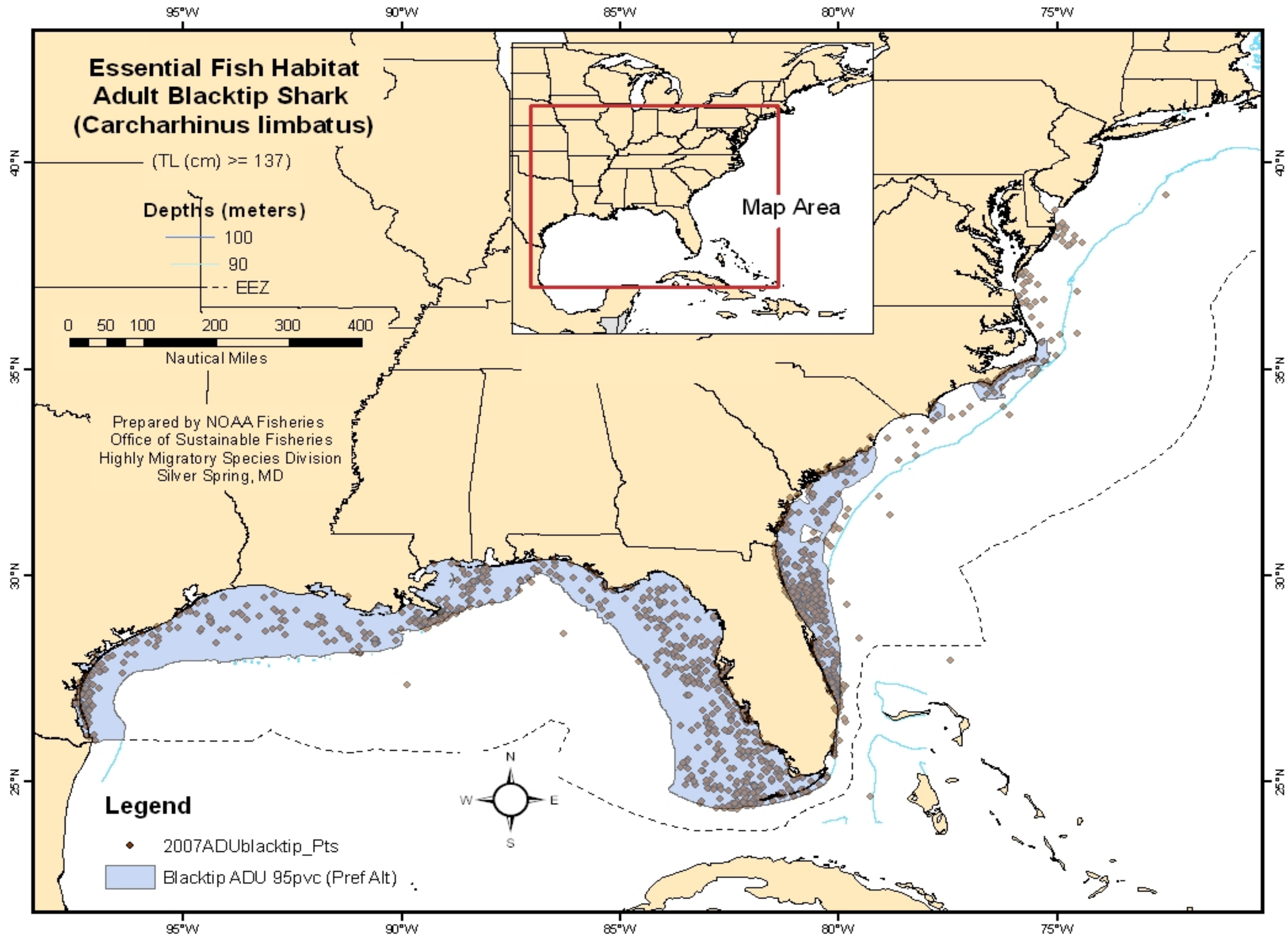

Figure 2.3 Essential fish habitat for adult blacktip shark. The figure shows the 95 percent probability boundary edited by clipping to the shoreline and the 90 m isobath and including additional areas in the Gulf of Mexico (Alternative 3 - preferred).

