UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
PROGRAM PLANNING AND INTEGRATION
Silver Spring, Maryland 20910

OCT 19 2010

To All Interested Government Agencies and Public Groups:

Under the National Environmental Policy Act, an environmental review has been performed on the following action:

TITLE: Programmatic Environmental Assessment for the Marine Turtle Genetics Program and Marine Turtle Ecology & Assessment Program at the Southwest Fisheries Science Center

LOCATION: Various

SUMMARY:

The purpose of the Programmatic Environmental Assessment (PEA) is for the National Marine Fisheries Service (NMFS) to consider the potential environmental impacts of routine marine turtle research activities conducted by the Marine Turtle Genetics Program and the Marine Turtle Ecology & Assessment Program at the Southwest Fisheries Science Center (SWFSC). The research programs and activities analyzed in the PEA represent the major sea turtle-related research components of the SWFSC. General program research activities outlined and analyzed for environmental impacts include:

- computer analysis and marine turtle population modeling;
- training and outreach programs;
- genetic and stable isotope analysis to define stock boundaries and population structures, and characterization of the trophic ecology of foraging marine turtles;
- support nesting beach monitoring efforts for marine turtle species;
- identification of critical marine turtle habitat use and migratory corridors using various research techniques such as satellite telemetry and aerial surveys to determine distribution and abundance.

In this PEA, NMFS evaluated two alternatives: the no action alternative, i.e., baseline sea turtle and sea turtle related research activities of the SWFSC that do not directly involve human interaction with turtles, and the preferred alternative, which is for the SWFSC to conduct scientific research activities and data gathering through the Marine Turtle Genetics Program and the Marine Turtle Ecology & Assessment Program in order to improve sea turtle conservation and management strategies pursuant to the U.S. Recovery Plans for sea turtles through the specifically outlined methods.

The PEA analysis presents information indicating that no adverse impacts to the human environment or other resources are expected to result from the research programs as outlined. 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. The proposed research activities are likely to have net cumulative effects that are positive in that they: a) support current sea turtle monitoring programs in various parts of the world; b) establish community outreach programs and positive partnerships with foreign governmental agencies and non-governmental organizations to encourage a sense of environmental stewardship; and c) are highly likely to develop into usable strategies to help reduce sea turtle interactions and incidental mortalities.

RESPONSIBLE
OFFICIAL: Usha Varanasi
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The environmental review process led us to conclude that this action will not have a significant impact on the environment. Therefore, an environmental impact statement was not prepared. A copy of the finding of no significant impact (FONSI), including the environmental assessment, is enclosed for your information.

Although NOAA is not soliciting comments on this completed EA/FONSI, we will consider any comments submitted that would assist us in preparing future NEPA documents. Please submit any written comments to the Responsible Official named above.

Sincerely,

for Paul N. Doremus, Ph.D.
NOAA NEPA Coordinator

Enclosure

Final
Programmatic Environmental Assessment

for the

Marine Turtle Genetics Program and Marine Turtle Ecology & Assessment Program at the Southwest Fisheries Science Center

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Lead Agency:	National Oceanic and Atmospheric Administration National Marine Fisheries Service Southwest Fisheries Science Center
Responsible Official:	Usha Varanasi Acting Director, Southwest Fisheries Science Center
Contact for Further Information:	Jeffrey Seminoff, Ph.D. NOAA - National Marine Fisheries Service Southwest Fisheries Science Center 3333 N. Torrey Pines Ct. La Jolla, California 92037 (858) 546-7152

September 2010

Programmatic Environmental Assessment
Marine Turtle Genetics Program and Marine Turtle Ecology & Assessment Program at the SWFSC

TABLE OF CONTENTS

List of Acronyms	
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CITES	Convention on International Trade in Endangered Species
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
GPS	Global Positioning System
IACUC	Institutional Animal Care and Use Committee
IUCN	International Union for Conservation of Nature and Natural Resources
LORAN	Long Range Navigation
MMPA	Marine Mammal Protection Act
MPA	Marine Protected Area
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NMSA	National Marine Sanctuary Act
NMSP	National Marine Sanctuary Program
NOAA	National Oceanic and Atmospheric Administration
PEA	Programmatic Environmental Assessment
PIFSC	Pacific Islands Fisheries Science Center
RPM	Responsible Program Manager
SWFSC	Southwest Fisheries Science Center
TDR	Time Depth Recorder
USFWS	U.S. Fish and Wildlife Service
VHF	Very High Frequency
WPRFMC	Western Pacific Regional Fishery Management Council

1 Purpose and Need for Proposed Action

1.1 Proposed Action

The Proposed Action is for the National Marine Fisheries (NMFS) Southwest Fisheries Science Center (SWFSC) to conduct scientific research activities and data gathering through the Marine Turtle Genetics Program and the Marine Turtle Ecology & Assessment Program in order to improve sea turtle conservation and management strategies pursuant to the U.S. Recovery Plans for sea turtles through the following general methods:

- computer analysis and marine turtle population modeling;
- training and outreach programs;
- genetic and stable isotope analysis to define stock boundaries and population structures, and characterization of the trophic ecology of foraging marine turtles;
- support nesting beach monitoring efforts for marine turtle species;
- identification of critical marine turtle habitat use and migratory corridors using various research techniques such as satellite telemetry and aerial surveys to determine distribution and abundance.

1.2 Purpose and Need for Proposed Action

The purpose and need of the proposed action is to provide the marine turtle research community with research data that will assist in addressing the priority actions identified in the U.S. Pacific Sea Turtle Recovery Plans aimed at long term sea turtle conservation and management (NMFS and USFWS 1998a-e).

The National Oceanic and Atmospheric Administration (NOAA) and the U.S. Fish and Wildlife Service (USFWS) share responsibility for the conservation and recovery of sea turtles pursuant to U.S. Endangered Species Act (ESA) mandates. Pursuant to a Memorandum of Understanding dated July 18, 1977, NOAA has sole jurisdiction over sea turtles when they are in the marine environment and the USFWS has sole jurisdiction when they are on land. The SWFSC plays a key role in supporting this shared responsibility by undertaking research activities and obtaining scientific information for the purpose of achieving the biological recovery and sustained management of sea turtle populations in the Pacific Ocean and worldwide, and making these data, analyses, and experiences available to other sea turtle research programs in support of sound long term management practices involving international sea turtle populations.

A major goal of NOAA's SWFSC is to implement research programs that lead to a better understanding of marine turtle population structure, habitat use, abundance and distribution, and marine turtle migratory behavior in order to mitigate bycatch mortality and other factors such as loss of nesting habitat that might contribute to declines in these populations. Due to the endangered or threatened status of all marine turtle species, there is a specific need for the Marine Turtle Genetics Program and the Marine Turtle Ecology & Assessment Program to conduct research activities in order to effectively monitor and protect these species both within U.S. waters and internationally.

The Final Recovery Plans for the U.S. Pacific populations of the loggerhead, leatherback, olive ridley, hawksbill, and green sea turtles all state that necessary recovery actions for these species include: elimination of direct harvest of turtles and eggs; reduction of incidental harvest by commercial and artisan fisheries; determination of population size and status based on regular censuses; collection of biological information on nesting turtle populations; determination of distribution, abundance, and status in the marine environment; identification of stock home ranges using DNA analysis; support conservation and biologically viable management of green turtle populations in countries that share U.S. turtle stocks; and identify and protect primary nesting and foraging areas for turtle species (NMFS and USFWS 1998a-e). To this end, the marine turtle research programs at the SWFSC will directly address the goals of NOAA and other agencies aimed at sea turtle recovery and conservation. The marine turtle research programs at the SWFSC do not currently participate in any activities that directly support the elimination of direct harvest of turtles and their eggs, and as such, further inclusion of that specific recovery action in this PEA is not carried forward.

The research programs and activities analyzed in this PEA represent the major sea turtle-related research components of the SWFSC. Similar research programs involving sea turtles have been previously analyzed in the Environmental Assessment for the Western Pacific Regional Fishery Management Council's (WPRFMC) Sea Turtle Conservation Program for protecting loggerhead and leatherback nesting sites, the Programmatic Environmental Assessment of the Pacific Islands Fisheries Science Center (PIFSC) Marine Turtle Research Program, the Environmental Assessment for the Sea Turtle Bycatch Reduction Research Activities at the Pacific Islands Fisheries Science Center, and the Programmatic Environmental Assessment for Research to Support Reduction of Sea Turtle Bycatch in Domestic and International Fisheries (WPRFMC 2005, NMFS and NOAA 2006, NMFS and NOAA 2007, NMFS and NOAA 2009).

