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National Oceanic and Atmospheric Administration
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Pacific Islands Fisheries Science Center

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LOCATION: Pacific Islands Region

ABSTRACT: This Programmatic Environmental Assessment analyzes the environmental impacts of the National Marine Fisheries Service, Pacific Islands Fisheries Science Center, Protected Species Division, Marine Turtle Biology and Assessment Program proposal to continue its long-standing research activities on sea turtle populations throughout the Pacific Islands Region (PIR).

DATE: April 2023

TABLE OF CONTENTS

TABLES

FIGURES

List of Acronyms

Abbreviation	Definition
CEQ	Council on Environmental Quality
CI	Cook Islands
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CNMI	Commonwealth of the Northern Mariana Islands
DAWR	Guam Department of Agriculture, Division of Aquatic & Wildlife Resources
DFW	CNMI DLNR Division of Fish and Wildlife
DLNR	State of Hawai'i, Department of Land and Natural Resources
DOI	Department of the Interior
DPS	Distinct Population Segment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EFP	Exempted Fishing Permit
EO	Executive Order
ESA	Endangered Species Act of 1973
FAA	Federal Aviation Administration
FFS	French Frigate Shoals (Lalo)
FSM	Federated States of Micronesia
HAPC	Habitat Areas of Particular Concern
IACUC	Institutional Animal Care and Use Committee
IUCN	International Union for Conservation of Nature and Natural Resources
JIMAR	Joint Institute for Marine and Atmospheric Research
MHI	Main Hawaiian Islands
MMPA	Marine Mammal Protection Act
MNM	Marine National Monument
MPA	Marine Protected Area
MSA	Magnuson-Steven Fisheries Management Act

Abbreviation	Definition
MTAP	Marine Turtle Assessment Program
MTRP	Marine Turtle Research Program
MTBAP	Marine Turtle Biology and Assessment Program of PIFSC
MTMCP	Marine Turtle Management and Conservation Program of PIRO
MTMNM	Marianas Trench Marine National Monument
NEPA	National Environmental Policy Act of 1969
NGO	Non-Governmental Organization
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
NWHI	Northwestern Hawaiian Islands
OMAO	NOAA's Office of Marine and Aviation Operations
PEA	Programmatic Environmental Assessment
PIFSC	NMFS Pacific Islands Fisheries Science Center
PIR	Pacific Islands Region
PIRO	NMFS Pacific Islands Regional Office
PIT	Passive Integrated Transponder
PMNM	Papahānaumokuākea Marine National Monument
PNG	Papua New Guinea
PRIA	Pacific Remote Islands Areas
RAMNM	Rose Atoll Marine National Monument
RMI	Republic of the Marshall Islands
SPREP	South Pacific Regional Environmental Program
T&E	Threatened and Endangered
UAS	Unmanned Aerial System
UAV	Unmanned Aerial Vehicle
USFWS	United States Fish and Wildlife Service
WPRFMC	Western Pacific Regional Fishery Management Council

Chapter 1 Introduction and Purpose and Need

1.1. Background

Under the Endangered Species Act (ESA), the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) share responsibility in the U.S. for the conservation and recovery of marine turtles, more commonly referred to as sea turtles. NMFS and the USFWS work cooperatively on conservation and recovery of sea turtle efforts in the Pacific Islands Region (PIR), which includes the marine environment and nesting beaches in State of Hawai‘i, Territory of American Sāmoa, Territory of Guam, the Commonwealth of the Northern Marianas Islands (CNMI), and the U.S. Pacific Remote Islands Area (PRIA). There are five species of sea turtles that occur in the PIR: green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), loggerhead (*Caretta caretta*), leatherback (*Dermochelys coriacea*), and olive ridley (*Lepidochelys olivacea*). All species of sea turtles are listed and protected under the ESA.

Within the PIR, NMFS's ESA mandated sea turtle recovery efforts are carried out by two independent offices: Pacific Islands Fisheries Science Center (PIFSC) and the Pacific Islands Regional Office (PIRO). At PIFSC, the Marine Turtle Biology and Assessment Program (MTBAP) is responsible for the collection of data to support recovery actions as outlined in U.S. Sea Turtle Recovery Plans (NMFS and USFWS 1998a-e). With continuous data collection since 1973, MTBAP provides technical insight, logistical advice, and shares its experiences with other U.S. and international sea turtle research programs. At PIRO, the Marine Turtle Management and Conservation Program (MTMCP) is responsible for evaluating and mitigating the impacts of proposed federal actions to sea turtles, and implementing recovery actions as outlined in species-specific U.S. Sea Turtle Recovery Plans (NMFS and USFWS 1998a-e).

Two Programmatic Environmental Assessments (PEA) were published for marine turtle research activities in the PIR (see Appendix 7 and 8). At the time of publication, the PIFSC Protected Species Division had two turtle programs (the Marine Turtle Research Program (MTRP) and the Marine Turtle Assessment Program (MTAP)), and the activities in each program were covered under their respective PEAs (NMFS 2011 and NMFS 2012a). The two turtle programs were combined into one program around 2014, which is now called the MTBAP. Since the publication of the 2011 and 2012 PEAs, MTBAP leadership changed, thus, research foci were adjusted requiring the addition of new research methods and an update to the PEA. This PEA provides a detailed framework for operating the MTBAP, including analysis of potential environmental impacts associated with implementation of the research program initiatives. Section 1 of this PEA provides background information to understand the program, a description of the proposed action, and the purpose and need for action. The proposed alternatives are described in Section 2. The affected environment and analyses of the potential impacts on the human environment are in Sections 3 and 4, respectively. The list of prepares is included in Section 5 and references cited are listed in Section 6.

1.2. Proposed Action

The proposed action is the continued research activities by the MTBAP that directly support the priority actions as described in the five U.S. Sea Turtle Recovery Plans (NMFS and USFWS 1998a-e). The objectives of the program, pursuant to U.S. Sea Turtle Recovery Plans for sea turtles are:

- Monitor population trends at nesting beaches, basking beaches, foraging areas, and identify new areas to monitor as appropriate, while continuing to explore the use of advanced technology for research and monitoring.
- Long-term population monitoring and modeling. Continue the development and application of simulation modeling of sea turtle population dynamics using long-term datasets for the assessment of the status of the various stocks of sea turtles in the PIR.
- Conduct sea turtle stranding response and research, in addition to rescue, rehabilitation, and return to the wild within the PIR.
- Capacity building through training of NMFS and international observer personnel in Pacific Ocean fisheries, as well as research personnel within the PIR and in foreign nations that share sea turtle populations.
- Public education, outreach, community science projects, and scientific publishing in an effort to build public support for sea turtle research and provide timely publication of results/findings.

To meet these objectives, the MTBAP conducts both field and laboratory-based research activities. The primary MTBAP field research activities are: (1) nesting and basking beach monitoring; (2) in-water monitoring; and (3) stranding response and research. The primary laboratory-based research and analytical activities include: (1) statistical analysis and population modeling; (2) training and outreach; (3) laboratory and molecular analysis; and (4) standard operating procedures and research techniques. A complete description of the current research activities is provided in Section 2.1.1.

In addition to the current research, the proposed action also includes site-specific nest relocations, which are currently not being conducted, and are described in detail in Section 2.2.2. All research will be performed in concert with local authorities and sea turtle programs [e.g., Guam Department of Agriculture, Division of Aquatic and Wildlife Resources (DAWR); CNMI Department of Land and Natural Resources (DLNR); Department of Environment and Natural Resources Philippines; and USFWS] to ensure compliance with all applicable laws and research efforts are not duplicative.

1.3. Purpose and Need

The purpose of the MTBAP and its associated research activities is to collect (or facilitate the collection of) scientific data on marine turtle stocks in collaboration with local partners; conduct recovery activities; and perform population assessments relevant to the recovery of these stocks throughout the PIR, associated high seas, and adjacent foreign Exclusive Economic Zones

(EEZ). The need for this action is to improve our understanding of sea turtle threats (e.g., fishery bycatch, climate change) and other population influences to ensure the continued existence of sea turtles in the world's oceans.

1.4. Action Area

Research activities primarily occur in open ocean, near shore, and nesting areas, and may occur in water or on land, including beaches or other coastal adjacent areas. The geographic scope of the proposed action includes the PIR and internationally in locations or with aggregations of turtles that are relevant to populations with PIR connections. The USFWS permit TE-72088A-3 describes the locations in more detail for each turtle species and we refer the reader to this document for this detailed information (see supporting documents). The international areas where MTBAP conducts sea turtle research include Papua New Guinea, Indonesia, the Solomon Islands, Japan, Philippines, Thailand, Vietnam, Malaysia, Federated States of Micronesia, Palau, and Marshall Islands. These areas are described in depth in the PIRO EA for the MTMCP (NMFS 2014a), which describes the sea turtle management activities within the region, and we refer the reader to them for more information, including a description of the physical conditions, sea turtle use of the areas, the human use of the area, and the conservation and research activities found at each location (see supporting documents). Additional detailed description of the physical, chemical, and biological conditions of the PIR can be found in the Final Environmental Impact Statement *Toward an ecosystem approach for the western Pacific region: from species-based fishery management plans to place-based fishery ecosystem plans*, and is available at: https://repository.library.noaa.gov/view/noaa/3791.

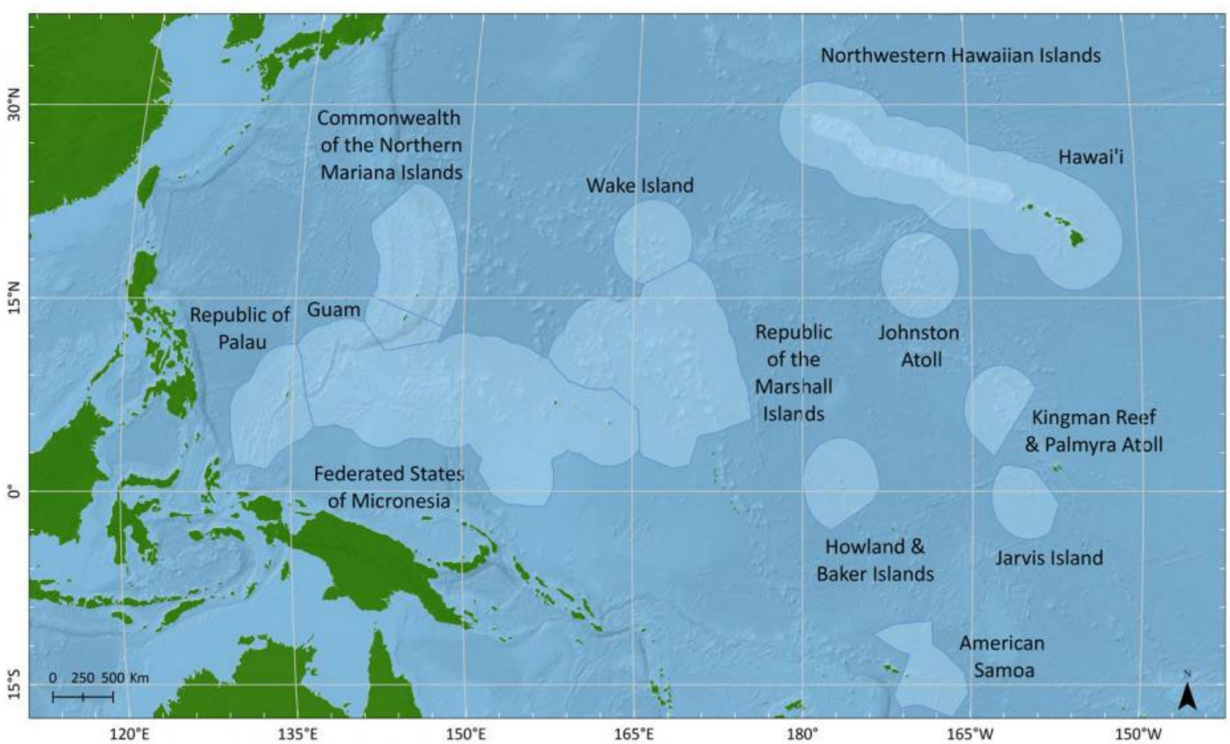

Figure 1. General area where the Marine Turtle Biology and Assessment Program sea turtle research activities will occur. Note: Research may occur in Papua New Guinea, Indonesia, the Solomon Islands, Japan, Philippines, Thailand, Vietnam, and Malaysia, which are not labeled on the map. Source: NOAA NCEI.

1.4.1. Sea Turtles in the Action Area

Table 1 lists the sea turtles under NMFS and USFWS' jurisdictions that could inhabit the action area where MTBAP's research activities occur. In summary, there are 10 distinct population segments (DPS) from 5 sea turtle species with potential or confirmed occurrence in waters within the action area, all of which are listed under the ESA. Refer to Chapters 3 and 4 of this PEA, for detailed information about these sea turtles.