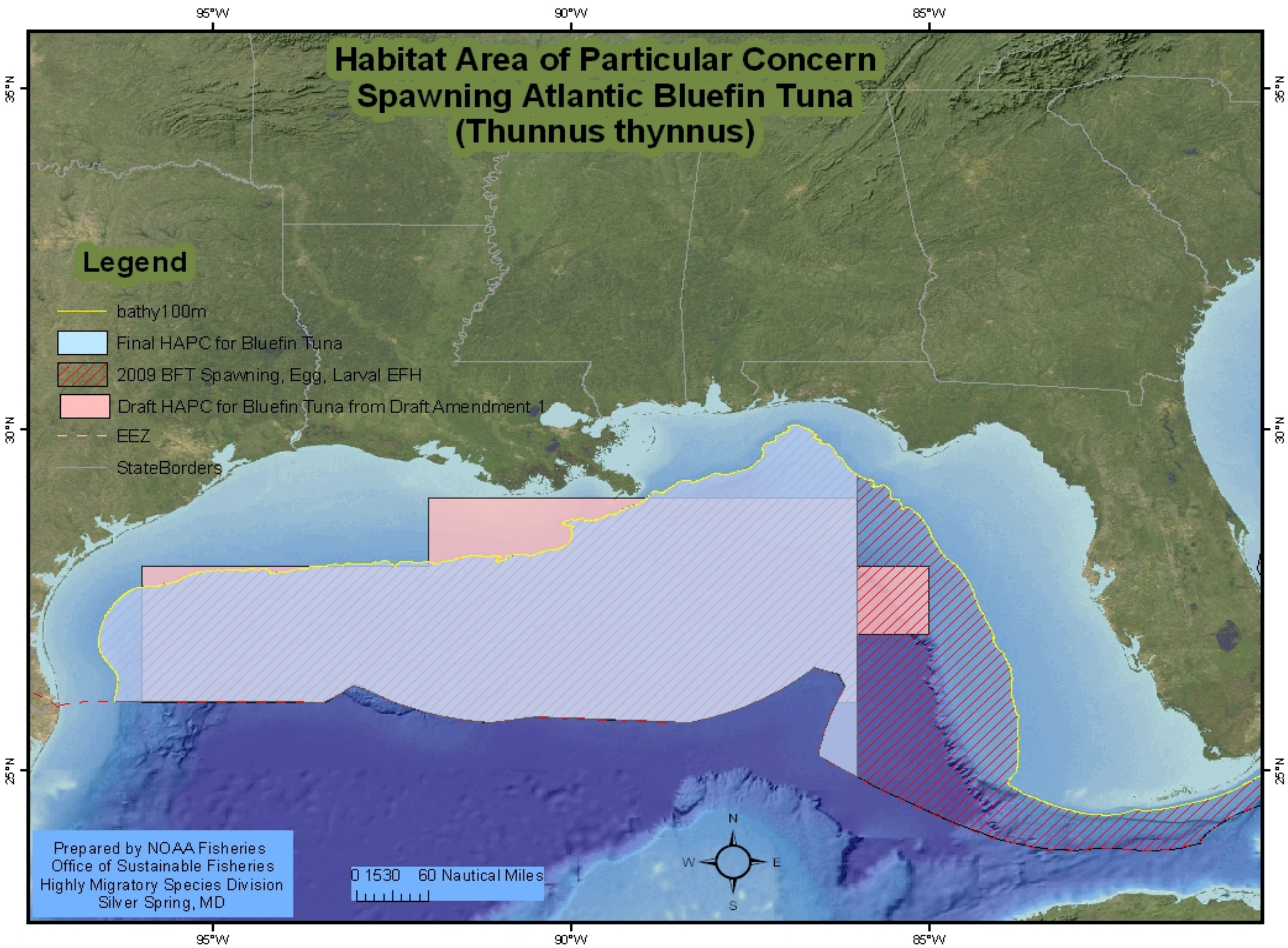

Figure 2.4 Final HAPC for Spawning Bluefin Tuna in the Gulf of Mexico (in light blue). The figure shows the boundary for bluefin tuna spawning, egg, and larval EFH (hatched areas) and the area originally proposed for the HAPC in the Draft Amendment for preferred Alternative 2 (in pink). The hatched area is continuous underneath the HAPC area.