1.3 Scope of this Programmatic Environmental Assessment

This PEA provides a detailed framework for conducting research activities through the Marine Turtle Genetics Program and the Marine Turtle Ecology & Assessment Program at the SWFSC, including analysis of potential environmental impacts associated with implementation of the research program initiatives.

As long as individual research projects are conducted as described in section 2 in Alternative 2 (the proposed action, which includes the past, present, and reasonably foreseeable future program components), and the actual impacts associated with implementation remain within the range of impacts identified in section 4, this document will remain current. 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 will need additional appropriate NEPA analysis.

Permits under Section 10 (a)(1)(A) of the ESA to 'take' ESA-listed species for scientific purposes or to enhance the propagation or survival of the affected species have already been approved to conduct applicable components of the research programs outlined in this document. For research activities that take place outside of U.S. jurisdiction, the appropriate in-country permits and authorizations have been obtained and approved. Further, all research actions and sampling conducted in support of international sea turtle research programs are the same as those being implemented in the U.S., and as such the impacts analyzed in this PEA are applicable.

This PEA is not intended to and does not address the potential environmental or economic effects of widespread adoption of modified fishing gear or other operational strategies for reducing turtle bycatch, nor does it address the affected environments and environmental consequences of various fishing operations and fisheries as a whole.

2 Alternatives

2.1 Alternative 1: No Action Alternative

The No Action Alternative is for the SWFSC to not conduct specific research activities through the Marine Turtle Genetics Program and Marine Turtle Ecology & Assessment Program as proposed and outlined in this PEA. Other baseline sea turtle and sea turtle related research activities of the SWFSC that do not directly involve human interaction with turtles would continue as usual including but not limited to non-invasive basic investigations of the biology, life history, and ecology of sea turtles and their benthic habitats and nesting beaches, population monitoring at nesting beaches, sea turtle stranding and salvage work, sea turtle health assessments, aerial and vessel surveys, photo identification, behavioral observation, educational outreach, and theoretical population modeling. Actions already permitted or that could be permitted would continue (see Table 4).

2.2 Alternative 2: Proposed Action

The Proposed Action (Preferred Alternative) is for the SWFSC to conduct scientific research activities and data gathering through the Marine Turtle Genetics Program and the Marine Turtle Ecology & Assessment Program in order to improve sea turtle conservation and management strategies pursuant to the U.S. Recovery Plans for sea turtles through the following general methods:

- computer analysis and marine turtle population modeling;
- training and outreach programs;
- genetic and stable isotope analysis to define stock boundaries and population structures, and characterization of the trophic ecology of foraging marine turtles;
- support nesting beach monitoring efforts for marine turtle species;
- identification of critical marine turtle habitat use and migratory corridors using various research techniques such as satellite telemetry and aerial surveys to determine distribution and abundance.

Marine turtle research activities at the SWFSC have been producing continuous, quality data for 15 years, studying hawksbill, green, leatherback, loggerhead and olive ridley turtles. None of the current or proposed research activities within these programs are expected to generate public controversy. Researchers would be using common and professionally accepted research techniques and protocols that are specifically designed to mitigate any adverse effects to individual turtles, as described in section 2.2.2. In addition, all domestic activities are covered by and subjected to strict permit rules and regulations which govern the taking and handling of protected species, as described in section 4.5. Research performed in international jurisdictions as outlined in section 2.2.3 will operate under the same protocols and methods required by the U.S. permits.

2.2.1 *Description of Marine Turtle Programs*

The primary components of the Marine Turtle Genetics Program and the Marine Turtle Ecology & Assessment Program are described in the following sections.

<u>Computer Analysis</u>

1. Development and application of simulation modeling of sea turtle population dynamics for the assessment of the status of various stocks of sea turtles.
2. Evaluation of cost-effective conservation alternative strategies for various sea turtle species.
3. Characterization of regions of marine debris accumulation as they relate to marine turtles in the Pacific.
4. Publication of research findings in a timely manner in peer-reviewed journals to increase the knowledge base of sea turtle biology and population dynamics worldwide.

<u>Training and Outreach</u>

1. Conduct dock-side and on-board observer training courses to teach proper sea turtle research protocols including de-hooking and resuscitation for sea turtles captured incidentally by artisanal and industrial fisheries.
2. Train international research and observer personnel in sea turtle research techniques and continue to share data, analyses, experience and information to increase international research capacity.
3. Conduct educational outreach to the public focused on sea turtle research projects to encourage support for such activities.
4. Support 'Conservation Radio' in areas of South America, which provides real-time information on areas of high turtle interaction likelihood.

<u>Genetic and Stable Isotope Analysis</u>

1. Conduct stable carbon, nitrogen, and/or sulfur isotope analysis on sea turtle blood and skin tissue to characterize the foraging ecology and trophic niche width of all species of marine turtles from a variety of geographic regions in the Pacific Ocean.
2. Use genetic analysis to determine stock structure, stock boundaries, population structure, and demographic connectivity of marine turtles from a variety of geographic regions.
3. Sampling and genetic fingerprinting of leatherback hatchlings for measuring life history parameters.
4. Development and implementation of genetic tools to assign stock origin of sea turtle bycatch in U.S.-based and foreign fisheries.

<u>Nesting Beach Monitoring</u>

1. Determination of density dependent impacts on hatchling success.
2. Determination of hatchling survivorship, nesting beach monitoring, and conservation activities for nesting leatherbacks, hawksbills, olive ridleys, and green turtles.

3. Support of efforts to determine hawksbill marine turtle nesting abundance as well as nesting beach monitoring.
4. To conduct basic investigations of the biology, life history, and ecology of marine turtles nesting beaches to establish and continue long term databases.

In-water Monitoring

1. Identification of critical marine turtle habitat use, migratory corridors, and population abundance of all marine turtle species in the Pacific Ocean using turtle-borne telemetry packages (satellite telemetry, ultrasonic telemetry, time-depth recorders, underwater cameras), ship-based line transects, and 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.
4. Opportunistic sampling of turtles entrained in coastal power plants or stranded live in the marine environment.
5. Investigate the relationship between jellyfish abundance, caloric content, and movements and energy budgets of leatherback turtles off the coast of California.

2.2.2 Standard Operating Procedures and Research Techniques

The Marine Turtle Genetics Program and Marine Turtle Ecology & Assessment Program both emphasize the safety of research personnel in all program sponsored activities, and conduct continuous safety training for all personnel in the implementation of techniques and protocols in the laboratory and the field. Research techniques employed are consistent with accepted standards within the marine turtle research community described in the Marine Turtle Specialist Group Manual on Research Techniques (Eckert et al. 1999). In addition, researchers are required to comply with all terms and conditions outlined in permits obtained in support of research activities.

Each research technique, as outlined in the following sections, may be used alone or in combination to meet specific research program objectives. All protocols are specifically designed to minimize the impacts of the research techniques and methods on turtles and the surrounding environment. Table 1 provides an overview of the turtle species expected to be studied using the various research techniques.

Aerial Surveys

The use of non-invasive aerial survey methodology has been established as an additional, effective means of identifying sea turtle nesting and foraging patterns (Benson et al. 2007a, Benson et al. 2007b). In recent decades in the Pacific, numbers of nesting female leatherback turtles have dropped 95% and numbers of nesting female loggerhead turtles have dropped by about 80% on their primary nesting beaches (Spotila et al. 1996, 2000, Kamezaki et al. 2003, Limpus and Limpus 2003). Although local communities in areas where sea turtle nesting beaches are common have recognized a population decline, conservation and protection of these turtles is difficult due to a lack of broad-scale knowledge of nesting beaches and leatherback movements following nesting. In particular, estimating the total nesting population size at a given area along with indentifying relevant offshore internesting habitats and migratory routes are critical for effective conservation efforts.