Table 1. Sea turtle species likely to occur in the project area

Species	DPS	ESA* status	Abundance Estimate[1]	Occurrence in project area
Green	Central West Pacific	E	6,518[2]	Forage – waters surrounding Guam and CNMI Nest –relatively low numbers in Guam, CNMI, Federated States of Micronesia (FSM), Marshall Islands, Solomon Islands, Palau
Green	Central South Pacific	E	2,677[2]	Forage – French Polynesia, Fiji, American Samoa, Cook Islands Nest – low lying atolls; Rose atoll in American Sāmoa, Tongareva Atoll in the Cook Islands, Ringgold Isles in Fiji, Scilly Atoll in French Polynesia, Enderbury in Kiribati, Nukunonu in Tokelau, Tonga Funafuti in Tuvala, and Henderson in the UK
Green	Central North Pacific	T	3,846[2]	Forage – waters surrounding main Hawaiian islands (MHI), Johnston Atoll Nest – beaches in Northwest Hawaiian Islands/ Papahānaumokuākea Marine National Monument
Hawksbill	Global	E	22,004 to 29,035[3]	Forage – near-shore waters in MHI, West Pacific, South Pacific Nest – MHI, Ofu in American Sāmoa
Leatherback	Western Pacific	E	1,277[4]	Forage – North, Eastern, and Western Pacific Ocean Nest – Indonesia, Papua New Guinea, and Solomon Islands

Species	DPS	ESA* status	Abundance Estimate[1]	Occurrence in project area
Loggerhead	North Pacific	E	8,733[5]	Forage – throughout the Central and Eastern Pacific when immature; Western Pacific as adults Nest – Japan
Loggerhead	South Pacific	E	700[6]	Forage – Australia, New Caledonia, the Solomon Islands, Papua New Guinea, Indonesia, Peru, Chile, and Ecuador Nest – Eastern Australia, New Caledonia
Olive ridley	Global	T	1.39 million[7]	Forage – oceanic, throughout North Pacific Ocean Nest – No known nesting beaches within the PIR, but recent hatchling emergence observations in MHI

*Endangered Species Act. [1]Number of nesting females. [2]Seminoff et al. 2015. [3]NMFS and USFWS 2013. [4]NMFS and USFWS 2020a. [5]NMFS and USFWS 2020b. [6]NMFS and USFWS 2021. [7]NMFS and USFWS 2014

1.5.Environmental Permits and Regulatory Requirements

MTBAP has been authorized to conduct research activities within the PIR under various permits. For projects operating within the U.S. jurisdiction (i.e., the PIR), this would include permits authorized by NMFS for activities that may "take" marine turtles in the marine environment and permits authorized by USFWS for activities that may "take" marine turtles in the terrestrial environment (Table 2). The term "take" as defined in Section 3 of the ESA means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." In some U.S. territory locations, USFWS authorizations are provided via cooperative agreement (e.g., American Sāmoa). CITES export permits are also required for the shipping of samples (e.g., genetic or tissue) from any international location to the U.S. NMFS agencies (e.g., PIFSC or SWFSC) for analysis. For any research conducted outside of U.S. jurisdiction, MTBAP follows the other countries' laws.

Table 2. Permits under which MTBAP conducts activities within the proposed area.

File Number	Project Title	Location*	Expiration	Species
NMFS: 21260	Permit to take protected species for scientific purposes	Pacific Islands Region	September 30, 2027	Green, hawksbill, leatherback, loggerhead, olive ridley
USFWS: TE-72088A-3	U.S. Fish and Wildlife Service	Beaches surrounding the islands, islets, atolls, and	November 18, 2025	Green, hawksbill,

File Number	Project Title	Location*	Expiration	Species
	recovery permit issued	shoals in the Hawaiian Archipelago; Johnston Atoll, CNMI, Guam, American Sāmoa		leatherback, loggerhead, olive ridley
DLNR DAR: 2023-02	Special Activity Permit	Waters of the island(s) of Hawai'i, Oahu, Kauai, Maui, Molokai, Lanai, Niihau and Kaho'olawe*	January 4, 2023	Green, hawksbill, leatherback, loggerhead, olive ridley
PMNM: PMNM-2022-001	Co-Trustee Conservation and Management Activities in Papahānaumokuākea Marine National Monument	Papahānaumokuākea Marine National Monument	December 31, 2022	Green

*See Appendix 1-6 for more information on specific requirements for each permit.

1.6.Public Involvement

NMFS will seek public comment on this proposed action for a 30-day period following the publication of the draft to the Pacific Island Region NEPA website at https://www.fisheries.noaa.gov/pacific-islands/laws-and-policies/national-environmental-policy-act-pacific-islands. The reader may find instructions on how to comment and obtain copies of this EA at this website. Specific dates of the comment period will be defined in an email to interested stakeholders and on the website. NMFS will consider comments received by the deadline in developing the final action.

1.1.NEPA Compliance

This Programmatic Environmental Assessment (PEA) was prepared in accordance with National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. §4321, et seq.), as implemented by the Council of Environmental Quality (CEQ) regulations (40 C.F.R. §1500-1508); NOAA Administrative Order Series (NAO) 216-6, Environmental Review Procedures for Implementing the National Environmental Policy Act, of May 20, 1999; and Executive Order (EO) 12114, as implemented by Department Administrative Order 216-12 with respect to potential impacts of the proposed action in foreign territorial waters. This PEA is being prepared using the 2020 CEQ NEPA Regulations as modified by the Phase I 2022 revisions. The effective date of the 2022 revisions was May 20, 2022 and reviews begun after this date are required to apply the

2020 regulations as modified by the Phase I revisions unless there is a clear and fundamental conflict with an applicable statute. This PEA began after and accordingly proceeds under the 2020 regulations as modified by the Phase I revisions.

Any individual projects implemented within the described program and documented as consistent with this PEA and its associated decision can be implemented. However, any site-specific and/or project-specific action that would be added to the program long-term, not specifically covered by this PEA, or projects that would potentially have environmental considerations that are not evaluated in this PEA may need additional appropriate NEPA analysis.

After considering public comments, this document will support a decision by the PIFSC Director, on behalf of the Secretary of Commerce, on the proposed action and alternatives considered. The Director will use the information in this EA to make a determination about whether the proposed action would constitute a major Federal action that has the potential to significantly affect the quality of the environment. If NMFS determines that the action would not significantly affect the quality of the environment, NMFS will prepare a Finding of No Significant Impact. If NMFS determines that the proposed action is a major Federal action that would significantly affect the quality of the environment, NMFS would prepare an environmental impact statement before taking action.

Chapter 2 Alternatives

2.1. Introduction

With continuous data collection since 1973, the MTBAP provides technical insight, logistical advice, and shares its experiences with other U.S. and international sea turtle research programs. As described in Chapter 1, NMFS is proposing the continuation and possible expansion of the MTBAP. In accordance with the NEPA and the CEQ Regulations, NMFS is required to consider alternatives to the proposed action. This includes the no action and other reasonable courses of action associated with authorizing incidental take of protected species. To warrant detailed evaluation under NEPA, an alternative must be reasonable along with meeting the stated purpose and need for the proposed action. Based on this evaluation, only two alternatives were identified as reasonable, along with the no-action alternative, and are evaluated in this PEA. Alternative 1 represents the status quo and would maintain the current research program. Alternative 2 would add nest relocation to and maintain the current research program. Alternative 3 represents the no action alternative.

2.1.1. Description of Current Research Activities

The following research activities are approved under USFWS Recovery Permit TE72088A-3, NMFS Permit 21260, NMFS Institutional Animal Care and Use Committee (IACUC) Protocol 2019-03M, and University of Hawai'i IACUC Protocol 18-2782-4. (Appendix 6). They are also analyzed under NMFS programmatic biological opinion (NMFS 2017). MTBAP incorporates those descriptions by reference in this PEA and briefly summarize them here. Table 4 provides a summary of the research activities that are conducted on each turtle species within the PIR.

2.1.1.1. **Statistical Analysis and Population Modeling**

1. Continue the development and application of simulation modeling of sea turtle population dynamics using MTBAP long-term datasets for the assessment of the status of the various stocks of sea turtles in the PIR
2. Fisheries bycatch modeling and development of bycatch mitigation strategies within the PIR

2.1.1.2. **Training and Outreach**

1. Training of NMFS and international observer personnel in Pacific Ocean fisheries
2. Training of and capacity building for research partners within the PIR
3. Public outreach, education, and citizen/community science within the PIR
4. Continue to publish research findings in a timely manner in peer-reviewed journals to increase the knowledge base of sea turtle biology and population dynamics worldwide

2.1.1.3. **Stranding Response and Research**

1. Co-manage and participate in stranding response activities within the stranding and salvage network within the Main Hawaiian Islands (MHI) in collaboration with PIRO and manage resulting data

2. Provide veterinary care, coordinate rehabilitation with partners, and return rehabilitated turtles to the wild
3. Perform necropsies to identify primary threats to sea turtles in Hawaiian waters

2.1.1.4. **Laboratory and Molecular Analysis**

1. Conduct stable isotope analysis of sea turtle bio-samples to investigate foraging ecology strategies of different populations within the PIR
2. Conduct skeletochronology of sea turtle humerus tissue for growth and age estimates for sea turtle populations within the PIR
3. Use genetic/genomic analyses to determine stock structure, stock boundaries, population structure, demographic connectivity, relatedness, and/or kinship of marine turtles within the PIR
4. Use endocrine analyses of bio-samples to determine sea turtle sex, sex ratios, reproductive status, sexual maturity, sex-based survivorship, and/or stress response for sea turtle populations within the PIR

2.1.1.5. **Nesting and Basking Beach Monitoring**

1. Identification and monitoring of critical nesting beaches (for green and hawksbill sea turtles) and basking beaches (for Hawaiian green turtles)
2. Estimate abundance at nesting (for green and hawksbill sea turtles) and basking beaches (for Hawaiian green turtles) for population size estimates
3. Determine factors impacting nest success and hatchling survival
4. Relocate doomed nests to locations that promote viability of the clutch
5. Conduct basic investigations of the biology, life history, and ecology of marine turtles at nesting (for green and hawksbill sea turtles) and basking beaches (for Hawaiian green turtles) to establish and continue long term databases
6. Investigate the impacts of climate change on population dynamics for sea turtle populations within the PIR

2.1.1.6. **In-water Monitoring**

1. Identification of critical marine turtle habitat use, migratory corridors, and population abundance of all marine turtle species in the PIR using turtle-borne telemetry packages (satellite telemetry, ultrasonic telemetry, time-depth recorders, underwater cameras), ship-/small boat-/snorkel-based- line transects, and/or aerial surveys
2. Conduct basic investigations of the biology, life history, and ecology of marine turtles in their near shore and benthic habitats to establish and continue long-term datasets
3. Conduct fishery bycatch reduction research through international collaboration, leading to increased knowledge of the pelagic ecology and movements of sea turtles

2.1.1.7. **Standard Operating Procedures and Research Techniques**

The MTBAP ensures the safety of research and technician personnel first and foremost in all Program activities, and conducts regular training of all personnel in the implementation of techniques and methods, both in the laboratory and in the field.

All research techniques and methods are consistent with accepted standards within the international sea turtle research community (Eckert et al. 1999) based on efficacy and the experience gained by MTBAP since 1973. All Standard Operating Procedures and Research Techniques are detailed in MTBAP's permits included in the Appendices of this document.

Table 3. Overview of sea turtle species in the PIR and the corresponding research techniques, which will be applied for each species.

Research Technique	Green	Hawksbill	Leatherback	Loggerhead	Olive Ridley
Capture	X	X	X	X	X
External Inspection, Attach Tags	X	X	X	X	X
Blood and Tissue Collection	X	X	X	X	X
Lavage	X	X		X	X
Transmitter Attachment	X	X	X	X	X
Ultrasound	X	X	X	X	X
Laparoscopy	X	X		X	X
Monitor Nesting Beach	X	X	X	X	X
Monitor Basking Beach	X				
Hatchling Sampling	X	X	X	X	X
UAV Surveys	X	X	X	X	X
Doomed Nest Relocation	X	X	X	X	X
Nest Relocation of any nest for conservation/management purposes[1]	X	X	X	X	X
Nest Probing[1]	X	X	X	X	X

[1]Pending approval to be included in our USFWS permit TE-72088A-3.

Projects may take place in additional locations abroad under EO12114 provided that the general project activities and predicted impacts remain within the scope of this PEA. Table 3 summarizes the proposed research categories and general project locations.

Table 4. Summary of research project locations by category.

Research Category	Research Location
Statistical Analysis and Population Modeling	Not Applicable (conducted at PIFSC or other laboratory setting)
Training and Outreach	Hawai'i, Guam, CNMI, American Sāmoa, PRIA, Southeast Asia
Stranding Response and Research	Hawai'i and offshore waters (commercial fishing vessels in the PIR), Guam, CNMI, American Sāmoa,
Laboratory and Molecular Analysis	Samples collected in Hawai'i, Guam, CNMI, American Sāmoa, PRIA, and from commercial fishing vessels in the PIR

Research Category	Research Location
Nesting and Basking Beach Monitoring	Hawai'i, Guam, CNMI, American Sāmoa, PRIA
In-water Monitoring	Hawai'i, Guam, CNMI, American Sāmoa, PRIA

2.2. Description of Alternatives

2.2.1. Alternative 1 – Continuation of Current Research Activities (Status Quo)

Under this alternative, PIFSC MTBAP would conduct all research activities listed above in Sections 2.1.1, and described in the issued permits NMFS 21260 and USFWS TE-72088A-3 (see Appendix 1 and 3). These research activities will involve take, under the ESA, of the five sea turtle species within the PIR. As noted in Section 2.1.1.7, the MTBAP ensures the safety of research personnel first and foremost in all Program activities, and conducts training of all personnel in the implementation of techniques and methods, both in the laboratory and in the field. In addition, all research techniques and methods are conducted according to accepted standards within the international sea turtle research community based on efficacy and the experience gained by MTBAP since 1973. All Standard Operating Procedures and Research Techniques are detailed in MTBAP's permits included in the Appendices of this document.

2.2.2. Alternative 2 - Continuation of Current Research Activities with the Addition of Nest Relocations of Non-Doomed Nests and Nest Probing (*Preferred Alternative*)

The Proposed Action constitutes Alternative 2 and is the Preferred Alternative. This alternative would include all activities listed in Alternative 1 and described in sections 2.1.1 and 2.2, plus site-specific nest relocations and nest probing, which are described below. The MTAP PEA (2012a) included the capture of hatchlings and collection of eggs, either in the nest or on the beach, and MTBAP is currently permitted to only relocate nests that are doomed. Under Alternative 2, MTBAP will request to amend our USFWS permit to include the ability to relocate any nest (doomed or not doomed), should the need arise, and to conduct nest probing.