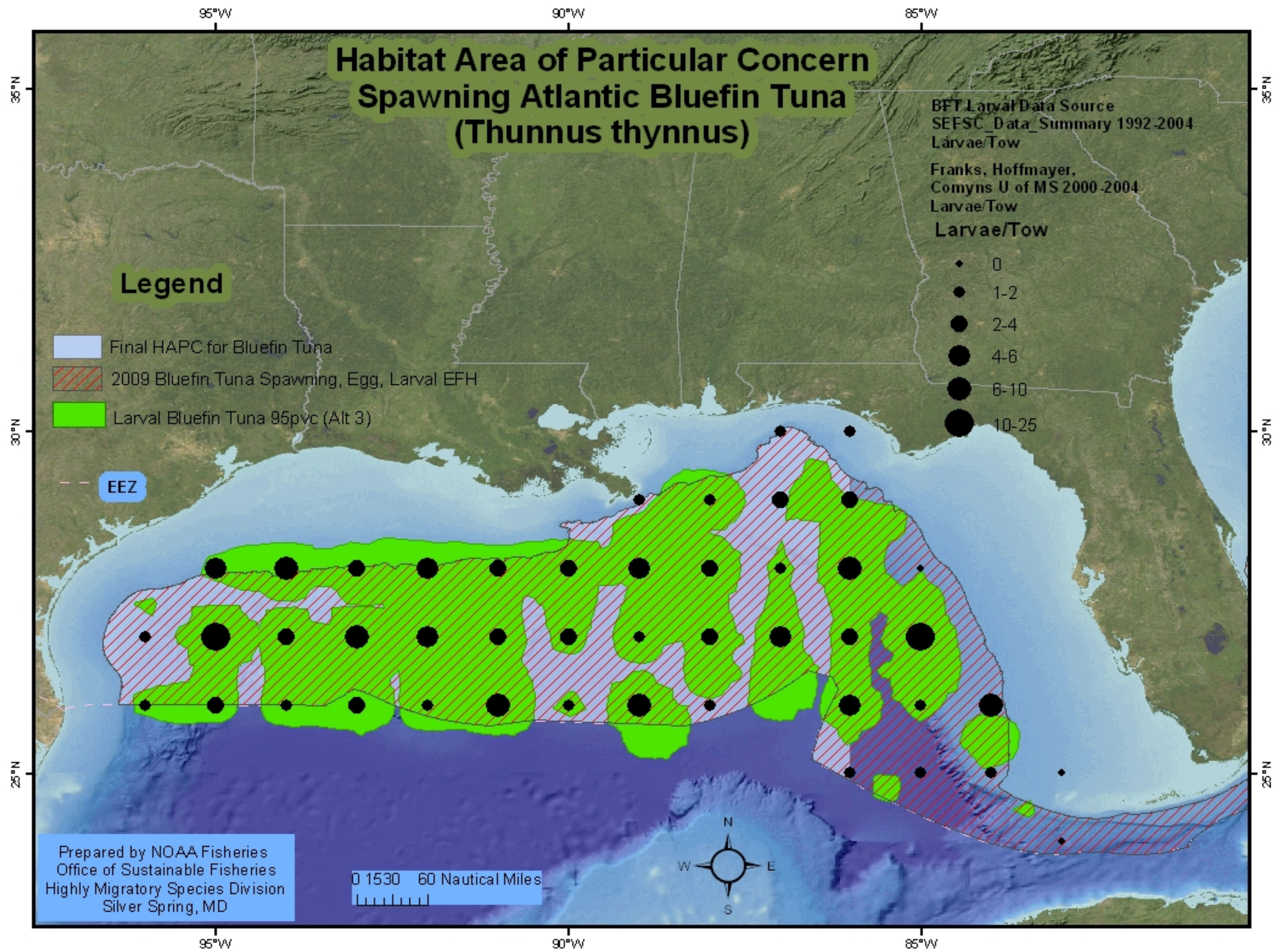

Figure 2.5 Alternative 3 proposed HAPC for Spawning Bluefin Tuna (shown in green) in the Gulf of Mexico based on the 95 probability boundary for bluefin tuna larvae. Other boundaries are shown for reference.