Aerial surveys over foraging areas are restricted to good weather days, defined as days with clear to partly cloudy skies and winds of less than 12 knots (kt), and Beaufort sea states of 0 to 3. Surveys are flown at approximately 167-185 kilometers/hour (90-100 kt) airspeed and 213 meters (m) (700 feet) altitude, unless otherwise specified in permit rules and regulations. Sighting information and environmental conditions, including Beaufort sea state, percentage cloud cover, and horizontal sun position (to measure glare direction) are recorded and updated throughout the survey using a laptop computer connected to the aircraft's Global Positioning Satellite (GPS) navigation system (Benson et al. 2007b). To minimize disturbance to listed species, surveys are flown at an altitude of 153 meters (500 feet) or greater if regulations require higher altitudes. Aerial flights are not conducted over marine mammal haul out areas.

Aerial surveys over nesting beaches are conducted using methods developed by Sarti et al. (1998) at an altitude of approximately 46 to 61 m (150 to 200 feet), at 167 to 185 km/hr (90 to 100 knots) air speed in a high wing twin-engine aircraft. The aircraft flies over water parallel to the coast at a distance that allows good visibility of the beach. During each flight, three observers search for evidence of nests (e.g. track lines and sand disturbance) through flat lateral windows. Two observers record nests using a handheld counter and cue the third observer, who records positions for all nests with a handheld GPS receiver (Benson et al. 2007a). Following the flights, observer counts are averaged. Flights are conducted during morning or late afternoon hours when the sun angle is low to maximize visibility of nests and tracks.

<u>Capture</u>

Turtle capture involves handling of individual turtles in the following ways: capture using gear in the water such as an entanglement or hoop net, capture on the beach including handling of adults and hatchlings, capture of dead or live stranded animals, or incidental bycatch capture in commercial fisheries.

Turtles may be captured using specialized sea turtle entanglement nets (100 m x 6 m, 30 cm mesh knot-to-knot), with a large enough mesh size to diminish bycatch of other species. Highly visible buoys are attached to the float line of each net and spaced at intervals of 10 yards or less. Nets are checked at intervals of approximately 30 minutes, and more frequently when turtles or other organisms are observed in or around the net. The float lines of all nets are observed at all times for movements that indicate an animal has encountered the net, at which time the net is immediately checked. 'Net checking' is defined as a complete and thorough visual check of the net either by snorkeling along the net in clear water or by pulling the net up such that the full depth of the net is viewed along its entire length. Researchers plan for unexpected circumstances and demands of the research activities, and have the ability and resources to meet the net checking conditions at all times (e.g., if one animal is entangled and requires extra time and effort to remove the net, researchers would have sufficient staff and resources to continue checking the rest of the net at the same time). Researchers routinely employ a minimum of two watercrafts during netting operations to ensure that nets can be checked within the required time period. When a turtle is caught it is promptly brought on board the research vessel and disentangled.

If transportation is required, captured turtles are covered with a shade tarp for sun protection if necessary. Front flippers are immobilized so as to prevent injury to the turtle and researchers within the vessel. If transfer to shore is required, turtles are placed in a specialized restraint harness prior to being unloaded onto the shore to prevent injury. The entire process from the time the turtle is brought on board the boat until its release generally takes a maximum of 2.5 hours. During all domestic research efforts, a veterinarian will be on call to assist if needed.

Nets are not put in the water when marine mammals are observed within the vicinity of the research, and marine mammals are allowed to either leave or pass through the area safely before net setting is initiated. If any marine mammals enter the research area after the nets have been set, nets are immediately removed.

Large diameter breakaway hoop nets have been used successfully to catch and attach satellite transmitters and other instruments on sea turtles without harm to the animal (Asper 1975, James et al. 2006). The breakaway hoop nets are custom made so that the hoop is wide enough to fit easily over a leatherback or other sea turtles species with front flippers loosely held at their side. Crew members are positioned on the bow ready to guide the hoop net over the turtle using a long guiding pole. The net, constructed of four-inch diameter knotless mesh, is designed to contain the front flippers, which permits greater control of the captured animal by reducing movement of the front flippers through the mesh and reduces potential for abrasion. Upon capture, the net is adjusted by hand to provide ‘slack’ and ensure the turtle is able to breathe several times alongside the boat prior to bringing aboard the vessel. Only researchers with experience in hoop net captures are permitted to use this technique.

External Inspection

After capture, turtles may undergo external inspection and morphometric data collection including: measurement for size and growth rate; weight; brief external and oral examination for overall health status determination; inspection for presence of biota on skin or carapace; inspection for existence of and information from prior tags; and determination of any external injuries or evidence of attempted predation, fishing line entanglement, or boat strikes; and photographs of the carapace, plastron, head and any visible injuries are taken.

Turtles are measured using a soft measuring tape to collect curved carapace, plastron, and tail lengths, and calipers are used to measure straight carapace lengths and body depth. Turtles are weighed using a specially designed tri-pod for lifting the animals and a digital scale is used to record weight. Animals are restrained in a harness designed specifically for lifting turtles during the weighing process, which can be accomplished within five minutes.

Tissue Collection

Tissue sampling (e.g., blood, skin, scute, muscle) is a widely used technique in both ecological and physiological studies of sea turtles in the laboratory and in their natural environment. Samples are tested for DNA identification, stable isotope composition, and heavy metal /organic contaminant concentrations. Technological limitations to the use of tags or other individual tracking devices have increased the use of intrinsic markers such as genetic analyses and the measurement of naturally occurring stable isotopes in animal tissues in order to trace the nutritional and paternal origins and migration patterns of sea turtles. For example, genetic analysis of loggerheads near Baja California showed that 95% originated at nesting beaches in Japan, and 5% were from nesting colonies in Australia (Bowen et al. 1995). Similarly, genetic analysis has shown that olive ridleys from western and eastern Pacific nesting regions forage in the central north Pacific (Dutton et al. 1999). Stable isotope analysis relies on the fact that foodweb isotopic signatures are reflected in the tissues of organisms, and that such signatures can vary spatially based on a variety of biogeochemical processes. Organisms moving between isotopically distinct foodwebs can carry with them information on the location of previous feedings. Stable isotopes of nitrogen and carbon have been used in recent years to study migration, feeding ecology, and trophic structure in marine and terrestrial ecosystems (Hobson and Welch 1992, Hobson 1999, Post 2002, Cerling et al. 2006). Levels of nitrogen are used to determine trophic position, and in marine environments, carbon isotopes can distinguish between oceanic and near shore habitat use. The stable carbon and nitrogen isotope signatures of blood and skin samples and potential prey species can be analyzed to determine the trophic status of each turtle and to potentially identify turtles recently arriving to certain geographical areas (Seminoff et al. 2006a). Understanding linkages between areas used by animals throughout their life history is critical to their effective conservation, as efforts can be directed more appropriately at breeding, foraging, and stopover sites.

Blood samples are drawn immediately after capture using standard techniques employed routinely by NOAA Fisheries staff and other researchers in the field. While in the care of researchers, the turtle is kept out of direct sunlight and kept moist with seawater soaked towels. A blood sample of approximately 10 – 30 milliliters is generally taken from each turtle. The sampling location is thoroughly cleaned with betadine prior to and after each sample is taken. Once clean, a sterile needle attached to a vacuum syringe is inserted into the dorsal cervical sinus on the dorsolateral region of the neck, using the technique described in Bentley and Dunbar-Cooper (1980) and Owens and Ruiz (1980).

Tissue, skin, and scute samples are obtained with a sterile 6 millimeter (mm) biopsy tissue punch or sterile razor blade and forceps. The sample location depends on the species of turtle and whether the turtle is brought aboard a vessel or brought to shore. If the animal is able to be landed, the sample site is swabbed with alcohol and/or betadine and cleaned thoroughly before the sample is collected. The tissue sample is generally collected from the fleshy area between the rear flippers and below the plastron or the fleshy neck area between the head and carapace. In rare cases where a turtle is too large to bring aboard a vessel or to shore, the sample is collected from a location most easily accessed by the researcher, usually the flipper or neck. Scute samples are taken from one or more of the eight posterior marginal scutes of the carapace and are used to determine contaminant levels in the tissue. Collection locations are thoroughly cleaned with a plastic scrubbing pad, clean room wipes, high purity water, and 2-propanol. Keratin is scraped from the radial edge, where the dorsal and ventral surfaces form a thin edge and the keratin and underlying tissue can be discriminated. A disposable stainless steel biopsy tool is used to obtain 0.2 grams (g) to 0.5 g of the scute by moving the tool parallel to the edge. This process yields splinters of keratin approximately 1 mm in thickness representing the entire depth of scute deposition (Day et al. 2005). Samples are stored in acid washed containers and kept in a -20° C freezer until analysis.