Relocation of nests is a conservation measure utilized across many international sea turtle nesting populations. The purpose of relocating a nest is to increase the likelihood for a nest that is considered doomed (e.g., sand erosion, water inundation, etc.) due to location relative to the high tide line or potential for wash out due to beach erosion, which would destroy or suffocate the nest. In this alternative, MTBAP proposes to continue to perform nest relocations for a "doomed" nest (i.e. when a nest was laid in an area that is at risk of erosion or inundation), but would add nest relocations for any nest (doomed or not doomed) to any location in the PIR if the relocation was deemed necessary for management/conservation purposes (e.g., if a nesting beach has reached carrying capacity or nesting habitat is too poor to sustain a nest, the nest may need to be relocated to maintain population abundance). Nest relocation will follow the protocol/s outlined in the Research and Management Techniques for the Conservation of Sea Turtles (Eckert et al. 1999) publication. In summary, eggs laid in a natural nest will be gently gathered during deposition (if researcher is present) or the nest will be gently excavated and eggs carefully removed while minimizing the amount of sand gathered with the eggs to avoid abrasion of the eggs. Once collected, eggs will be covered to reduce moisture loss during transport. Nest depth and diameter of the neck of the original nest will be recorded and a new nest will be excavated according to the nest depth and diameter recordings and located sufficiently above the high tide line and conform with species-specific parameters. Reburial will occur as quickly as possible to minimize movement-induced injury to embryos, eggs will be placed carefully into the nest chamber and counted, then the nest will be covered by replacing the damp subsurface sand removed from the hole during excavation and firmly tamping the damp sand in place in layers of 8-12 cm. Coordinates of the new nest will be recorded and/or nest marker placed, and finally the nest will be disguised by distributing surface sand evenly.

Both green turtles and hawksbill turtles nest on islands in Hawai`i and across the PIR. Recently, an olive ridley nest was laid and a loggerhead turtle attempted to nest in the Hawaiian Islands; a rare and previously undocumented occurrence.

Oftentimes, signs of nesting (e.g., tracks and body pits) are encountered, but the actual turtle is not observed nesting. In such cases, it is often impossible to confirm whether a nest was successfully deposited or identify the exact location of the clutch. Even the most experienced beach monitors cannot always tell whether or not a turtle has successfully laid a clutch.

Confirming nest deposition is important to accurately quantify nesting across the PIR as this data is central to population assessments and modeling. Similarly, confirming the exact location of nests is necessary to conduct post-hatching nest excavations, which also provide data (such as hatching success) that are central to population modeling activities.

Often, researchers attempt to confirm and locate marine turtle nests via digging by hand. However, given that marine turtle body pits are often large, digging by hand can be extremely time consuming and is often unsuccessful. A probe stick can be used as a tool to more efficiently locate a nest cavity, decreasing the time and labor needed to do so (Brig 2014). A probe typically consists of a straight or tapered, T-handled rod constructed of either wood or metal.

Nest probing is a technique used by numerous sea turtle monitoring programs in the U.S. East coast and globally (e.g., TCOT 2003; Henson and Boettcher 2006; KITP 2017). Before probing within the body pit, we will probe outside the body pit to get a feel for the sand and determine how far the probe goes down in sand that has not been dug previously (by the nesting female turtle). This will serve as a reference for when the probe does enter the egg chamber. When possible, we will avoid stepping directly on the nesting pit area as it may be necessary to do multiple probing passes to locate the nest. In such cases, leaving the pit area as undisturbed as possible will facilitate where to start and end additional passes. Identifying the most likely spot to begin probing is a skill that improves with experience.

Probing shall begin in the area where the nest is most likely to be located. Nesting turtles typically create an initial body pit, in which they excavate a nest chamber and deposit their eggs, then proceed to widen the body pit by throwing sand to cover or "camouflage" the nest.

The compacted layer of sand directly over an egg chamber is relatively thin and thus can be easily penetrated by a probe stick. The person conducting the probing will apply initial weight on the probe using arms and shoulders. The rod will give way when it perforates the compacted layer and enters the chamber. In other words, the probe will sink quickly once perforating the compacted layer of sand and entering the nest cavity, compared to the surrounding sand. The distinct feel of the rod perforating the compacted layer and entering a nest chamber is learned with practice. Enough pressure should be applied on the rod to ensure that it will break through the surface layer, but with care being taken to minimize the possibility of breakage of any of the eggs within the nest chamber. Once the egg chamber (or potential egg chamber) has been identified, dig by hand to locate the eggs.

If the egg chamber has not been located after having probed in the most likely locations, a systematic grid approach should be used to probe the entire body pit until the egg chamber is located or it has been determined that additional probing is no longer warranted. Inexperienced use of a probe can result in one or more eggs along the top layer of the nest being punctured and thus should only be conducted by trained personnel.

2.2.3. Alternative 3 – No Action Alternative

The No Action Alternative is for the PIFSC to not operate the MTBAP related research activities in the proposed area as described.

Alternative 3 would not meet the purpose of the MTBAP and would not fulfill the requirements of NMFS and/or USFWS ESA mandates, as the agencies responsible for sea turtle recovery. Additionally, the No Action Alternative would not meet the purpose and need for the action. However, this alternative would alleviate the potential incidental take of marine mammals and seabirds under certain conditions. The CEQ's regulations require consideration and analysis of a No Action Alternative for the purposes of presenting a comparative analysis to the action alternatives.

2.3. Alternatives Considered but Eliminated from Further Consideration

NMFS considered whether other alternatives could meet the purpose and need for the action. Other potential alternatives that do not satisfy the agency's purpose and need, or would not meet minimum environmental standards, are not considered reasonable and need not be carried forward for evaluation in an EA. The following alternative was considered but rejected:

MTBAP ceases green sea turtle nesting/basking research specifically in the PMNM such that MTBAP does not disturb listed species (see Table 4) within the monument. MTBAP rejects this alternative because it creates an inability for MTBAP to assess abundance, trends, and threats to the Hawaiian green sea turtle, and the benefits to other listed species (e.g., Hawaiian monk seals and seabirds) do not outweigh the loss of data needed to manage/conserve the target species (i.e., Hawaiian green sea turtles). This alternative would rank lower than Alternative 1 and was eliminated from further consideration.

Chapter 3 Affected Environment

NMFS reviewed all possible environmental, cultural, historical, social, and economic resources based on the geographic location associated with the proposed action and alternatives. Based on this review, this chapter describes the affected environment and existing (baseline) conditions for select resource categories. Chapter 4 provides an analysis and description of environmental impacts associated with the affected environment.

3.1.Physical Environment

The area where research activities occur is primarily in open ocean, near shore, and nesting areas of the PIR and international areas, and may occur in water or on land. A detailed description of the physical, chemical, and biological conditions of the PIR can be found in the (1) 2014 PIRO Environmental Assessment (EA, NMFS 2014a), which describes the sea turtle management activities within the PIR; (2) the Hawaiian Monk Seal Recovery Actions Environmental Impact Statement (NMFS 204b), which describes the impact of monk seal research and recovery activities on the habitat, including some beaches that are also used for turtle nesting and basking; (3) EA for Annual Catch Limits and Accountability Measures for Main Hawaiian Islands Kona Crab 2020-2023 (85 FR 79928, 12/11/2020), which includes descriptions of habitat and species that sea turtles may use or interact with, and (4) Pacific Islands Fisheries Science Center Programmatic Environmental Assessment for Fisheries and Ecosystem Research (NMFS 2023), which describes all activities and areas of PIFSC's research within the PIR We refer the reader to these documents (see supporting documents) for more detailed information. The non-US areas where MTBAP conducts sea turtle research include Papua New Guinea, Indonesia, the Solomon Islands, Japan, Philippines, Thailand, Vietnam, Malaysia, Federated States of Micronesia, Palau, and Marshall Islands. These areas and their conditions are described in depth in the PIRO EA (NMFS 2014a).

3.2.Biological Environment

3.2.1 Target Species - Sea Turtles and Sea Turtle Habitat

The sea turtles most likely to be encountered as part of PIFSC's MTBAP research activities include green, hawksbill, loggerhead, leatherback, and olive ridley sea turtles (Table 1). The latest abundance and life history information about each species/stock in Hawai'i was collected from the most recent and best available science. MTBAP provided information on the distribution, population size, and conservation status for each species in the NMFS permit 21260 application, and MTBAP incorporates those descriptions by reference. MTBAP briefly summarizes this information here.

Green, hawksbill, loggerhead, leatherback, and olive ridley sea turtles are protected throughout United States waters under the ESA. Inclusion of these species into the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) has made it illegal to trade any products made from these species among the U.S. and 169 other countries. Recovery plans for all U.S. Pacific populations of sea turtles were finalized in 1998 and serve as guidance in actions to recover these stocks (NMFS and USFWS 1998a-e). Sea turtle critical habitat has not been designated in the proposed area.

3.2.1.1. **Green Turtle**

In 2015, the green turtle was listed as threatened or endangered under the ESA throughout its Pacific Range with delineated DPSs based on genetic differentiation (Seminoff et al. 2015). MTBAP conducts research on three DPSs of green turtles: (1) Central North Pacific (CNP) – threatened, (2) Central South Pacific (CSP) – endangered, (3) Central West Pacific (CWP) – endangered. As well, at foraging grounds within the PIR, MTBAP may also interact with the East Pacific, East Indian/West Pacific, and Southwest Pacific DPSs – threatened.

In 1998, critical habitat was designated for the green sea turtle off Puerto Rico (50 CFR 226; September 2, 2014). This critical habitat is outside of the study area for MTBAP research activities; however, following the listing of 11 DPS for the green sea turtles in 2015, critical habitat designation for green sea turtles in the PIR is forthcoming.

Central North Pacific DPS

The CNP green sea turtle population includes the Hawaiian Archipelago and Johnston Atoll. It is a genetically distinct stock from others within the Pacific and there is no genetic differentiation between the main nesting site, Lalo / French Frigate Shoals (FFS), and Laysan Island, both located in the Northwest Hawaiian Islands (NWHI; Dutton et al. 2008, Dutton et al. 2014). Additionally, scattered nesting on the MHI is likely due to nesting activity of a few founding females (now captive and whose progeny is released into the wild) which originated from Lalo (Frey et al. 2013). Seminoff et al. (2015) estimated that the CNP DPS has a total of 3,346 nesting females which has increased approximately 4.8 to 5.4 % over the past 40 years (Balazs and Chaloupka 2004, Balazs and Chaloupka 2006, Chaloupka and Balazs 2007, NMFS PIFSC unpublished data). The sex ratio determined by stranded turtles in the MHI from 1983-2013 was not biased (Balazs et al. 2015). However, recent preliminary results (n = 35) show a female bias (3.4F:1M) in immature green sea turtles captured at three foraging grounds within the MHI between 2011-2015 (Allen et al. 2017).

Green turtles forage and nest within the CNP DPS areas. Foraging grounds are primarily located in the waters surrounding the MHI, whereas nesting primarily occurs on sandy beaches 500 miles to the northwest of Honolulu in the Papahānaumokuākea Marine National Monument (PMNM), with 96% of all nesting occurring at Lalo (Seminoff et al. 2015). Nesting females have been tracked by satellite telemetry to foraging grounds within the DPS at the MHI and Johnston Atoll (Balazs and Ellis 2000, NMFS PIFSC unpublished data). In addition to nesting and foraging, green turtles in Hawai'i haul out on beaches to bask.

Threats to green sea turtles in the CNP DPS include incidental capture in commercial and recreational fishing gear, boat collisions, shark attack, and the tumor disease fibropapillomatosis (NMFS and USFWS 1998a, Chaloupka et al. 2008a, NMFS PIFSC unpublished data,). Climatic changes and sea level rise have also been identified as a significant threat to this population as the nesting habitat in the NWHI is comprised of low lying atoll islets (Baker et al. 2006). Whale-Skate Island in the NWHI was historically densely nested; however this island subsided and never reformed (Kittinger et al. 2013). In October 2018, East Island (the most densely nested island in the atoll) was completely wiped out by Hurricane Walaka and has yet to reform to its previous size.

Central South Pacific DPS

The CSP DPS extends 7,500 km longitudinally from Fiji in the West to Easter Island, Chile in the East. Low to moderate nesting activity is dispersed throughout the geographic distribution of the CSP DPS. There is a lack of consistent monitoring of green sea turtle nesting in the DPS because most nesting occurs on low-lying atolls, which are remote and difficult to access. The main rookeries include Rose Atoll in American Sāmoa (Maison et al. 2010); Tongareva Atoll in the Cook Islands (White et al. 2014); Ringgold Isles in Fiji (Sharma-Gounder and Veeran 2010); Scilly Atoll in French Polynesia (Balazs et al. 1995); Enderbury in Kiribati (Obura and Stone 2002); Nukunonu in Tokelau (Balazs 1983); Tonga (Bell et al. 2009); Funafuti in Tuvala (Alefaio And Alefaio 2006); and Henderson in the UK (Brooke 1995). Seminoff et al. (2015) estimated approximately 3,000 nesting females in the DPS. Hatchlings disburse throughout the region and post-nesting migrations have stayed within (Fiji; Piovano 2018, Balazs et al. 1995; French Polynesia, Craig et al. 2004,; Tonga, the Cook Islands, and Wallis, Balazs et al. 1995) or travelled outside (western South Pacific, Tuato'o-Bartley et al., 1993; New Caledonia and Vanuatu, Balazs et al. 1995) of the DPS' geographic range. In-water data are limited, but green sea turtles have been found in coastal waters of American Sāmoa (M. MacDonald personal communication, June 2021), Cook Islands (White et al. 2014, White and Galbraith 2013) and French Polynesia (Petit et al. 2012) as well as at two major foraging grounds in Fiji (Piovano et al. 2020). When examining the genetics of nesting females in the CSP DPS, Dutton et al. (2014) found that American Sāmoa and French Polynesia are two different genetic stocks. Additionally when examining green turtle nesting sites across the Pacific Islands the authors found that neighboring rookeries (within 500 km) were genetically similar, however, rookeries more than 1,000 km apart were genetically different from each other (Dutton et al., 2014). The DPS has unique haplotypes not found elsewhere with a moderate level of diversity (P. Dutton personal communication cited in Seminoff et al. 2015). Considering that this DPS extends longitudinally over 7,500 km it is possible that there are more than just these two genetic stocks within the CSP DPS. For turtles encountered in-water, preliminary genetic results show that immature green turtles captured in Tongareva Atoll, French Polynesia share haplotypes with American Sāmoa, the Marshall Islands, Federated States of Micronesia, and the Eastern Pacific; with one additional novel/unknown haplotype found (White 2016). Despite there being two key foraging grounds in Fiji, Piovano et al. (2020) have not encountered a single turtle born in Fiji.