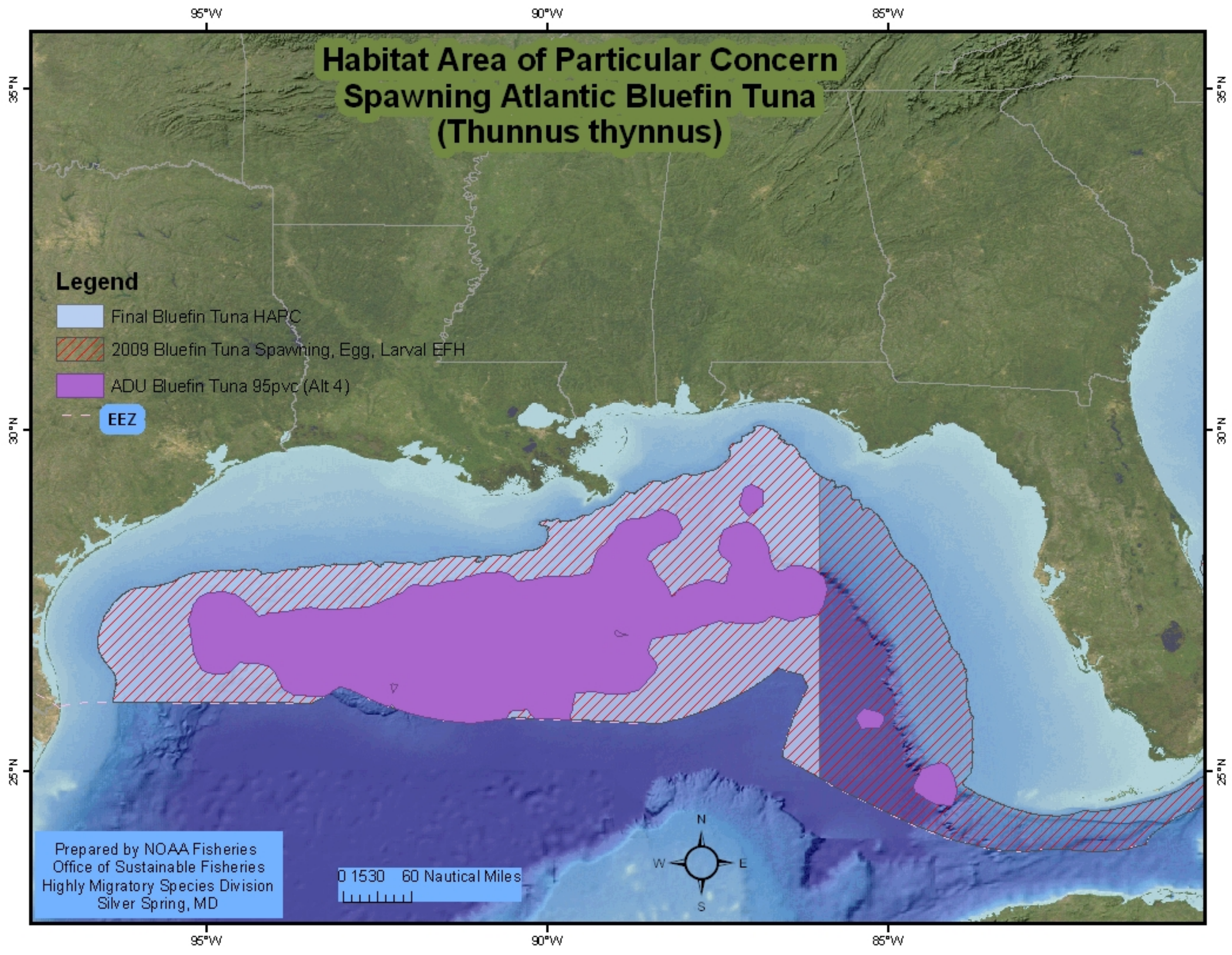

Figure 2.6 Alternative 4 proposed HAPC for Spawning Bluefin Tuna (shown in light blue) in the Gulf of Mexico based on the 95 percent probability boundary for adult bluefin. Other boundaries are shown for reference.

CHAPTER 2 REFERENCES

ESRI 2007. ArcGIS 9.2 User Manual. Environmental Systems Research Institute, Inc., 380 New York Street, Redlands, California 92373-8100.

Teo, S.L.H., A. Boustany, and B.A. Block. 2007b. Oceanographic preferences of Atlantic bluefin tuna, *Thunnus thynnus*, on their Gulf of Mexico breeding grounds. Marine Biology. 152:1105–1119.