Fat sampling is another vital component in assessing the health and nutritional condition of marine turtles. Fat samples can be evaluated for lipid composition in conjunction with ultrasound of subcutaneous fat layers, blood lipid panels, and plasma chemistries to quantify nutritional condition between foraging and nesting turtles. Nutritional condition can be evaluated with concurrent satellite telemetry information and stable isotope analysis to determine whether there is a positive correlation between individual energy reserves and trans-Pacific migrations to the nesting grounds within the same year. This knowledge provides a framework to more accurately assess how changing ocean conditions that negatively affect habitat quality can impact the condition of individuals and ultimately the nesting population. Fat biopsies can also be evaluated for persistent organic pollutants, which are then compared with blood contaminant levels, as well as blood health parameters. Understanding an individual's nutritional status can improve interpretation of contaminant levels, given the complex dynamics between fat mobilization, blood lipid content, and fluctuating levels of lipophilic compounds in tissues. These data will help contribute to knowledge that can be used to facilitate recovery of the species.

Subcutaneous fat biopsies may be collected from adult or large immature leatherback sea turtles during in-water captures or on nesting beaches and is performed by a veterinarian or other highly trained individual skilled in sterile technique. Fat biopsies are collected from one of two sites: in the dorsal fat pads at the base of the hind flippers or in the fatty pads in the dorsal shoulder region. The person collecting the biopsy sample wears sterile gloves to minimize contamination of the site. For surgical preparation, the skin is scrubbed in a circular motion from the center to the periphery with three alternating washes of either 10% povidone-iodine (betadine) surgical scrub or 4% chlorhexidine diacetate (Nolvasan) surgical scrub followed by 70% isopropyl alcohol. The biopsy site is infused with lidocaine hydrochloride 2.0% injectible solution (up to 2 milligrams (mg)/kilogram (kg)), subcutaneously and intradermally at least 10 minutes prior to biopsy procedure to minimize pain and discomfort to the animal. The efficacy of the local anesthetic is assessed by observing the turtle's response to a needle prick to the biopsy site prior to skin incision; additional lidocaine is administered as necessary. The flipper adjacent to the biopsy site is manually restrained during the procedure. A superficial skin incision (1-2 centimeters) is made with a sterile disposable scalpel blade and the connective tissue is bluntly dissected using sterile surgical scissors. The fat sample (0.4-4.0 g) may be collected either using sterile scissors (excisional biopsy) or using an 8 mm sterile punch biopsy inserted into the incision site. In the event of excessive bleeding, constant pressure will be applied with sterile gauze, and epinephrine may be applied to the biopsy site to facilitate hemostasis. The incision site is closed using absorbable sutures in a simple continuous subcuticular pattern, taking care to close the dead space to reduce the risk of seroma or hematoma formation, followed by application of cyanoacrylate veterinary tissue glue. A digital photo of the biopsy site is taken prior to release, which is included as part of the turtle's medical record.

In addition, ultrasonography may be used to non-invasively measure the depth of the subcutaneous fat layer to quantify nutritional condition in some animals (particularly leatherback and green turtles). A portable veterinary ultrasound machine is used to obtain images of the subcutaneous fat and underlying musculature at five anatomical sites: right shoulder, central neck, left shoulder, right hip, and left hip. Ultrasound gel will be applied to the skin and the probe will be held against the skin for several seconds until an image is obtained. The resulting image will be frozen on the screen, measurements of the subcutaneous fat will be recorded, and the image will be saved and later downloaded to a laptop computer.

Lavage

The collection of stomach samples for analysis is obtained through esophageal lavage immediately after capture (Forbes and Limpus 1993, Seminoff et al. 2002a). This procedure involves inserting a length of 3/4 inch diameter soft plastic tubing down the esophagus to the "pre-stomach" and flushing it with clean seawater poured into the tubing. Contents are caught in a separate basin. The procedure takes between five and ten minutes, and poses no risk to the animal.

Nesting Beach Monitoring and Sampling of Hatchlings

Nesting beach monitoring and the collection of genetic samples from hatchling leatherback turtles can also be used to determine critical life history parameters, including age at first reproduction and juvenile survival rates. Genetic fingerprints can be constructed for each hatchling sampled, allowing identification of individuals upon their return to the natal beach at some time in the future. Age at first reproduction for leatherbacks in particular remains one of the critical questions that must be answered for developing the most effective management strategies and for setting and evaluating recovery plan objectives.

On nesting beaches, nesting females and hatchling turtles are observed from a distance to determine activity phase. Females are not approached until egg deposition has begun. Headlamps may be used when working on the beach during inspections, but their use is limited to avoid disturbing the animal. In some cases, a red filter may be used to dim the light. Females may be handled briefly for tissue sampling.

Once nests that are beginning to emerge are identified (e.g. where a hatchling's head or flippers are visible on the surface of the sand), team members remain with the nest to guard against predators and wait for the full clutch to emerge. Once the turtles begin emerging *en masse*, they are counted and collected into a canvas bag that has a layer of cool sand on the bottom. The time is noted and the nest is marked. Hatchlings are transported to the sampling area as soon as possible after collection. For obtaining blood samples, hatchlings are positioned securely on a sanitized surface (4" x 4" x 0.13" polyethylene board). While the hatchling's head is covered, the right front flipper at the biopsy site is treated with disinfectant and a 2 mm biopsy punch is used to sample skin from the trailing edge of the front flipper. The flipper is immediately treated with a hemostatic agent (styptic pencil), and each hatchling is monitored for bleeding. Hatchlings are then placed in the recovery bin and held until after dark. Sampling continues rapidly for each hatchling in each clutch. Hatchlings are released in small groups along the shoreline over a distance of approximately 50 m, and all hatchlings are observed crawling to and entering the water. Skin samples are stored in a saturated salt solution in a 96 well sample storage plate, with each set of samples kept separate and labeled appropriately. Whenever possible, the identity of the nesting mother is also determined and recorded for each clutch.

Temperature dataloggers may be buried on nesting beaches to determine the incubation temperatures and sex ratios of leatherback nests. Dataloggers may be buried in the sand (e.g., near the vegetation line, at mid-beach, or in the hatchery) and are placed away from incubating nests at the average leatherback nest depth. They are left untouched until the end of the nesting season before being excavated. Placement of dataloggers inside a nest takes place while a female is nesting; the datalogger is carefully placed at the bottom of the nest after the females have dug the egg chamber and either before egg deposition has begun or after 20-30 eggs have been laid without disturbing the female or harming the eggs. The dataloggers are only retrieved after the nest has completed its incubation and hatched.

Attachment of Tags

The successful use of satellite telemetry and other tagging methods to track sea turtle movements have been widely documented as a method for determining at-sea movement patterns (Godley et al. 2008). The use of satellite tracking for the study of marine turtles began in the 1980s, and the ensuing descriptions of migration routes, seasonal behaviors, foraging areas, and other habitats have offered novel insights into the basic life history patterns of marine turtle species, and highlighted focal areas for conservation. Other approaches using telemetery-based research have elucidated navigational capabilities and post-release survival of turtles following fisheries interactions and long-term captivities. In addition, through the Internet and other media, satellite tracking appears to have been effective in engaging public attention toward sea turtle conservation in many countries.

Applying tracking tags on turtles involves placing a physical tag either into the tissue of the flipper, under the skin surface, or on the external surface of the shell of an individual turtle. Tags include external flipper tags, which may be metal or plastic, Passive Integrated Transponders (PITs) which are injected under the skin and can be electronically scanned, or external shell markings such as alphanumeric identification etched into or painted onto the shell.