Central West Pacific DPS

Within the CWP DPS, green turtle nesting occurs in relatively low numbers in the FSM, Marshall Islands, Solomon Islands, Palau, Guam, and CNMI (Maison et al. 2010, Martin et al. 2015, Summers et al. 2018a). The nesting female abundance for this DPS is estimated to be 6,518 individuals, with the majority of nesting females occurring in Ulithi Atoll, Yap, FSM and Ogasawara, Japan (Seminoff et al. 2015). The majority of the nesting populations in this DPS have insufficient long-term monitoring information to adequately assess the abundance and trends. Limited data suggest population decreases in the Marshall Islands, increases in the CNMI, and unknown trends in Palau, PNG, Solomon Islands, and FSM (Maison et al. 2010, Seminoff et al. 2015, Summers et al. 2018a). Chichijima, Japan is estimated to be increasing at approximately 5% per year (Balazs et al. 2015, Seminoff et al. 2015).

Direct take and trade are significant threats to this DPS (Seminoff et al. 2015, Summers et al. 2018b, Miller et al. 2019). Harvest of nesting females and their eggs occurs in CNMI, Guam, FSM, Kiribati, Marshall Islands, Palau, PNG, Malaysia, Phillippines, and Indonesia (summarized by Seminoff et al. 2015; Humber et al. 2014; Lam et al. 2011; Martin et al. 2019; Summers et al. 2018a, Summers et al. 2018b; Tapilatu et al. 2017). In addition to direct take, land predators consume large numbers of eggs on nesting beaches throughout the DPS (Seminoff et al. 2015). Incidental take in artisanal and commercials fisheries is also a significant threat to sea turtles in this DPS.

Green sea turtles account for 85% of turtles captured in-water in Guam (Martin et al. 2016), 93% of turtles captured in-water in CNMI (Summers et al. 2018b), and five decades of aerial surveys around Guam suggest that sea turtle numbers increased an order of magnitude since the 1960s (Martin et al. 2016). The 11 year study of CNMI nesting data suggest an annual increase in nesting females of 7.4% per year (Summers et al., 2018a). Genetic analysis of females from nesting sites in the region has identified Guam/CNMI as a management unit along with Palau, PNG, Yap, and the Marshall Islands (Seminoff et al. 2015).

3.2.1.2. **Hawksbill**

The hawksbill turtle (*Eretmochelys imbricata)* is listed under the ESA as endangered throughout its range. Hawksbill populations have declined dramatically in the Pacific (Mortimer and Donnelly 2008), and the species is rapidly approaching extinction due to a number of factors. The most recent abundance estimate for this species in the Pacific Ocean is a total of 10,194 to 12,770 nesting females each season among 88 sites evaluated, which is a rough estimate of total annual reproductive effort in the Pacific (NMFS and USFWS 2013). In the PIR, Hawai'i hosts the largest population of hawksbills with 10 to 25 females nesting annually (NMFS and USFWS 2013). The intentional harvest of this species for meat, eggs, and the illegal international trade of tortoiseshell are the greatest threats to its survival. Other threats to the continued existence of this species include beach erosion, coastal construction, habitat loss, capture in fishing nets, and boat collisions (NMFS and USFWS 1998b, NMFS 2013).

In Hawai'i, hawksbill turtles nest in small numbers (<15 females annually) in the MHI (i.e., Hawai'i, Maui, and Moloka'i; Seitz et al. 2012, Kurpita 2015). Historically, the majority of monitoring occurred on the islands of Hawai'i and Maui. Hawksbill turtles migrate through, rest, and forage in the near-shore waters in the MHI (Parker et al. 2009, Van Houtan et al. 2016). They also occur in the NWHI and likely nested there historically (Van Houtan et al. 2012). Even though there was an increase in MHI nesting activity from 2005-2009, this population has not demonstrated signs of recovery despite years of protective efforts (Seitz et al. 2012). Genetic analyses indicate that Hawaiian hawksbills are a distinct genetic stock, and that most individuals remain in or close to the archipelago throughout their lives; however there is evidence of potential dispersal to foraging grounds in the West Pacific (Gaos et al. 2020). The population appears to be strongly female biased based on stranding data and in-water surveys (Brunson et al. 2022, King and McLeish 2016).

Nesting is not regularly monitored (Grant et al. 1997, Hutchinson et al. 2008) throughout the PIR, but a few hawksbill turtles nest on the island of Ofu in American Sāmoa (M. MacDonald personal communication, December 2019). Surveys for hawksbill nesting occur on Guam and in CNMI but there have been no documented nesting of hawksbills in recent years (T. Summers and C. Cayanan Personal Communication, August 2022; Summers et al. 2018b).

Hawksbill sea turtles are found in nearshore waters throughout the PIR, with hawksbills accounting for 15% of turtles captured in-water in Guam (Martin et al. 2016), 7% of turtles captured in-water in CNMI (Summers et al. 2017), and many were sighted by aerial surveys conducted over five decades (Martin et al. 2016). Their occurrence and distribution in the PRIAs is not well understood. Immature and mature hawksbills occasionally strand in the MHI and American Sāmoa, which are documented through stranding research programs.

In 1998, critical habitat was designated for the hawksbill sea turtle off Puerto Rico (50 CFR 226; September 2, 2014). This critical habitat is outside of the study area for MTBAP research activities.

3.2.1.3. **Leatherback**

The leatherback turtle (*Dermochelys coriacea*) is listed as endangered throughout its range (85 FR 48332, August 10, 2020). Leatherback populations in the Pacific are in severe decline (Tapilatu et al. 2013) and, in some cases, on the verge of extinction. The decline has been attributed to incidental take in coastal and high seas fisheries, the killing of nesting females by humans for meat, and the collecting of eggs at nesting beaches (Benson et al. 2015; Fahy 2011; Martin et al. 2020). There are three distinct genetic stocks in the Pacific: eastern Pacific, western Pacific, and the functionally extinct Malaysian stock (Benson et al. 2015). The Western Pacific leatherback stock is made up of three rookeries (1) Papua-Barat, Indonesia, (2) PNG, and (3) Solomon Islands (Dutton and Shanker 2015). The most recent population status review recognizes two Pacific distinct populations: western Pacific and eastern Pacific (NMFS and USFWS 2020). Leatherbacks encountered in Hawai'i represent individuals in transit between nesting beaches in the western Pacific and foraging grounds (Benson et al. 2015). The number of nesting females for the West Pacific DPS is estimated at 1,277 individuals (NMFS and USFWS 2020). Leatherbacks nesting in the western Pacific migrate through the EEZ's of at least 32 nations, and spend between 45 and 78% of the year on the high seas including in the U.S. EEZs of California and Hawai'i (Harrison et al. 2018). Some individuals forage in the Eastern Pacific Ocean, such as Peru, Chile, and California (Dutton et al. 2000; Donoso and Dutton 2010, Seminoff et al. 2012). Some of the largest nesting populations of leatherback turtles in the world border the Pacific Ocean, but no nesting occurs on beaches under U.S. jurisdiction (NMFS and USFWS 1998c).

Critical habitat for leatherback turtles was originally designated in 1978 (43 FR 43688; September 26, 1978), and was revised in 2012 to include more areas within the Pacific Ocean (77 FR 4169; January 26, 2012). This designation occurs along the U.S. west coast and comprises approximately 41,914 square miles (108,558 square km) of marine habitat and includes waters from the ocean surface down to a maximum depth of 262 feet (80 m). This critical habitat is outside of the study area for MTBAP research activities.

3.2.1.4. **Loggerhead**

The loggerhead turtle (*Caretta caretta*) is listed in the North and South Pacific as DPSs with an endangered status (75 FR 58868). Loggerheads in the North Pacific are derived primarily from nesting beaches in Japan (Bowen et al. 1995, Kamezaki et al. 2003); whereas, loggerheads in the South Pacific are derived primarily from nesting beaches in eastern Australia and New Caledonia (Limpus and Limpus 2003, Boyle et al. 2009). The North Pacific nesting female population is estimated at 3,652 individuals and is modeled to have a slightly increasing population trend (Martin et al. 2020). North Pacific loggerheads spend their immature years foraging throughout the Central and Eastern Pacific, but return to the Western Pacific for the duration of their adult lives (Abecassis et al. 2013, Seminoff et al. 2014, Briscoe et al. 2016).

These stocks are threatened primarily by incidental capture in commercial fishing gear (i.e., longline gear and gillnets) and loss or degradation of nesting habitat (NMFS and USFWS 1998d, Polovina et al. 2000, Polovina et al. 2003, Polovina et al. 2004, Polovina et al. 2006, Peckham et al. 2007, Howell et al. 2008, Howell et al. 2010, Kobayashi et al. 2008, Chaloupka et al. 2008b, NMFS and USFWS 2009, Martin et al. 2020). Other threats include egg harvest and predation as well as nesting beach alteration.

Critical habitat was designated for the loggerhead sea turtle Northwest Atlantic Ocean Distinct Population Segment (DPS) in 2014 (79 FR 39855; July 10, 2014). This critical habitat is outside of the study area for MTBAP research activities.

3.2.1.5. **Olive Ridley**

The olive ridley turtle (*Lepidochelys olivacea*) is listed as threatened globally in the Pacific, except for the Mexican breeding population, which is classified as endangered. The olive ridley is widely regarded as the most abundant sea turtle in the world, with the most recent status review of this species estimating a weighted estimate of 1.39 million turtles (NMFS and USFWS 2014); however, it is rare in the central Pacific because there are no nesting beaches in the PIR. Occasionally, a wayward female is found nesting in the Hawaiian Islands, most recently in 2019 on the Island of Oahu and one that attempted to nest in Lalo in 2021 (NMFS unpublished data). Individuals also occasionally strand in the MHI and are incidentally captured in western and central Pacific longline fisheries more frequently than the other species (Fahy 2011). The primary threats to this species throughout the Pacific are incidental take in fisheries and harvest of eggs and adults on Mexican and Central American nesting beaches (NMFS and USFWS 2014).

3.2.2. Protected Species

This section identifies the non-target and protected species that may be encountered during research activities in the proposed area. These include marine mammals, birds, fish, reptiles, corals, and plants. More information about the species that may be potentially encountered can be found in the NMFS (2022b) PIFSC research biological opinion. The MTBAP activities have been evaluated for impacts on protected resources and are managed in compliance with the requirements of the Marine Mammal Protection Act, the ESA, the Migratory Bird Treaty Act, and other applicable statutes. The biology of these species is described in greater detail within several documents, and we refer the reader to them for more in-depth information (see supporting documents): (1) the Pacific Islands Regional Office (PIRO) Environmental Assessment for the Marine Turtle Management and Conservation Program (NMFS 2014a), which describes the sea turtle management activities within the PIR; (2) the Hawaiian Monk Seal Recovery Actions Environmental Impact Statement (NMFS 2014b), which describes the impact of monk seal research and recovery activities on the habitat, including some beaches that are also used for turtle nesting and basking; (3) EA for Annual Catch Limits and Accountability Measures for Main Hawaiian Islands Kona Crab 2020-2023 (85 FR 79928, 12/11/2020), which includes descriptions of habitat and species that sea turtles may use or interact with, and (4) Pacific Islands Fisheries Science Center Programmatic Environmental Assessment for Fisheries and Ecosystem Research (NMFS 2023), which describes all activities and areas of PIFSC's research within the PIR.

3.2.2.1. **Marine Mammals**

3.2.2.1.1. Cetaceans

Throughout the PIR, over 30 species of cetaceans inhabit these waters. MTBAP activities would rarely encounter any of these species, but may potentially overlap with marine mammals during in-water monitoring (e.g. UAV surveys, boat surveys). A list of the cetacean species found in the Hawaiian archipelago, American Samoa, Guam and CNMI can be found in Table 5.

Table 5. Cetaceans found in the Hawaiian archipelago, American Samoa, Guam and CNMI.

Common Name	Scientific Name
Common bottlenose dolphin	*Tursiops truncatus*
Common dolphin	*Delphinus delphis*
Fraser's dolphin	*Lagenodelphis hosei*
Northern right whale dolphin	*Lissodelphis borealis*
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*
Indo-Pacific bottlenose dolphin	*Tursiops aduncus*
Pantropical spotted dolphin	*Stenella attenuata*
Risso's dolphin	*Grampus griseus*
Rough-toothed dolphin	*Steno bredanensis*
Spinner dolphin	*Stenella longirostris*
Striped dolphin	*Stenella coruleoalba*
Baird's beaked whale	*Berardius bairdii*
Blainville's beaked whale	*Mesoplodon densirostris*
Blue whale	*Balaenoptera musculus*
Bryde's whale	*Balaenoptera edeni*
Cuvier's beaked whale	*Ziphius cavirostris*
Deraniyagala's beaked whale	*Mesoplodon hotaula*
Dwarf sperm whale	*Kogia sima*
False killer whale	*Pseudorca crassidens*
Fin whale	*Balaenoptera physalus*
Ginko-toothed beaked whale	*Mesoplodon ginkgodens*
Humpback whale	*Megaptera novaeangliae*
Killer whale	*Orcinus orca*
Longman's beaked whale	*Indopacetus pacificus*
Melon-headed whale	*Peponocephala electra*
Minke whale	*Balaenoptera acutorostrata*
Short-finned pilot whale	*Globicephala macrorhyncus*
Pygmy killer whale	*Feresa attenuata*
Pygmy sperm whale	*Kogia breviceps*
North Pacific right whale	*Eubalaena japonica*
Sei whale	*Balaenoptera borealis*
Sperm whale	*Physeter macrocephalus*
Stejneger's beaked whale	*Mesoplodon stejnegeri*

3.2.2.1.2. Hawaiian Monk Seal

Hawaiian monk seals (*Neomonachus schauinslandi*) are found in the Hawaiian archipelago and at Johnston atoll within the action area. While monk seals spend most of their time in the water, they also use the terrestrial environment to haul-out on beaches, shores, and reefs. A detailed description of the status and biology of Hawaiian monk seals can be found in the Hawaiian

Monk Seal Recovery Actions Environmental Impact Statement[1] (NMFS 2014b), which describes the impact of monk seal research and recovery activities on the habitat, including some beaches that are also used for turtle nesting and basking; and we refer the reader to that document for more detailed information (see footnote). Since the publication of the Hawaiian Monk Seal Recovery Actions Environmental Impact Statement in 2014, ten areas within the Hawaiian Archipelago were designated as Hawaiian monk seal critical (80 FR 50925; August 21, 2015) – described in greater detail in Section 3.2.3.4 below.

3.2.2.2. **Birds**

There are many seabird species that are considered residents or visitors within the action area. Of the presented species, four are listed under the ESA. However, all species likely to occur in the U.S. EEZ are protected by the Migratory Bird Treaty Act (MBTA).

There are also numerous terrestrial birds located within the action area. Terrestrial birds that are protected and likely to be found within the expected locations where research actions may take place are also included in Table 6.

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[1] https://www.fisheries.noaa.gov/resource/document/final-programmatic-environmental-impact-statement-hawaiian-monk-seal-recovery

Table 6. Birds protected under ESA or MBTA within the action area.

Common Name	***Scientific Name***
Newell's shearwater*	*(Puffinus auricularis newelli)*
Hawaiian petrel*	*(Pterodroma phaeopygia)*
Band-rumped storm-petrel*	*(Oceanodroma castro)*
Short-tailed albatross*	*(Phoebastria albatrus)*
Wedge-tailed shearwater	*Puffinus pacificus*
Audubon's shearwater	*Puffinus lherminieri*
Short-tailed shearwater	*Puffinus tenuirostris*
Leach's storm-petrel	*Oceanodroma leucorhoa*
Matsudaira's storm-petrel	*Oceanodroma matsudairae*
Red-footed booby	*Sula sula*
Brown booby	*Sula leucogaster*
Masked booby	*Sula dactylatra*
White-tailed tropicbird	*Phaethon lepturus*
Red-tailed tropicbird	*Phaethon rubricauda*
Great frigate bird	*Fregata minor*
Sooty tern	*Sterna fuscata*
Brown noddy	*Anous stolidus*
Black noddy	*Anous minutus*
White tern/Common fairy-tern	*Gygis alba*
Hawaiian goose	*Branta sandvicensis*
Hawaiian coot	*Fulica alai*
Hawaiian duck*	*Anas wyvilliana*
Hawaiian stilt*	*Himantopus mexicanus knudseni*
Laysan duck*	*Anas laysanensis*
Laysan finch	*Telespiza cantans*
Guam rail	*Gallirallus owstoni*
Mao	*Gymnomyza samoaensis*
Tongan ground dove	*Gallicolumba stairi*

* listed under the ESA

3.2.2.3. **ESA-listed plants**

The proposed activities would mainly be located in coastal waters on the beach or within 5 m inland of the splash zone where vegetation occurs. Field research camps in the NWHI are located further inland than this immediate shoreline area. Some listed plants may occur near field camps or trail paths leading to beaches where research activities may be conducted. These species are threatened by human disturbance and are known to exist in areas where humans access beaches. MTBAP research and associated activities may be conducted in areas where these species occur.

3.2.2.4. **Invertebrates**

3.2.2.4.1. Yellow-faced bees

There are 63 species in the bee genus Hylaeus, which occur on all the Main Hawaiian Islands (MHI) and Nihoa. Native Hawaiian yellow-faced bees in the genus Hylaeus (Hymenoptera: Colletidae) have adapted to a wide array of habitat types ranging from coastal strand to high elevation wet forests. They nest in hollow stems, holes in trees, under bark, in crevices, or in burrows in soil. MTBAP activities may occur near areas where these bees nest and forage.

3.2.2.4.2. ESA-listed Corals

Executive Order 13089 requires federal agencies to identify actions that may affect coral reefs, protect and enhance the condition of coral reef ecosystems through existing projects, and ensure their actions do not degrade the conditions of coral reef ecosystems. On September 10, 2014, NMFS issued a final rule to list 20 species of corals as threatened under the ESA (79 FR 53851). Fifteen of the newly listed species occur in the Indo-Pacific, and five in the Caribbean. Of those that occur in the Indo-Pacific, NMFS assumes only eight occur in waters under U.S. jurisdiction (79 FR 53851). Six of these species occur in the waters around American Samoa, three of the species occur in the waters around the Mariana Archipelago, and three listed species are confirmed in PRIA (Table 7). None of the species has a common name. Species-specific information on the exact location of these ESA-listed coral is unavailable. Critical habitat has been proposed for these species (85 FR 76262) but has not been designated at this time. See Section 3.2.3.4 below.

Table 7. ESA-listed corals within the action area.

Species Name	Location
Acropora globiceps	American Samoa, Mariana archipelago, PRIA
Acropora retusa	American Samoa, Mariana archipelago, PRIA
Acropora speciosa	American Samoa, PRIA
Acropora jacquelineae	American Samoa
Euphyllia paradivisa	American Samoa
Isopora crateriformis	American Samoa
Seriatopora aculeata	Mariana archipelago

3.2.3. Habitats and Vulnerable Ecosystems

3.2.3.1. **Marine Protected Areas**

Marine Protected Areas (MPAs) and protected areas are numerous in the PIR. These include Marine National Monuments, Sanctuaries, Refuges, and Parks and other designated conservation areas. The MPAs that occur within the action area and where MTBAP sea turtle research activities or associated actions could take place include:

- Papahānaumokuākea Marine National Monument
- Rose Atoll Marine National Monument
- National Marine Sanctuary of American Samoa
- Marianas Trench Marine National Monument
- Pacific Remote Islands Marine National Monument
- Hawaiian Islands Humpback Whale National Marine Sanctuary
- Fagatele Bay National Marine Sanctuary
- Hanauma Nature Preserve

These areas have been described in detail previously within (1) the PIRO Environmental Assessment for the Marine Turtle Management and Conservation Program (NMFS 2014a), which describes the sea turtle management activities within the PIR; (2) the Hawaiian Monk Seal Recovery Actions Environmental Impact Statement (NMFS 204b), which describes the impact of monk seal research and recovery activities on the habitat, including some beaches that are also used for turtle nesting and basking; (3) EA for Annual Catch Limits and Accountability Measures for Main Hawaiian Islands Kona Crab 2020-2023 (85 FR 79928, 12/11/2020), which includes descriptions of habitat and species that sea turtles may use or interact with, and (4) Pacific Islands Fisheries Science Center Programmatic Environmental Assessment for Fisheries and Ecosystem Research (NMFS 2023), which describes all activities and areas of PIFSC's research within the PIR. We refer the reader to these documents for more detailed information (see supporting documents). Executive Order 13158 requires federal agencies to avoid harm of MPAs.

In addition, several other MPAs that occur within the action area and where MTBAP sea turtle research activities or associated actions could take place, but have not been described in detail in other documents are listed below. We describe those briefly here. These include:

- James Campbell National Wildlife Refuge
- Pearl Harbor National Wildlife Refuge
- Hawaii Volcanoes National Park

3.2.3.1.1. James Campbell National Wildlife Refuge

James Campbell NWR is a remnant wetland located in Kahuku, Koʻolauloa on the island of Oʻahu. The Refuge was established in 1976 for the purpose of providing habitat for endangered Hawaiian waterbirds, and was further expanded in 2005 for the purposes of providing additional habitat for endangered waterbirds, migratory shorebirds, waterfowl, seabirds, endangered and native plant species, endangered Hawaiian monk seal, and threatened Hawaiian green sea turtle; providing increased wildlife-dependent public uses; and assisting with flood damage reduction in the local area. JCNWR is typically a closed refuge; however, bird tours during the nonbreeding season of the endangered Hawaiian waterbirds may be offered to the public. In addition, a few beaches within the NWR are a sanctuary for nesting green sea turtles.

3.2.3.1.2. Hawai'i Volcanoes National Park

Hawaii Volcanoes National Park was established as a Hawaii National Park in 1916 and protects native plants and animals, and cultural sites. Many land and marine wildlife are protected within the HVNP, including hawksbill and green sea turtles. Important hawksbill sea turtle nesting beaches are protected under the jurisdiction of the Hawai'i Volcanoes National Park.

3.2.3.1.3. Pearl Harbor National Wildlife Refuge

Pearl Harbor NWR was established in 1972 as mitigation for construction of the Honolulu International Airport Reef Runway. The Kalaeloa Unit, once part of the former Barber's Point Naval Air Station, was established during military base closure proceedings in 2001 to protect native plants. Pearl Harbor NWR is managed as part of the O'ahu NWR Complex. Pearl Harbor is a sanctuary for many species that are native and endemic to the Hawaiian Islands, including green and hawksbill sea turtles.

3.2.3.2. **Critical Habitats**

The ESA requires the designation of critical habitat for a listed species when it is "prudent and determinable." There are two species for which critical habitat has been designated within the project area, and seven coral species for which critical habitat designation has been proposed. These are briefly described below.

Hawaiian monk seal critical habitat includes sixteen occupied areas within the range of the species: ten areas in the NWHI and six in the MHI (80 FR 50925; August 21, 2015). These areas contain one or a combination of habitat types: preferred pupping and nursing areas, significant haul-out areas, and/or marine foraging areas, that will support conservation for the species. Specific areas in the NWHI include all beach areas, sand spits and islets, including all beach crest vegetation to its deepest extent inland, lagoon waters, inner reef waters, and including marine habitat through the water's edge, including the seafloor and all subsurface waters and marine habitat within 10 meters of the seafloor, out to the 200-m depth contour line around the following 10 areas: Kure Atoll, Midway Islands, Pearl and Hermes Reef, Lisianski Island, Laysan Island, Maro Reef, Gardner Pinnacles, Lalo (French Frigate Shoals), Mokumanamana Island, and Nihoa Island. Specific areas in the MHI include marine habitat from the 200-m depth contour line, including the seafloor and all subsurface waters and marine habitat within 10 m of the seafloor, through the water's edge 5 m into the terrestrial environment from the shoreline between identified boundary points on the islands of: Kaula, Niihau, Kauai, O'ahu, Maui Nui (including Kahoolawe, Lanai, Maui, and Molokai), and Hawai'i.

Insular false killer whale (*Pseudorca crassidens*) critical habitat includes areas that contain any of four features that are essential to the population: Island-associated habitat, prey, water quality, and sound. 83 FR 35062 (July 24, 2018). The critical habitat was designated in approximately 45,504 km2 (17,564 mi2) of marine habitat in waters from the 45-meter depth contour to the 3,200-meter depth contour around the main Hawaiian Islands from Ni'ihau east to Hawai'i. There are 14 areas that were excluded from critical habitat designation based on military use and public safety concerns.

The designation of coral critical habitat within the PIR has been proposed by NMFS for seven threatened coral species (*Acropora globiceps, A. jacquelineae, A. retusa, A. speciosa, Euphyllia paradivisa, Isopora crateriformis, and Seriatopora aculeata*) pursuant to section 4 of the ESA (November 27, 2020; 85 FR 83899). Seventeen specific occupied areas containing physical features essential to the conservation of these coral species are being proposed for designation as critical habitat; these areas contain approximately 600 square kilometers (230 square miles) of marine habitat.

Chapter 4 Environmental Effects

This section describes the potential effects of each alternative on the components of the affected environment identified in Section 3.0 above. Table 8 provides a summary of the potential effects of the proposed alternatives. The NMFS ESA permit (21260, Appendix 1) and USFWS permit (TE-72088A-3, Appendix 3) informs our analysis of the direct, indirect, and cumulative effects of our proposed activities. As described in Section 2, the MTBAP has decades of experience in the development of many avoidance and minimization measures for handling and working with sea turtles. The existing baseline conditions within the geographic scope of analysis vary from place to place and with the level of human activity (i.e., from an uninhabited island to a heavily developed beachfront city). This section will discuss the impacts of the Proposed Action and Alternatives on each relevant resource component. These impacts will be compared to the existing baseline conditions by rating them as negligible, minor, moderate, or major. These ratings are made by taking into consideration the context, intensity, and likelihood of the impact.