Turtles are tagged with inconel tags (Style 681, National Band and Tag Company, Newport, Kentucky) issued by the NMFS SWFSC using the standard technique described in Eckert et al. (1999). These tags have been used on captive sea turtles at SeaWorld as well as wild green, hawksbill, olive ridley, Kemp's ridley, loggerhead, and leatherback turtles worldwide. The tag is attached to the soft skin along the trailing edge of the left or right front flipper near the carapace. The applicator is similar to that used to ear-tag livestock; the pointed end of the tag goes through the flipper and connects on the underside. PIT tags are small (14 mm length x 2 mm diameter), electromagnetically-coded glass-encased "microchips" that are injected into the muscle between the first two phalanges in the front flipper, or within the triceps muscle on the anterior arm, based on recent studies by McMichael et al. (2009). PIT tags are read with a scanner, and are designed to last the lifetime of the turtle.

Attachment of Transmitters

A variety of transmitters are routinely used to monitor short-range and long-range movements, diving behavior, and habitat use of marine turtles. The transmitters include ultrasonic transmitters, satellite transmitters, time-depth recorders (TDR), video cameras, and GPS.

Ultrasonic Transmitters. Ultrasonic transmitters (dimensions = 90 mm long x 18 mm diameter, weight = 11.5 g) are used to learn about the movements and residency patterns of turtles within a study area. Tags are programmed to transmit signals in 35.0 to 40.0 kHz, a frequency range that is outside the hearing capacity of marine turtles (30 Hz – 1kHz; Ridgeway et al. 1969). Each 'ping' from the transmitter lasts between 528 and 942 milliseconds, depending on the transmitter configuration. Transmissions are 145 decibels (dB) and have a transmission range of up to 1 kilometer (km). The decibel level is extremely low out of water, with pings indistinguishable to the human ear. The transmitters have a battery life of up to 12 months.

Transmitters are attached to either the left or right rear-side of the carapace with thin coats of fiberglass tape and laminating resin as described in Balazs et al. (1996). The attachment area, roughly 8" x 6" on the carapace, is lightly sanded to remove algae. A non-toxic elastomer compound or plumbers putty is used to "cushion" the transmitter and hold it in place during the attachment procedure. A thin coat of laminating resin is applied to the carapace and transmitter, and 4 strips of fiberglass cloth are pasted over the transmitter for secure attachment. In the event a turtle bearing a non-functional sonic tag is re-captured, all fiberglass resin as well as the tag is carefully removed from the turtle using a scraper tool and fine grit sand paper.

Tracking ultrasonic transmitter-equipped turtles is done using either boat-based tracking with a hand-held sonic receiver and directional hydrophone or remote tracking using submersible stationary sonic receiving stations placed strategically throughout the study areas. In order to minimize disturbance to the turtles when boat-based tracking, each re-sighting position is determined by maneuvering the tracking vessel to within 10–20 m of the turtle and recording the location of the tracking vessel with a GPS (error range = ± 3 m to ± 12 m). Distances from turtles are determined from direct observation of surfacing turtles or estimated from the strength of the sonic signal at one-tenth gain with a directional hydrophone.

Satellite Transmitters. Satellite transmitters, which are used to track migratory movements, dive behavior, and habitat use, are attached to the carapace of hard-shelled turtles using either fiberglass and laminating resin or power-fast quick set epoxy. Prior to attachment the carapace is prepared by removing any epibiotic growth from the attachment area. Once clean, the attachment area on the carapace is lightly sanded to allow for better adhesion of the resin or epoxy. Acetone or ethanol is used to wipe the attachment area clean after sanding to remove any oil and dust residue. A thin base of non-adhesive silicone putty is placed between the transmitter and the carapace to provide a barrier between the transmitter and the carapace. Small pieces of fiberglass tape and thin coats of laminating resin may be used to attach the transmitter to the carapace as described in Balazs et al. (1996). This technique has been widely used and is an accepted safe and effective method for transmitter attachment. Depending upon the tag, an alternative method using power-fast quick set epoxy (such as Sika AnchorFix) may be used to attach a transmitter to the carapace. In this method, a small portion of mixed epoxy is applied to the bottom of the transmitter. The transmitter is then placed in the attachment location on the carapace and beads of epoxy are then applied around and over the transmitter and smoothed with a spatula to form a thin layer. This process is repeated 2 to 3 times. The turtles are held on the shore for up to 2.5 hours until resin has cured and then released back into the ocean at the point of capture. One satellite tag is generally deployed on any single turtle, although a subset of satellite transmitter -equipped turtles may also be fitted with an ultrasonic transmitter to track short range movements. Satellite transmitters for stranded or entrained animals are only applied to animals that are deemed healthy.

The transmitters routinely used by the SWFSC include: 1) Telonics A-1010, formerly called the ST-20, dimensions = 6.0 x 12.3 x 2.8 cm, 276 g; 2) Telonics A-2025, dimensions = 13.97 x 7.6 x 4.1, 595 g; 3) Wildlife Computers ‘Splash’ Tag, variable dimensions based on configuration; 4) Wildlife Computers ‘Spot 5’ Tag, variable dimensions based on configuration; and 5) Wildlife Computers MK-10 GPS tag. The A-1010 is a location only tag while the A-2025, Splash, and Spot-5 tags record location and depth data. The MK-10 GPS tag records location, depth, temperature, and constant light levels.

Direct attachment of satellite-linked transmitters for leatherbacks is facilitated by drilling two small (4.5 mm diameter) horizontal tracts through the medial ridge of the carapace with an orthopedic drill bit. The selected attachment site on the carapace is located where the medial ridge is most prominent, usually posterior of the widest area of the carapace. The attachment site is prepared with three separate applications of Betadine prior to the drilling procedure. In addition, the attachment site is desensitized with ethyl chloride prior to drilling and all drill bits and surgical tubing sheaths are soaked in Betadine prior to insertion into the carapace. The satellite-linked transmitter is fitted to the carapace ridge by placing it onto a cold-curing, non-adhesive silicone putty base. The transmitter is attached with tethers (plastic-coated stainless wire) threaded through the drill tracts (cushioned by surgical tubing). The tethers are secured with corrodible stainless steel crimps which are set up to release the tag within approximately one year. Use of a leatherback-specific ‘ridgemount’ tag (Wildlife Computers, MK10-A and MK10-AF) has been shown to substantially reduce drag when compared to the older ‘backpack’ style tag (T. Jones, unpubl. data).

Time Depth Recorders. To determine movement and behavior patterns within a study area, TDRs (dimensions = 67 x 17 x 17 mm, 30g) are seated in a tubular-shaped syntactic foam containment (20 cm length x 7 cm diameter) that has a hydrodynamically optimized dome and conical tail. For tracking and retrieval, each TDR containment has an internally mounted very-high-frequency (VHF) radio transmitter (dimensions = 55 mm long x 17 mm diameter; transmission range = 148.0 - 140.0 mHz) and ultrasonic tag. TDRs log time-of-day, depth (resolution = 0.5 m), temperature, and light levels. Data collection intervals are generally set at 10 seconds (depth) and 1 minute (temperature and light levels) and initiated by a salt-water switch.

To ensure prompt recovery of the TDRs, an automatic release mechanism consisting of two interlocking plates is used. One plate is fixed to the turtle’s carapace with a nylon mesh apron and a five minute quickset epoxy, and the second plate is attached to the TDR containment with hose clamps. To offset the slight positive buoyancy of the TDR, a counterweight is attached the bottom plate to achieve neutral buoyancy. A screw-and-groove assembly links the anterior portion of these plates; the rear portion is connected with a galvanic (Mg) link that dissolves at a constant rate when immersed in seawater. Upon dissolving, a spring mechanism forces the rear of the top plate upwards, thereby disengaging the front portion. The slight buoyancy causes the containment units to float to the surface.

Video Cameras. The video camera for deployment on hard-shelled marine turtles consists of a Hi-8 video camera integrated with a time-depth recorder and on-board microcomputer for data collection. These components are housed in a tubular shaped aluminum cylinder (dimensions = 31.7 cm long x 10.1 cm diameter) that has a hydrodynamically optimized dome and conical tail portion composed of incompressible syntactic foam. For retrieval after detachment, each camera has an internally mounted very-high-frequency (VHF) radio transmitter (dimensions = 55 mm long x 17 mm diameter; transmission range = 148.0 - 140.0 mHz) and ultrasonic tag. Units weigh 2.0 kg out of water, but are neutrally buoyant in water due to a counter weighting system. Only large turtles are equipped with this mechanism such that the camera system weighs no more than 3% of the body weight. Cameras are programmed to collect video in both short-play (3 hours) and long-play (6 hours) modes and to record continuously or at a 5 minute on / 5 minute off duty cycle. Water depth and temperature information are collected at 2 to 7 second intervals for the entire duration of each deployment, irrespective of camera function.