Table 8. Summary of the affected environment and potential effects of the proposed alternatives

	Alternative 1 Status Quo	**Alternative 2 preferred**	**Alternative 3 No action**
Description	Continuation of Current Research Activities	Continuation of Current Research Activities with the Addition of Nest Relocations of any nest and Nest Probing	No Research
Impact to Target Stock	Negligible impact	Minor impact	Major impact
Impact to non-target species	Minor impact	Same as Alternative 1	No impact
Habitat Impact	Minor impact	Same as Alternative 1	No impact

4.1. Effects of Alternative 1 and 2 – Continuation of Current Research Activities

Alternative 1 is the continuation of current research activities conducted by PIFSC MTBAP, which may involve activities that range from computer analyses and outreach to collection of blood and tissue samples or attaching tags and transmitters to sea turtles in the field. MTBAP standard operating procedures would continue to incorporate research techniques as described in section 2.1.1.7 of this PEA, which are specifically designed to minimize the impacts of these research techniques on turtles and the surrounding marine environment. MTBAP incorporates (by reference) the descriptions of the activities in Alternative 1 from section 2.2.1 in this document (Table 9), and briefly summarize or supplement the relevant information in the following subsections. Alternative 2 involves the continuation of all activities described under Alternative 1 plus the addition of nest relocation. Therefore, the effects described under this section will apply to both alternatives 1 and 2 and only the effects of the proposed nest relocation activities are described under Section 4.2.

4.1.1. Effects to Sea Turtle Habitat

MTBAP activities in the PIR under Alternatives 1 and 2 would not result in permanent negative impacts to habitats used directly by sea turtles. The main impact issue associated with the activities described in Alternative 1, would be the short term disturbance to beach and marine habitat for the duration of the research activities. These disturbances are minimal, intermittent, short term, and of low frequency, and would not have any long-term impacts to habitat.

4.1.2. Effects to Sea Turtles

Even under the best circumstances with experienced research personnel and well-planned research methodologies, the potential for accidental mortality or serious injury does exist. To address this issue, there are mitigation protocols in place such that researchers are required to cease research activities and contact permit officials at NMFS and USFWS immediately should a sea turtle mortality event or a serious injury occur. This would allow for a careful review of the circumstances and, where needed, consultation with others to determine if the research methodology or qualifications of personnel are likely to lead to further incidences. Nonetheless, when searching MTBAP's database and using institutional knowledge obtained since 1992 to confirm the findings in the database, zero serious injuries or accidental mortalities of sea turtles have occurred in over 94,000 capture, 50,000 tagging, or 17,000 bio-sampling events of nesting, basking, in-water, and hatchling sea turtles. In 1994, one sea turtle did become entangled in a net and was found unconscious, the turtle was resuscitated and released alive; this type of net is no longer used by the MTBAP.

Possible impacts to sea turtles for various proposed research techniques are described in detail in the following sections. The expected number of turtles by species to be handled annually for each research technique are depicted in Tables 10 and 11. As shown, there are no mortalities expected to result from implementation of the techniques as described. Based on current and past research, there are minimal levels of discomfort to individual animals expected to result from the proposed research methods. There are no other feasible research methods available to collect the data necessary to address research questions and recovery plan goals. Indirectly, impacts on sea turtle populations as a result of the proposed action are expected to be positive in that collection of data will assist researchers and conservation managers worldwide in monitoring the overall health status in order to inform conservation and management actions designed to maintain and increase these endangered and threatened populations.

Table 9. Descriptions of the activities in Alternative 1 and how they relate to MTBAP's research activities.

Alternative 1 Activity	Section 2 Research Activities	Effect on sea turtles (y/n)
4.1.2.1 Aerial survey	2.1.1.1 2.1.1.5 2.1.1.6	N Y Y
4.1.2.2 Nesting and basking surveys	2.1.1.1 2.1.1.5	N Y
4.2.2.3 Capturing and handling sea turtles in-water	2.1.1.1 2.1.1.2 2.1.1.4 2.1.1.6 2.1.1.7	N Y N Y N
4.2.2.4 Capturing and biosampling hatchlings	2.1.1.1 2.1.1.2 2.1.1.4 2.1.1.5 2.1.1.7	N Y N Y N
4.2.2.5 Procedures such as tissue sampling, tagging, and transmitter attachment	2.1.1.1 2.1.1.2 2.1.1.3 2.1.1.4 2.1.1.5 2.1.1.6 2.1.1.7	N Y Y N Y Y N
4.2.2.6 Stranding response and research	2.1.1.1 2.1.1.2 2.1.1.3 2.1.1.4 2.1.1.7	N Y Y N N

4.1.2.1. **Effects of Aerial Surveys**

Aerial surveys over open ocean areas are expected to be transient in time and space. Both manned and unmanned aerial vehicles (UAV) may be used. Aerial research surveys (i.e., manned and unmanned) of sea turtle populations are not known to have significant impacts on sea turtles due to methodologies used to prevent disturbance (e.g., Bevan et al. 2018). The approach of a research vessel or aircraft (from which the UAV would be deployed) and associated noise may cause temporary disturbance to the target sea turtles and non-target species, and may temporarily interrupt normal activities such as feeding, resting, or mating. However, while sea turtles and non-target species may exhibit these temporary startle and evasive behaviors in response to the activities of researchers, the impact to individual animals or populations as a whole would not be likely to be significant because the reactions would be non-invasive and short-lived.

As of 2022, MTBAP does not conduct turtle research via aerial surveys. However, MTBAP is permit approved to conduct aerial surveys and intends to conduct sea turtle aerial research survey activities in the PIR. For more detailed descriptions of UAV use during research activities, see MTBAP permits (Appendix 1-6).

DOI secretarial order 3379, issued on January 29th 2020, temporarily ceased all UAS flights "which take off or land on FWS lands and waters" including those within the PMNM. However, FWS has allowed for some limited UAV for activities under the co-managers permit that directly support conservation and management objectives of the Monument and do not result in any education/outreach material to be gathered or published from the UAS. MTBAP could not permit UAV under any other type of permit. To operate under the co-manager PMNM permit, MTBAP will submit the standard memo-to-file prior to the start of each field season to describe how UAV would be used within the PMNM. In addition, MTBAP will coordinate with NMFS for ESA/MMPA permit requirements prior to the action occurring.

In summary, given the altitude the UAV operates and the short duration of operation, the operation of manned and unmanned UAV under Alternatives 1 and 2 are not expected to have any impact on sea turtles or other wildlife. However, if UAS operations are in danger of creating a disturbance to seabirds, marine mammals, or other natural resources, the aircraft would increase altitude to a non-threatening distance per permit requirements. Researchers would conduct research so as to avoid harassment of any sea turtles or other target or non-target species. There have been significant developments in UAS technology in recent years, such that protocols may evolve, as well as utilizing newer platforms approved by the Federal Aviation Administration (FAA) and NOAA's Office of Marine and Aviation Operations (OMAO). Close communication with the NMFS UAS Working Group and UAS experts from PIFSC will be maintained to adjust operational parameters according to the current technology capabilities with minimal animal disturbance. All UAS operations will be conducted in coordination with and approved by OMAO.

4.1.2.2. **Effects of Nesting and Basking Surveys**

During nesting surveys, researchers walk the beach to record data, including: identification of the female, date of encounter or nest deposition, date of nest hatching, location of nest, and nest density. When conducting night surveys for nesting activity, nesting females can become skittish or disturbed if a light is shined on their face during egg deposition, or if they see the researcher or the researcher's shadow. To reduce the likelihood of disturbance, red lights are utilized and researchers always approach a nesting turtle slowly from the rear. Before contact is made with the turtle, the nesting activity is noted, and an attempt to identify her by shell etching or tag is made. Based on the observed activity, the researcher decides if it is the appropriate time to safely tag and sample (if necessary) the turtle without disrupting the nesting process. The best time for the researcher to interact with the turtle is during and immediately after egg laying is complete to minimize adverse impacts. The presence of researchers conducting the nesting surveys has a negligible impact on turtles while they rest on the beach prior, during, and after nesting as a result of these avoidance and minimization measures.

For Alternatives 1 and 2, conducting nesting surveys would have short-term temporary direct minor adverse impacts to any sea turtle that is studied. These impacts would be in the form of non-lethal stress to the wild animal (Eckert et al.1999), but as described above would be mitigated through the use of red lights and approaching the animal from the rear. The indirect adverse impacts would be negligible because the nesting surveys would be conducted within a matter of minutes. The long-term minor beneficial indirect impact of surveys of sea turtles would be the increased understanding of the sea turtle populations of the PIR though additional data collection.

4.1.2.3. **Effects of capturing and handling sea turtles in-water**

As with any wildlife capture, there is a possibility that captured turtles could experience short- and long-term adverse impacts. These adverse impacts range from near-drowning to actual drowning by entanglement. To minimize the potential for adverse impacts, when nets are in the water to capture turtles, they are constantly monitored and turtles are immediately retrieved from the net (Ehrhart and Ogren 1999). Additionally, several field personnel are in the water during all capture activities to ensure that stress to the animal is minimized. A veterinarian is on call during capture activities in the event consultation is required. If a turtle is encountered during capture activities in a comatose state, resuscitation is attempted. Handling time is minimized to reduce the potential for additional stress. Turtles are only handled for the amount of time necessary to complete sampling, measuring, examination, and tagging. Capture and handling generally takes a matter of minutes, but sometimes up to one or two hours.

For the Alternatives 1 and 2, capturing sea turtles would have short-term temporary direct minor adverse impacts to any sea turtle that is captured. These impacts would be in the form of non-lethal stress to the wild animal (Eckert et al.1999). The risk of adverse impacts are mitigated by completing the procedures as quickly as possible, then the turtle is released on-site. The long-term minor beneficial indirect impact of capturing sea turtles would be the increased understanding of the sea turtle populations of the PIR though additional data collection.

4.1.2.4. **Effects of capturing and bio-sampling hatchlings**

Collecting data and biological samples from hatchling turtles can provide important information about population structure, genetic relatedness, sex ratio, and embryonic development. Handling of hatchling turtles requires care, as they are smaller and more delicate than immature or adult turtles. Hatchlings are collected during emergence from the nest and are kept in cool storage containers with damp sand. Standard morphometric data, tissue samples, and blood samples may be collected, depending on the needs for a particular study. All data and sample collection techniques are performed by trained individuals and follow peer-reviewed procedures. Biological samples are only collected from live hatchlings that appear healthy and lively and have occurred without serious injury or death on over 1,000+ live hatchlings.

For Alternatives 1 and 2, it is anticipated that collecting biological samples from hatchlings would have short-term temporary direct minor adverse impacts to the handled turtles. These impacts would be in the form of non-lethal stress (Eckert et al.1999). The indirect adverse impacts would be negligible because the sea turtles are captured, handled, sampled, and then released on-site in a short period of time (see references by Balazs and colleagues in the references section). The long-term minor beneficial indirect impact of capturing sea turtles would be the increased understanding of the sea turtle populations of the PIR though additional data collection.

4.1.2.5. **Effects of procedures such as tissue sampling, tagging, and transmitter attachment**

For a complete understanding of sea turtle population dynamics and life history, it is necessary to identify individuals and obtain biological samples for genetics, diet, disease, and habitat use. Tagging and biological sampling includes:

- Turtles are flipper tagged with metal inconel tags and/or PIT tags using standard techniques (Balazs 1999).
- Blood samples are collected using a medical grade needle and syringe (Bolten 1999, Owens 1999).
- Diet samples are obtained by esophageal lavage (Forbes and Limpus 1993, Forbes 1999, NMFS Southeast Fisheries Science Center (SEFSC, 2008).
- Tissue biopsies are taken using a biopsy punch or scalpel/razor blade (Dutton and Balazs 1996)
- Satellite telemetry tags are attached following up-to-date standard protocols (e.g.,(Hart et al. 2015):
- Ultrasound and laparoscopy are conducted following standard techniques SFSC 2008; Pease et al. 2010; Blanvillain et al. 2011).

All methods used are performed by trained personnel and have been peer-reviewed and used by sea turtle researchers worldwide (Eckert et al.1999). The MTBAP does not perform unnecessary sampling on sick or injured animals unless the animal is sufficiently healthy for tagging or collection of bio-samples. No mortality is expected from tagging or bio-sampling. Tagging, blood sampling, biopsies, ultrasound, and laparoscopy are expected to have negligible long-term adverse impacts to the turtle. Esophageal lavage, when implemented as proposed, will have no long-term adverse impacts to the turtle. The lavage technique to obtain diet items has been performed on 200+ individual turtles without any known detrimental effect (NMFS unpublished data 2022). For one specific study, additional diet samples were collected from 10 turtles (out of the 181 total in the study) without incident (Arthur and Balazs 2008). Sea turtle anatomy prevents researchers from inadvertently introducing fluid into the lungs and the lavage procedure is kept short to allow for typical sea turtle respiration rate. Individuals have been recaptured from the day after the procedure up to many years later and appear to be healthy and feeding (Forbes and Limpus 1993).

Certain transmitters, if improperly attached, because of their size, position, and weight, may increase drag and may substantially interfere with normal migration patterns, and disrupt mating (Jones et al. 2011). The attachment of satellite tags to the shell of a sea turtle may potentially interfere with mating; however, MTBAP have seen males mating with females that have been satellite tagged. Satellite tagging may cause increased drag to sea turtles that affect migration; however, since 2019, MTBAP has satellite tagged five females prior to their breeding migration and these turtles successfully migrated to nesting grounds. Post-hatching nest inventories indicated these nests contained fertilized eggs from which live hatchlings emerged (MTBAP unpublished data 2022). Additionally, reproductively active adult males and females satellite tagged at breeding grounds have successfully migrated back to their foraging grounds (NMFS unpublished data 2022). To avoid adverse indirect impacts, the MTBAP implemented the recommendations of Jones et al. (2011) including: use an array of smaller transmitters and apply attachment methods to reduce additional drag. Satellite tags remain on a turtle for a maximum of three years, but most likely for only several months.

For the Alternatives 1 and 2, it is anticipated that collecting biological samples would have short-term temporary direct minor adverse impacts to the sampled turtles. These impacts would be in the form of non-lethal stress. The indirect adverse impacts would be negligible because the sea turtles are captured, handled, sampled, and then released on-site in a short period of time. The long-term minor beneficial indirect impact of capturing sea turtles would be the increased understanding of the sea turtle populations of the PIR though additional data collection.

4.1.2.6. **Effects of stranding response and research**

Handling and transport of live stranded sea turtles is essential for diagnosis and treatment. For Alternatives 1 and 2, the majority of transported individuals would occur within the MHI, while it is anticipated that a limited number (e.g., < 10) of stranded sea turtles would be handled and transported per year at each of the other islands in the proposed area outside of the MHI. All live stranded sea turtles – other than individuals that are lightly entangled (i.e., not injured) in fishing gear and can be disentangled and released on site – are captured by trained and permit-approved team members and when logistically possible transported to a facility for diagnosis and treatment by a licensed veterinarian. Given the remote and uninhabited nature of many of our proposed study sites, such access or facilities are frequently not possible. In these instances, the highest level of treatment possible would be administered on-site, and the sea turtle would not be transported. Whenever possible, turtles are rehabilitated and ultimately released back into their natural environment.

Handling and transporting sea turtles will have a minor, short-term, temporary, direct, adverse impact on the animal's condition because they are wild animals not accustomed to being restrained by humans. Direct minor adverse impacts of transporting sea turtles, such as over-heating, are minimized through a variety of techniques, such as covering the turtle with a wet towel during transport. The long-term minor beneficial indirect impacts of handling and transporting stranded turtles would be the enhanced survival of individual sea turtles that would have succumbed to treatable injuries (e.g., entangled in fishing line), and analytical or predictive models for sea turtle stranding.

Humane euthanasia is only performed by a licensed veterinarian if they determine that an individual cannot survive or function in the wild. These animals are typically in extremely poor health and in a condition beyond treatment. Examples of such cases include animals severely afflicted with fibropapillomatosis for which there is no cure, or animals with severe physical trauma beyond repair because of fishing gear entanglement, shark attack, or boat strike. In such cases, humane euthanasia is performed and the animal is necropsied for furthering scientific understanding of marine turtle disease and basic biology. For the Alternatives 1 and 2, the impacts of humanely euthanizing sea turtles that are beyond treatments and incapable of surviving in the wild is negligible.

Table 10. Number of takes for in-water work under NMFS permit 21260 for each turtle species by activity type.

Activities include: Collect tumors; Count/survey; Tag attachment with epoxy; Laparoscopy; Gastric lavage; Mark, carapace (temporary); Flipper and PIT tag; Measure; Photograph/ Video; Sample blood; Cloacal swab; Fecal sample; Oral swab; Scute scraping; Tissue sample; Transport; Ultrasound; Weigh

Species	"Take" action	Observe/Collect Method	Anticipated # of takes	Expected # of mortalities
green	Capture/ Handle/ Release	Hand and/or Dip Net	250	0
hawksbill	Capture/ Handle/ Release	Hand and/or Dip Net	150	0

Species	"Take" action	Observe/Collect Method	Anticipated # of takes	Expected # of mortalities
olive ridley	Capture/ Handle/ Release	Hand and/or Dip Net	100	0
loggerhead	Capture/ Handle/ Release	Hand and/or Dip Net	100	0
leatherback	Capture/ Handle/ Release	Net, breakaway hoopnet	100	0

Table 11. Number of takes for terrestrial work under USFWS permit TE-72088A-3 for each turtle species by activity type.

Activity Type	green (CNP[1])	green (CSP[2])	green (CWP[3])	hawksbill	olive ridley	loggerhead	leatherback
captured, held, handled, and measured.	5000	250	300	500	10	10	10
flipper and PIT tagged and have their carapace marked.	5000	250	300	500	10	10	10
located, monitored, excavated, and salvaged.	500	100	100	300	10	10	10
data-loggers inserted.	300	100	100	300	10	10	10
biotelemetry transmitter tags and archival TDR attached.	250	20	20	50	10	10	10
tissue (blood, flipper tissue) samples collected.	5000	250	300	500	10	10	10
tumor biopsy samples collected	5000	100	100	100	10	10	10

Activity Type	green (CNP[1])	green (CSP[2])	green (CWP[3])	hawksbill	olive ridley	loggerhead	leatherback
Ultrasound and Laparoscopy	200	100	100	100	0	0	0
Oxytetracycline Injection	500	250	100	500	0	0	0
Esophageal lavage	100	50	50	50	0	0	0
Mortality	0	0	0	0	0	0	0

[1] Central North Pacific Distinct Population Segment

[2] Central South Pacific Distinct Population Segment

[3] Central West Pacific Distinct Population Segment

4.1.3. Effects to Non-Target Species

4.1.3.1. Cetaceans

Researchers conduct marine turtle research around all islands/islets within the study area and use small boats to make transits between islets within atolls. However, activities will rarely overlap with cetaceans within their habitat; cetaceans are more commonly offshore, or are only encountered during boat transits, not during research activities. Therefore, no effects are expected from MTBAP activities.

4.1.3.2. Hawaiian Monk Seal

Researchers conduct marine turtle terrestrial nesting/basking research on all islands/islets within the PMNM and use small boats to make transits between islets within atolls. Currently, field researchers may be deployed within the PMNM for up to 6 months during the summer. These research activities often occur around Hawaiian monk seals resting on the beach, and have the potential to disturb them. However, the MTBAP has conducted nesting/basking research without incident within Lalo almost every year since 1973. Standard operating procedures (see Appendices) avoid and minimize disturbance to other species that inhabit the islands and surrounding ocean, especially Hawaiian monk seals, while conducting marine turtle research. Prior to deployment, each MTBAP researcher must undergo training (provided by PIFSC's Hawaiian Monk Seal Program) in standard operating procedures for avoiding impacts to monk seals during MTBAP activities. Any sea turtle monitoring activities that would directly affect monk seals are halted until a later time when those activities would no longer impact monk seals.

Researchers conduct marine turtle terrestrial nesting/basking research on all MHI and most islands in the NWHI, conduct marine turtle in-water research within the MHI, and sometimes use small boats to conduct research within the MHI and NWHI. Mitigation includes:

- Traveling on marked trails to minimize impact to terrestrial plants
- Selection of boat operators that are highly skilled and can safely operate boats in/around coral reef and sea grass beds; and
- Selection of boat operators that are familiar with the area and where to anchor (e.g., sandy bottoms, away from coral and seagrass beds)

Through the implementation of the standardized avoidance and minimization measures, the direct adverse short-term impacts to Hawaiian monk seals from Alternatives 1 and 2 are minor and the indirect impacts are negligible. The majority of potential interactions would occur at Lalo. For Alternative 3, the MTBAP would not conduct any activities in the proposed area, hence there would be no direct or indirect adverse impacts to these resources in those areas.

In summary, research activities have the potential to disturb Hawaiian monk seals that are using the same beaches as turtles to haul out. We anticipate potential temporary disturbance or flushing of individuals or groups of hauled-out monk seals as a result of our activities. This temporary disturbance is expected to be of short duration, and have a negligible impact to individuals, the population, and the habitat. No long-term effects on disturbed seals are expected, and there is no anticipated negative impact on marine mammal habitat. Every effort is made to avoid disturbing seals, and a set of mitigating measures will be established prior to any turtle research activities. Incidental take of monk seals during turtle research activities are analyzed in the biological opinion for PIFSC's Fishery and Ecosystem Research Activities in the Western and Central Pacific Ocean, which resulted in a finding that the sea turtle research activities were not likely to adversely affect Hawaiian monk seals (NMFS 2022).

4.1.3.3. **Birds**

The actions proposed for Alternatives 1 and 2 would occur along the coast and in the ocean in the PIR where seabirds would be encountered (table with birds from Chapter 3). However, the proposed action does not involve killing, capturing, or intentionally disturbing any birds. Birds may be indirectly and temporarily adversely affected by researchers conducting sea turtle survey activities. Generally, these activities include researchers walking along a beach or conducting nest excavations in an area where birds may be roosting or nesting, or during small boat activities. These indirect adverse impacts would be limited to reactions from the bird moving from one area of the beach, or water surface, to another several meters away, which is considered negligible. Research activities would avoid bird nests to the maximum extent practicable. Mitigation includes:

- Looking for nests or for adults flushing from inconspicuous nests when approaching seabird colonies;
- Not disturbing any bird colonies with chicks 2-7 days old (before scapular feathers have erupted);

- Planning activities to avoid displacing adults from eggs or chicks for longer than 3 minutes;
- Never leaving string or line anywhere in nesting colonies;
- Planning work when the fewest birds are in the area;
- Extinguishing all ship lights except for running lights or anchor lights when operating in proximity to seabird colonies;
- Traveling on marked trails to avoid subsurface nests; and
- Digging out shearwaters or petrels if nests are stepped on (PMNM 2008).

Overall, the effects of Alternatives 1 and 2 would result in minor, adverse short-term effects because any bird flushed by such activities would either return to the site after the researcher has passed, or the bird would occupy another section of beach. For Alternative 3, the MTBAP would not conduct any activities in the U.S. Insular Areas of the PIR, hence there would be no direct or indirect adverse impacts to these resources in those areas.

4.1.3.4. **Invertebrates**

4.1.3.4.1. Yellow-faced bees

The actions proposed for Alternatives 1 and 2 would occur along the coast in the PIR where yellow-faced bees would be encountered in flowering plants on these beaches. However, the proposed action does not involve killing, capturing, or intentionally disturbing any bees. Bees may be indirectly and temporarily adversely affected by researchers conducting sea turtle survey activities. Generally, these activities include researchers walking along a beach or conducting nest excavations in an area where bees may be foraging or socializing. These indirect adverse impacts would be limited to reactions from the bee moving from one area of the beach, to another several meters away, which is considered negligible. Research activities would avoid bird nests to the maximum extent practicable.

4.1.3.4.2. Coral Reefs

Alternatives 1 and 2 may include in-water work in the vicinity of coral reefs. However, these actions are not expected to directly impact coral reefs. In the marine environment, sea turtles depend upon algae, sea grass, and coral reef habitats for food and refuge. The degradation of these habitats poses a serious threat to the recovery of sea turtle stocks. Surveys and stranding response activities will avoid corals. Additional mitigation measures to reduce impacts to coral reefs includes:

- Ensuring boat operators are highly skilled and can safely operate boats in/around coral reef and sea grass beds; and
- Selection of boat operators that are familiar with the area and where to anchor (e.g., sandy bottoms, away from coral and seagrass beds)

4.1.3.5. **ESA-Listed Plants**

Monument Permit PMNM 2022-001 (Appendix 5) allows NMFS researchers to enter the Monument to conduct research and enhancement activities, and covers field camp support and supply activities. Although the permit does not specifically identify procedures for protecting ESA-listed plants, NMFS would take all precautions necessary to avoid contact with these plants. This includes training biologists on the identification and locations of such plants and working with the USFWS to develop a training protocol to implement for work in the MHI (similar to that implemented for work in the NWHI). When accessing beaches by foot, researchers would stay on the path where no vegetation occurs. When accessing beaches by boat, they would only land on sandy beaches below the vegetation line. There are no known ESA-listed plants in the areas where research actions and associated activities will occur. Therefore, it would be highly unlikely that research biologists would encounter coastal ESA-listed plant species, or they would be easily avoidable.

4.1.4. Effects on Marine Protected Areas and Critical Habitat

There are numerous protected areas within the action area, as described in Section 3.2.3. Research activities which could impact these habitats include:

- Stranding Response and Research
- In-water Monitoring ship-/small boat-/snorkel-based- line transects, and/or aerial surveys
- Nesting and Basking Beach monitoring: Conduct basic investigations of the biology, life history, and ecology of marine turtles at nesting and basking beaches to establish and continue long term databases
- Training and Outreach: training new biologists in the field, and doing outreach on the beaches

All proposed activities are short term in nature and will not permanently alter any habitat. Therefore, no National Marine Sanctuaries, World Heritage Sites, or other marine conservation areas within the action area where research would take place would be adversely impacted by Alternatives 1 and 2. Additionally, there are no known National Register of Historic Places or archeological, cultural, religious resources located where research would take place within the action area. Responsible sea turtle research within these areas is encouraged and supported.

MTBAP research activities may occur in designated critical habitat for seven coral species and two marine mammal species (see section 3.2.3.4). When these areas are encountered, MTBAP will not adversely modify the critical habitat and any impacts are expected to be minor, short-term, and sporadic in time (NMFS 2022). Any specified regulations in these areas would be adhered to during any research activities conducted in this critical habitat. MTBAP activities generally do not occur within the Hawaiian Islands insular false killer whale critical habitat and, therefore, would not destroy or adversely modify this habitat (NMFS 2022b). MTBAP activities would not destroy or adversely modify Hawaiian monk seal critical habitat (NMFS 2017). If the seven areas are designated as coral critical habitat, MTBAP activities would not destroy or adversely modify coral critical habitat, and would consult with NMFS to fulfill this requirement (NMFS 2022). Alternatives 1 and 2 would also not affect EFH or HAPC. Lastly, Alternatives 1 and 2 are not expected to contribute to the introduction, continued existence, or spread of noxious weeds or nonnative invasive species known to occur in the area or actions that may promote the introduction, growth, or expansion of the range of the species. Mitigation includes:

- Traveling on marked trails to minimize impact to terrestrial plants
- Minimizing disturbance to sand dunes, and
- Minimizing pollution (e.g., marine debris, light, noise)

Based on this information, MTBAP expects that Alternatives 1 and 2 would not result in adverse modification in behavior and/or habitat disruption. MTBAP expects these impacts to be minor because MTBAP does not anticipate measurable changes to the population or impacts to rookeries, feeding grounds, and other areas of similar significance. MTBAP expects no long-term or substantial adverse effects on sea turtles, their habitats, or their role in the environment.