Video cameras are attached to the crown of each turtle's carapace with a two-plate mechanism. The top plate is linked to the video cameras with two 10 cm diameter hose clamps and the bottom plate is attached to the carapace with a nylon mesh apron and a five minute quick-set epoxy. The front of these plates is connected by an interlocking assembly and the back is connected with the burn-wire connector and backup corrosive (Mg) link. To offset the slight positive buoyancy of video cameras, the bottom plate is counterweighted to achieve neutral buoyancy. Cameras are programmed to detach at 4 to 20 hours after deployment, at which time a charge from a 9V battery housed internally within the video camera will be sent to the burn-wire, causing the wire to corrode and break, thereby disengaging the plates. Once detached from the baseplate, the slight positive buoyancy of the camera floats the unit to the surface. A VHF receiver with a 3-element Yagi antenna and a sonic receiver with a directional hydrophone is used to recover floating video cameras.

Video camera systems, TDR, sonic tags, and global positioning units may also be attached to leatherback turtles via a suction cup using the method developed by Dr. James Harvey (Moss Landing Marine Laboratories, California State Universities) for the purpose of monitoring short-term movements, dive behavior, and foraging ecology. This method would allow transmitters to be attached to free- swimming leatherbacks without capture of the animal, and with minimal disturbance as no glue or fiberglass adhesive is required for the deployment, nor is the animal landed on the boat for attachment. The tag (VHF transmitter and TDR or sonic tag) would be attached using a suction cup (8-cm in diameter), with a small amount of adhesive. The tag would be housed within a short tube made of PVC material (11-cm long x 2-cm diameter) attached directly to the suction cup. The transmitter and TDR would be surrounded by syntactic foam providing buoyancy, such that when the suction cup detaches the tag would float like a spare buoy, with the antenna oriented vertically out of the water. With the tag placed on the dorsal surface of the turtle, the tag would come to the surface each time the animal surfaced to breathe.

The VHF transmitter would monitor movements via a receiver in the vessel and the sonic tag would be monitored using a directional hydrophone mounted to the vessel.

The tag would be placed on free-swimming leatherback turtles via a small boat and 3-m long pole. The suction and tag would be attached to the end of the pole, such that with a small amount of thrust the suction cup would be placed on a relatively flat surface (e.g. dorsal carapace of a turtle). The use of a pole will allow precise placement of the tag on the most dorsal surface of the carapace in between the longitudinal ridges on the back. Turtles would be approached within 2.5 m, carefully to the side of the vessel, and the pole used to apply the tag as the animal comes to the surface for a breath. The approach and tagging would take about 5-10 seconds, and the vessel would immediately retreat from the position of the turtle. Sonic tags would be tracked from the vessel at a minimum distance of 300 m and a maximum of 1 km, whereas VHF transmitters could be tracked at distances of 1-4 km. The sonic tag would be coded for depth, so receive depth information would be received while tracking the animal in real time. The VHF/TDR tag would also be tracked in real time, however, it would require retrieval of the tag to recover the depth information because the TDR is an archival instrument. We expect the suction cup and tag would remain attached to the turtle for 1-4 days. In some instances, suction cups may be attached to captured animals prior to release.

Jellyfish Sampling

Jellyfish are the primary food source for leatherbacks and are collected for studies involving caloric content, food habitat, and stable isotope analysis. To better understand the effects of predator and prey and to evaluate the effects of jellyfish aggregations on foraging patterns of leatherbacks, the following protocols are in place for the collection of gelatinous zooplankton (jellyfish).

Surface and Midwater Trawling. A 16' wide box trawl net is deployed to conduct surface and midwater trawls. The net is usually deployed at the surface; however, sampling could occur at deeper depths if hydroacoustics suggest that jellyfish are located deeper than the vertical dimensions of the net. Net tows may also be performed to target oceanographic features at certain depths. Surface and midwater trawls are conducted at areas of interest which include: areas where leatherback have been sighted by aerial survey; areas where leatherback turtles have recently been documented by radio or satellite-linked telemetry; areas of potential foraging habitat based on either acoustic backscatter or remote sensing data; and areas where leatherbacks or jellyfish have been visually sighted. No trawl activity is permitted to occur within established Marine Protected Areas (MPAs). Samples are sorted at sea and material that cannot be processed at sea is preserved in formalin, alcohol or frozen, labeled, and stored in containers until the vessel returns to port. Sample material that is not retained is disposed of at sea. Each tow is fished for 10 to 30 minutes unless high catch rates of gelatinous zooplankton require a shorter tow. Ship speed should be approximately 2 kts to minimize the destruction of gelatinous organisms. Bottom depth is determined by the ship instrumentation and the scientific party communicates the depth of the net to the winch operator. Desired target depths of tows are achieved by modifying the length of cable deployed from the ship. Surface tows are accomplished by deploying less cable and visual inspection by the science team to adjust tow depth as needed.

Trawling operations only occur following a 30 minute marine mammal watch. If mammals are detected, the trawl position is moved to a new area and the marine mammal watch is reinitiated. If any marine mammal interactions occur, all activities are discontinued and immediately reported to SWFSC. Activities are only resumed if deemed appropriate after a thorough evaluation of the interaction event.

Dipnetting. Gelatinous surface fauna may be collected opportunistically by scientific personnel using a dipnet. Samples are preserved, labeled, and stored in ice coolers. Dipnet sampling takes place when the vessel is stationary. If organisms of interest are seen while underway, the scientific personnel may request that the vessel approach the organisms and stop the vessel. Once stationary, one or more members of the scientific team may perform dipnetting from one side of the vessel, as appropriate. No dipnetting activity is permitted to occur within established MPAs.

Table 1. Overview of turtle species that would be evaluated using various research techniques. Selected research techniques are performed depending on species-specific permitting and handling rules, availability and accessibility of resources, and overall relevance of data generated to conservation goals for a particular species.

Turtle Species Common Name (Scientific Name)	Research Techniques					
	Capture	External Inspection, Attach Tags	Blood and Tissue Collection	Lavage	Fat Biopsy and Ultrasound	Attachment of Various Transmitters
Green (*Chelonia mydas)*	X	X	X	X	X	X
Hawksbill (*Eretmochelys imbricata*)	X	X	X	X		X
Leatherback (*Dermochelys coriacea)*	X	X	X		X	X
Loggerhead (*Caretta caretta*)	X	X	X	X	X	X
Olive Ridley (*Lepidochelys olivacea*)	X	X	X	X		X

Turtle Species Common Name (Scientific Name)	Research Techniques (continued)				
	Nesting Beach Monitoring	Nesting Beach Temperature Surveys	Hatchling Sampling and Tagging	Nesting Beach Aerial Surveys	Foraging Aerial Surveys
Green (*Chelonia mydas)*	X	X	X	X	
Hawksbill (*Eretmochelys imbricata*)	X	X	X		
Leatherback (*Dermochelys coriacea)*	X	X	X	X	X
Loggerhead (*Caretta caretta*)					X
Olive Ridley (*Lepidochelys olivacea*)	X				X

2.2.3 Project Locations

Sea turtle research is proposed at the following general locations, primarily in open ocean, near shore or nesting areas of the Pacific Ocean near: U.S. west coast, specifically California, Oregon, and Washington; Indonesia; Papua New Guinea; Solomon Islands; Peru; Ecuador (including the Galapagos Islands and Isla de Plata); Chile; Mexico; Costa Rica; El Salvador; Nicaragua; Colombia, and U.S. Atlantic states. Nesting beach activities would also take place in St. Croix, U.S. Virgin Islands. Projects may take place in additional locations provided that the general project activities and predicted impacts remain within the scope of this PEA. Table 2 summarizes the proposed research categories and general project locations.

Table 2. Summary of research project locations by category.