4.2. Effects of Alternative 2 – Continuation of Current Research Activities with the Addition of Nest Relocations of Non-Doomed Nests and Nest Probing (*Preferred Alternative*)

The environmental impacts of the Proposed Action include the impacts assessed for Alternative 1, including impacts from aerial surveys; terrestrial nesting/basking and in-water surveys; capturing and handling of hatchling, immature, and adult sea turtles; procedures such as sampling, tagging, and transmitter attachment; and stranding response and research; and impacts to sea turtle habitat, non-target species, and Habitats and Vulnerable Ecosystems Additional impacts from nest relocations and nest probing are described below.

4.2.1. Effects of Nest Relocations

Under this alternative, MTBAP will request to amend our USFWS permit to include the ability to translocate any nest (including those that are not doomed), should the need arise. MTBAP is currently permitted to only translocate nests that are doomed (e.g., sand erosion, water inundation, etc. that would destroy or suffocate the nest). Doomed nest relocation is a conservation action intended to increase survival of sea turtle clutches that are located where they almost certainly will die. In addition, the need for a nest relocation of any nest, not just doomed nests would only occur if deemed necessary for other management and/or conservation purposes (e.g., Lalo nesting habitat is not viable for nest incubation and nests need to be relocated to the MHI in order to maintain the CNP green turtle DPS). In all nest relocation situations, nests would be moved to safe microhabitats similar to the original nest that provides adequate moisture, temperature, and gas exchange to support the developing embryos (Miller 1997). Nests would also be placed in a similar environment as the original nest (meaning similar temperature or substrate regime, but above the high tide line in an area where they are not as likely to be inundated). Relocation of nests would take place alongside nesting beach monitoring activities and would occur where non-target species can be identified and avoided, therefore this activity would only cause minimal additional disturbance to habitat and non-target species by the potential increase in the amount of time research is conducted in an area.

Although the relocation of nests may lower hatch success rates compared to in-situ nests (Mortimer 1999), if a nest must be moved due to environmental factors, this impact is negligible compared to total (100 percent) mortality of a doomed nest (Mortimer 1999; WPFMC 2005), and would therefore be considered a positive impact on the sea turtle population. Any adverse impacts will be minimized through the stringent protocols described above, which are designed to reduce the impact to the nest and the clutch.

MTBAP current research activities are not known to affect air quality, noise, water quality, view planes, or other associated physical resources given the limited time and intensity of the activities. Additionally, Alternatives 1 and 2 do not have the potential to affect public health or safety due to the standard operating procedures (as described in Section 2.1.1.7) which ensures the safety of research and technician personnel through regular training of all personnel in the implementation of techniques and methods, both in the laboratory and in the field. Lastly, Alternatives 1 and 2 are not expected to have a disproportionately high and adverse effect on the health or the environment of minority or low-income communities, compared to the impacts on other communities.

4.2.2. Effects of Nest Probing

Confirming nest deposition is important to accurately quantify sea turtle nesting across the PIR as this data is central to population assessments and modeling. Similarly, confirming the exact location of nests is necessary to conduct post-hatching nest excavations, which also provide data (such as hatching success) that are central to population modeling activities.

Often, researchers attempt to confirm and locate marine turtle nests via digging by hand, which can be extremely time consuming and is often unsuccessful. A probe stick can be used as a tool to more efficiently locate a nest cavity, decreasing the time and labor needed to do so; however, there is an increased risk of puncturing the eggs with the probe. Along the U.S. east coast, Brig (2014) found a strong correlation between loggerhead turtle nests that had been probed and presence of broken eggs throughout the clutch, and the lack of eggs broken in nests that had been located by hand digging. While an increase in broken eggs was found in probed nests, the use of the probe as a tool to locate the nest cavity (and subsequently relocated) did not significantly impact the hatching success of the nests compared to those located by hand digging (Brig 2014). The author concluded that using the probe as a tool to locate loggerhead clutches is more time efficient and less labor intensive than the alternative method of hand digging and that although a significantly higher number of eggs were found broken in nests located with the probe, hatching success did not significantly vary based on nest location method, suggesting that the probe is an appropriate tool to aid in the location of nest cavities and its use is not detrimental to overall loggerhead hatchling success (Brig 2014). Sea turtle survival from egg stage to the reproductive adult stage is extremely low (e.g. 1 in 1,000 to 1 in 10,000); therefore, the impact to any of the populations would be negligible.

The holes that pierce the egg chamber from the use of the probe may also indirectly affect sea turtle survival due to incidentally creating a pathway for predators or an opportunity for bacterial or fungal invasion. However, we do not expect the potential for this impact to be any more likely than what may naturally occur. Because of the small diameter of the probe (e.g. 1-2 cm), sand immediately fills in the holes as the probe is extracted. In addition, researchers will take care to cover holes on the surface of the sand once the presence of a nest has been determined with the probe.

4.3. Effects of Alternative 3 – No Action Alternative

Under the No Action Alternative, no sea turtle research or recovery activity would be conducted within the PIR by MBTAP. The no action alternative would result in a short-term reduction in minor adverse impacts to the environment (i.e., turtles and similarly affected species) because researchers would not be actively working in the field handling turtles and collecting data. The long-term impact of this alternative would be a lack of data necessary to analyze population trends and make management decisions to recover these species (i.e., remove them from the list of threatened and endangered species). This would have moderate direct and indirect adverse ramifications on the cultural identity and practices of native peoples, tourism, the fishing industry, and ecological services (e.g., food-web maintenance) in the PIR by, for example, potentially reducing sea turtle abundance from lack of stranding response and conservation efforts, and ecosystem viability changes from reduction of sea turtle grazing.

Under Alternative 3, it is anticipated that governmental agencies and non-governmental agencies (NGOs) would take over some of MTBAP’s sea turtle research and data collection activities, but the extent to which these agencies could fill the role of the MTBAP is difficult to predict due to the time and costs associated with funding these activities. Therefore, the impacts to elements of the human environment resulting from the No Action alternative would be greater than those impacts resulting from Alternatives 1 and 2.

4.4. Cumulative Effects

CEQ defines cumulative effects as “effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions” (40 CFR §1508.1. Cumulative impacts can result from individually minor but collectively significant actions that take place over a period of time.

This cumulative effects analysis focuses on activities that may temporally or geographically overlap with MTBAP’s research activities and would most likely impact the sea turtles present in the proposed areas. Other activities that may occur in the area include marine mammal research and response activities, fisheries research, research and conservation actions of other protected species (e.g. plants, animals) along the shoreline, marine debris removal activities, military training and testing activities, commercial fishing activities, shoreline construction activities, and human recreation in water and on shore.

Though difficult to accurately quantify, the incremental impact of the effects of the MTBAP activities when added to other past, present, and reasonably foreseeable future actions is likely to be positive in nature. The proposed project would add more, albeit short-term and sporadic, mandated research activities in the PIR, including in-water activities such as capturing turtles for health assessments, and on-land activities such as surveys and tagging activities that allow us to monitor the health and success of individuals within the population. While MTBAP's activities will increase human presence in the areas of sea turtle nesting and basking activities, where other activities may also occur (e.g. other endangered species monitoring, marine debris removal), the activities are directly related to the conservation and recovery of sea turtle species in the PIR, and as such are considered to have a positive impact on the population. As detailed previously, the direct and indirect environmental consequences of the proposed research programs are expected to be minimal, as research design, methodologies, and standard operating procedures for working with endangered species in sensitive habitats are specifically formulated to minimize any negative impacts on the environment and sea turtles in particular.

With respect to field research techniques as discussed in Chapter 2, research designs, research approaches, and standard operating research procedures are crafted to minimize the impact on the environment and sea turtles in particular. Section 4.1.2 provides details on potential environmental impacts that could result from implementation of the research on sea turtles and the surrounding terrestrial and marine environment. These risks include adverse impacts to sea turtles from invasive research procedures and potential for injury or mortality during research activities. However, MTBAP's research activities to understand sea turtle ecology and the impacts to sea turtles from sources of risk will result in a net benefit for the species in that they: a) support current sea turtle monitoring programs throughout the world; b) increase our knowledge of sea turtle ecology and how to apply this information to management and conservation efforts, c) establish positive partnerships with national and foreign governmental agencies and non-governmental organizations to encourage a sense of environmental stewardship; and d) are highly likely to inform strategies to help reduce sea turtle interactions and incidental mortalities.

In summary, the proposed research programs support ESA mandates for the conservation and recovery of sea turtles. The role of the proposed research does not include making management decisions that may affect population recovery. Rather, the research and monitoring activities obtain scientific information in support of achieving the biological recovery and sound management of sea turtle populations worldwide.

4.4.1. Climate Change

Climate change is a long-term, sustained trend of change in the climate. Human-emitted greenhouse gases have resulted in long-term warming of the planet, with much of the excess heat (>90%) stored within the world's oceans. The past five years (i.e., 2015–2019) are the warmest in the ocean since the mid-1950s, according to measurements using modern instruments (e.g., measuring ocean heat content), and the past ten years are also the warmest years on record (Cheng *et al.* 2020). The effects of warming waters have impacted marine ecosystems and are likely to continue in the future. These impacts include changes in circulation, ocean stratification, upwelling, acidification, nutrient input, oxygen content, primary production, species distribution, phenology, food webs, sea-level rise, extreme weather events, and ecosystem functions (NOAA 2013).

Climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the community structure and function of marine, coastal, and terrestrial ecosystems in the near future (IPCC 2007; IPCC 2013; McCarty 2001). Direct effects of climate change include increases in atmospheric temperatures, decreases in sea ice, and changes in sea surface temperatures, ocean acidity, patterns of precipitation, and sea level rise. Indirect effects of climate change include altered reproductive seasons/locations, shifts in migration patterns, reduced distribution and abundance of prey, and changes in the abundance of competitors and/or predators. There is a high degree of variability in the vulnerability and response of marine organisms to the impacts of climate change, but climate change will most likely have the most pronounced effects on vulnerable species whose populations are already in tenuous positions (Williams et al. 2008). Species with more plastic life histories and/or higher physiological tolerance for changes in environmental conditions will likely experience fewer impacts related to climate change (NOAA 2013). Increasing atmospheric temperatures have already contributed to changes in the quality of freshwater, coastal, and marine ecosystems and to the decline of endangered and threatened species populations (Karl 2009; Mantua et al. 1997).

Although the effects of climate change on sea turtles have not been fully analyzed, either globally or specific to PIR, it is generally understood that a changing climate may significantly influence marine turtle populations. Sea turtles occupy a wide range of terrestrial and marine habitats, and many aspects of their life history have been demonstrated to be closely tied to climatic variables such as ambient temperature and storminess (Hawkes et al. 2009). Sea turtles have temperature-dependent sex determination, and many populations produce highly female-biased offspring sex ratios, a skew likely to increase further with global warming (Patrício et al. 2017). In addition to altering sex ratios, increased temperatures in sea turtle nests can result in reduced incubation times (producing smaller hatchling), reduced clutch size, and reduced nesting success due to exceeded thermal tolerances (Azanza-Ricardo et al. 2017; Fuentes et al. 2010; Fuentes et al. 2011; Fuentes et al. 2009).

Other climatic aspects, such as extreme weather events, precipitation, ocean acidification and sea level rise also have potential to affect marine turtle populations. Changes in global climatic patterns will likely have profound effects on the coastlines of every continent, thus directly impacting sea turtle nesting habitat (Wilkinson and Souter 2008). In some areas, increases in sea level alone may be sufficient to inundate turtle nests and reduce hatching success by creating hypoxic conditions within inundated eggs (Caut et al. 2009; Pike et al. 2015). Flatter beaches, preferred by smaller sea turtle species, would likely be inundated sooner than would steeper beaches preferred by larger species (Hawkes et al. 2014). Relatively small increases in sea level can result in the loss of a large proportion of nesting beaches in some locations. Baker et al. (2006) predicted that up to 40 percent of green turtle nesting beaches in the NWHI could be flooded with 0.9 m of sea level rise by the year 2100 (Baker et al. 2006). However, habitat loss at Lalo has already occurred far more rapidly than predicted, highlighting the challenges turtles face in this declining habitat, especially when in competition with other animals (e.g., Hawaiian monk seals, seabirds) for beach space (Baker et al., 2020). The loss of nesting beaches would have catastrophic effects on sea turtle populations globally if they are unable to colonize new beaches that form, or if the newly formed beaches do not provide the habitat attributes (sand depth, temperature regimes, refuge) necessary for egg survival.

Changing patterns of coastal erosion and sand accretion, combined with an anticipated increase in the number and severity of extreme weather events, may further exacerbate the effects of sea level rise on turtle nesting beaches (Wilkinson and Souter 2008). Extreme weather events may directly harm sea turtles, causing “mass” strandings and mortality (Poloczanska et al. 2009). Studies examining the spatio-temporal coincidence of marine turtle nesting with hurricanes, cyclones, and storms suggest that cyclical loss of nesting beaches, decreased hatching success, and hatchling emergence success could occur with greater frequency in the future due to global climate change (Hawkes et al. 2009).

While changes in climate or sea level may affect sea turtles, sea turtle research projects are not expected to exacerbate climate change, in fact, in many cases conservation efforts supported by the MTBAP are designed to reduce or mitigate locally-based impacts that may be associated with or related to changing environmental conditions.

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- L.M. Ehrhart and L.H. Ogren. Studies in Foraging Habitats: Capturing and Handling Turtles
- G.H. Balazs. Factors to Consider in the Tagging of Sea Turtles
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