Research Category	Research Locations
Computer Analysis	Not Applicable (conducted at SWFSC or other laboratory setting)
Training and Outreach	Ecuador, Chile, Costa Rica, California U.S., El Salvador, Indonesia, Mexico, Papua New Guinea, Solomon Islands, Peru, Trinidad
Genetic and Isotope Analysis	General Pacific Ocean areas including, Baja California Peninsula, Mexico, Peru, El Salvador, Ecuador, Costa Rica, Indonesia, Solomon Islands, Palau, Marshall Islands, U.S.A. and U.S. Territories, U.S. and foreign coastal, pelagic, and gillnet fisheries, U.S. Atlantic coastal states, and several Caribbean nations
Nesting Beach Monitoring	Indonesia, El Salvador, Costa Rica, Nicaragua, Mexico, Ecuador, St. Croix, U.S. Virgin Islands
In-water Monitoring	General Pacific Ocean areas including U.S. west coast, California, Oregon, and Washington, San Diego Bay, Chile, Peru, Ecuador (including Isla de Plata and the Galapagos Islands), Mexico, Nicaragua, El Salvador, Colombia, Indonesia, Solomon Islands, and Malaysia

2.3 Alternatives Considered but Eliminated from Detailed Study

An alternative eliminated for further study was for the SWFSC to conduct research activities through one program while not conducting research through the other (e.g., conduct research through the Marine Turtle Genetics Program without conducting research through the Marine Turtle Ecology & Assessment Program or vice versa). This alternative was considered, but eliminated from detailed study. Both inter-related programs utilize the same research protocols and methods, and the activities of one program directly support the research outcomes of the other. Thus, this alternative was rejected as an option because it would limit the research data generated and undermine the goals of NOAA to support the priority actions identified in the U.S. Pacific Sea Turtle Recovery Plans aimed at long term sea turtle conservation and management (NMFS and USFWS 1998a-e).

3 Description of the Affected Environment

3.1 Biological Resources

3.1.1 Sea Turtles

Because the proposed projects considered in this PEA are geographically diverse and primarily concern sea turtles and sea turtle interactions, the following section will address background information of all potentially affected sea turtles.

At present, sea turtles are categorized by the International Union for Conservation of Nature and Natural Resources (IUCN) as the following (IUCN, 2009):

- Hawskbill (*Eretmochelys imbricata*) - critically endangered
- Kemp's ridley (*Lepidochelys kempii*) - critically endangered
- Leatherback (*Dermochelys coriacea*) - critically endangered
- Loggerhead (*Caretta caretta*) - endangered
- Green (*Chelonia mydas*) - endangered
- Olive ridley (*Lepidochelys olivacea*) - vulnerable

Australia's flatback turtle (*Natator depressa*) is listed as "data deficient", indicating that there is inadequate information to make an assessment of extinction risk. Under the ESA, leatherback, hawksbill, Kemp's ridley, the populations of olive ridley turtles nesting in Mexico, and the populations of green turtles in Florida and the Pacific coast of Mexico are listed as endangered; loggerhead turtles, other Pacific populations of olive ridley turtles, and the Hawaii population of green turtles are listed as threatened. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) identifies all sea turtle species excluding the flatback as threatened with extinction, and prohibits the international trade in sea turtles and sea turtle products.

The decline of sea turtle populations throughout the world are primarily due to the composite effect of human activities which include: the legal harvest and illegal poaching of adults, juveniles, and eggs, incidental capture in coastal and high-seas fisheries as bycatch, loss and degradation of nesting and foraging habitat, and predation on nesting beaches by feral and domestic animals, especially dogs and pigs, as well as humans. Increased environmental contaminants, such as sewage and industrial discharges, and marine debris, which adversely impact near shore ecosystems that turtles depend on for food and shelter, including sea grass and coral reef communities, also contribute to overall declines. In addition to anthropogenic factors, natural threats to the nesting beaches and pelagic-phase turtles such as coastal erosion, seasonal storms, predators, temperature variations, diseases such as fibropapillomatosis and spirochidiasis, and phenomena such as El Niño also affect the survival and recovery of sea turtle populations.

Highly productive areas of the world's oceans attract sea turtles by their accumulation of forage species. High concentrations of forage species also attract commercially valuable predators such as tunas and swordfish, which ultimately attract the foreign and domestic longline fishing fleets. Camiñas and de la Serna (1995) estimated that 200,000 to 316,000 loggerheads and 50,000 to 114,000 leatherbacks are captured annually in worldwide fisheries, with 60% of the catch from the Atlantic Ocean, 30% from the Pacific and Indian Oceans, and 10% from the Mediterranean Sea. Lewison et al. (2004) also attempted a global quantification of the issue and arrived at similar numbers with loggerhead and leatherback total capture in the Pacific estimated at 30,000 and 20,000, respectively. Turtles may become hooked by biting a baited longline hook or being snagged in passing, or they may become entangled in the line. If the branch line is not long enough to allow the turtle to surface to breathe and the turtle remains suspended under water, it will likely drown. Even turtles hooked or entangled but released alive may subsequently die due to internal injuries and/or secondary infections.

Green turtles, hawksbills, leatherbacks, loggerheads, and olive ridleys are highly migratory or have a highly migratory phase in their life history, which makes them susceptible to incidental capture by longline fisheries and other potentially detrimental population effects. Information on the status of these species is included in this section as well as in the Sea Turtle Recovery Plans (NMFS and USFWS 1991a-b, 1992a, 1993, 1998a-e) and are reviewed extensively in Eckert (1993).

The proposed action is not expected to impact populations of the flatback sea turtle, which is geographically restricted to the waters of Australia, Indonesia and Papua New Guinea north of 25ºS. Thus, this species is not considered further in this assessment. In addition, blood and skin samples sent for genetic analysis at the SWFSC from Kemp's ridley turtles will be collected by collaborators at the National Park Service (NPS) with appropriate authorization under NPS or related agency endangered species permits and environmental analyses. As a result, there would be no direct handling of Kemp's ridley turtles by SWFSC personnel. However, because it is a peripheral part of the proposed action in that samples would be obtained for genetic analysis, this species is included in this section for background purposes only, but will not be analyzed in detail as part of this PEA.

3.1.1.1 Green Turtle

The genus *Chelonia* is composed of two taxonomic units at the population level, the east Pacific green turtle (referred to by some as "black turtle," *C. mydas agassizii*), which ranges from southern California south to Peru and west to the Galapagos Islands, and the nominate *C. m. mydas* in the rest of its range.

The green turtle is a circumglobal species found in tropical seas and, to a lesser extent, in subtropical waters with temperatures above 20ºC. The species consists of five main populations: the Pacific Ocean, Atlantic Ocean, Indian Ocean, Caribbean Sea, and Mediterranean Sea that can be further divided into nesting aggregations.

Green turtles are listed as threatened under the ESA, except for breeding populations found in Florida and the Pacific coast of Mexico, which are listed as endangered. The green turtle is categorized as endangered by the IUCN (IUCN 2009), and is listed in Appendix I of CITES, as are all cheloniidae (hard-shelled marine turtles). Seminoff (2002) estimates that the global green turtle population has declined by 34% to 58% over the last three generations (approximately 150 years) although actual declines may be closer to 70% to 80%. Causes for this decline include harvest of eggs, subadults and adults, incidental capture by fisheries, loss of habitat, and disease. Despite international conservation efforts to protect green turtles in all areas of the world, threats to their survival continue. In the Atlantic, Pacific, and Indian Oceans and the Mediterranean Sea, harvest continues. Egg collection is ongoing at nesting beaches in the eastern Atlantic, western Atlantic and in the Caribbean, while nesting females continue to be killed in the Caribbean, eastern Atlantic and Indian Ocean. High numbers of juveniles and adults are intentionally captured at foraging habitats in the eastern Atlantic, Caribbean, Indian Ocean, and in the Mediterranean (Seminoff 2002). Green turtles are thought to be declining throughout the Pacific Ocean, with the exception of Hawaii, as a direct consequence of an historical combination of overexploitation and habitat loss (Eckert 1993, Seminoff 2002, NMFS and USFWS 1998a).

Green turtles occupy three habitat types: high-energy oceanic beaches, convergence zones in the pelagic habitat, and benthic feeding grounds in relatively shallow, protected waters. Females deposit egg clutches on high-energy beaches, usually on islands, where a deep nest cavity can be dug above the high water line. Hatchlings leave the beach and apparently move into convergence zones in the open ocean where they spend an undetermined length of time (Carr 1986b). When turtles reach a carapace length of approximately 20 to 25 cm (8-10 in), they leave the pelagic habitat and enter neritic (i.e. near shore) feeding grounds. Most commonly these foraging habitats are pastures of sea grasses and/or algae, but small green turtles can also be found over coral reefs, worm reefs and rocky bottoms.

Although most green turtles appear to have a nearly exclusively herbivorous diet consisting primarily of sea grass and algae, those along the eastern Pacific coast seem to have a more carnivorous diet (Wetherall et al. 1993, Seminoff et al. 2002a). Analysis of stomach contents of green turtles found off Peru revealed a large percentage of molluscs and polychaetes, while fish and fish eggs, and jellyfish and commensal amphipods comprised a lesser percentage (Bjorndal 1997).

Based on the behavior of post-hatchlings and juvenile green turtles raised in captivity, it is presumed that those in pelagic habitats live and feed at or near the ocean surface, and that their dives do not normally exceed several meters in depth (NMFS and USFWS 1998a). The maximum recorded dive depth for an adult green turtle was 110 m (Lutcavage and Lutz 1997), while subadults routinely dive 20 m for 9 to 23 minutes, with a maximum recorded dive of 66 minutes (Lutcavage and Lutz 1997). Additionally, it is presumed that drift lines or surface current convergences are preferential zones due to increased densities of likely food items (NMFS and USFWS 1998a). Underwater resting sites include coral recesses, the undersides of ledges, and sand bottom areas that are relatively free of strong currents and disturbance from natural predators and humans.

3.1.1.2 Hawksbill Turtle

Hawksbill turtles are circumtropical in distribution, generally occurring from latitudes 30ºN to 30ºS within the Atlantic, Pacific and Indian Oceans and associated bodies of water (NMFS and USFWS 1998b). The species is widely distributed in the Caribbean Sea and western Atlantic

Ocean, with representatives of at least some life history stages regularly occurring in southern Florida and the northern Gulf of Mexico (especially Texas); in the Greater and Lesser Antilles; and along the Central American mainland south to Brazil. Within the United States, hawksbills are most common in Puerto Rico and its associated islands, and in the U.S. Virgin Islands. In the continental U.S., the species is recorded from all the Gulf States and from along the eastern seaboard as far north as Massachusetts, although sightings north of Florida are rare. Hawksbills are observed in Florida with some regularity on the reefs off Palm Beach County, where the warm Gulf Stream current passes close to shore, and in the Florida Keys. Texas is the only other state where hawksbills are sighted with any regularity. Most sightings involve posthatchlings and juveniles. These small turtles are believed to originate from nesting beaches in Mexico.

In the U.S. Pacific, there have been no hawksbill sightings off the west coast. Hawksbills have been observed in the Gulf of California as far as 29ºN, throughout the northwestern states of Mexico, and south along the Central and South American coasts to Columbia and Ecuador.

The hawksbill is threatened with extinction throughout its range. It is considered critically endangered by the IUCN (IUCN 2009) and is included in Appendix I of CITES. The hawksbill is protected as an endangered species under the ESA in the U.S. and in certain independent states (Federated States of Micronesia, Republic of the Marshall Islands, Palau) through cooperative agreements.

Hawksbills utilize both low- and high-energy nesting beaches in tropical oceans of the world. Hawksbills will nest on small pocket beaches and, because of their small body size and great agility can traverse fringing reefs that limit access by other species. They exhibit a wide tolerance for nesting substrate type. Visual evidence of hawksbill nesting is the least obvious among the sea turtle species, because hawksbills often select remote pocket beaches with little exposed sand to leave traces of revealing crawl marks. Nests are typically placed under vegetation.

Throughout their range, hawksbills typically nest at low densities; aggregations consist of a few dozen, at most a few hundred individuals. Within U.S. jurisdiction in the Caribbean Sea, nesting occurs principally on beaches in Puerto Rico and the U.S. Virgin Islands. Nesting also occurs on other beaches of St. Croix, Culebra Island, Vieques Island, mainland Puerto Rico, St. John, and St. Thomas. Within the continental United States, nesting is restricted to the southeastern coast of Florida and the Florida Keys. The largest remaining concentrations of nesting hawksbills in the Pacific occur on remote oceanic islands of Australia (Torres Strait) and the Indian Ocean (Republic of the Seychelles). In the eastern Pacific, the primary nesting sites occur in El Salvador, Nicaragua, Costa Rica, and Ecuador, with a cumulative of ca. 500 nests annually (Gaos et al. in press)

Hawksbills utilize different habitats at different stages of their life cycle. Posthatchling hawksbills occupy the pelagic environment, taking shelter in weedlines that accumulate at convergence points. Hawksbills reenter coastal waters when they reach approximately 20-25 cm carapace length. Hawksbills have a relatively unique diet of sponges (Meylan 1985, 1988). Coral reefs are widely recognized as the resident foraging habitat of juveniles, subadults and adults. The ledges and caves of the reef provide shelter for resting both during the day and night.

Hawksbills are also found around rocky outcrops and high energy shoals, which are also optimum sites for sponge growth. Hawksbills are also known to inhabit mangrove-fringed bays and estuaries, particularly along the eastern shore of continents where coral reefs are absent.

As a hawksbill turtle grows from a juvenile to an adult, data suggest that the turtle switches foraging behaviors from pelagic surface feeding to benthic reef feeding (Limpus 1992). As with other sea turtles, hawksbills will make long reproductive migrations between foraging and nesting areas (Meylan 1999), but otherwise they remain within coastal reef habitats.

Anecdotal observations throughout Micronesia, from across the Pacific, and from other tropical oceans of the world are in near total agreement that current stock sizes are significantly below historical numbers. Although quantitative historical records are few, dramatic reductions in numbers of nesting and foraging hawksbills have apparently occurred in Micronesia (Johannes 1986, Pritchard 1982a) and Pacific Mexico just south of California (Cliffton et al. 1982) since World War II, largely because of increased access to remote nesting beaches by indigenous fishermen equipped with spear guns, outboard motors, and other high-tech fishing gear (Johannes 1986, Pritchard 1982a). Market pressures from Asia, sustained by a vast fleet of Taiwanese and other fishing vessels of various national origins, are overwhelming the existing stocks. Most important of all, hawksbills are threatened by a pervasive tortoiseshell trade, which continues particularly in southeast Asia and Indonesia even though the once lucrative Japanese markets were closed in 1994 (NMFS and USFWS 1998b).

3.1.1.3 Leatherback Turtle

The leatherback turtle is the largest, deepest diving and most pelagic of the marine turtles. Leatherbacks have the most extensive range of any living reptile and have been reported circumglobally from latitudes 71ºN to 42ºS in the Pacific and in all other major oceans (NMFS and USFWS 1998c). Except for nesting, leatherbacks lead a completely pelagic existence, foraging widely in temperate waters. The evidence currently available from tag returns and strandings in the western Atlantic suggests that adults engage in routine migrations between boreal, temperate and tropical waters, presumably to optimize both foraging and nesting opportunities (Bleakney 1965, Pritchard 1976, Lazell 1980, Rodin and Schoelkopf 1982, Boulon et al. 1988). Typically, leatherbacks are found in convergence zones and upwelling areas in the open ocean, along continental margins, and in archipelagic waters (Duron 1978, Eckert 1998, 1999, Morreale et al. 1996, Shoop and Kenney 1992).

The species is divided into four main populations in the Pacific, Atlantic, and Indian Oceans, and the Caribbean Sea. Leatherbacks also occur in the Mediterranean Sea, although they are not known to nest there.

The leatherback turtle is listed as endangered under the ESA, and critically endangered on the IUCN Red List (IUCN 2009). Leatherback populations have been severely reduced worldwide. In 1980, the leatherback population was estimated at approximately 115,000 (adult females) globally (Pritchard 1982b). By 1995, this global population of adult females had declined to 34,500 (Spotila et al. 1996). Increases in the number of nesting females have been noted at some sites in the Atlantic, but these are far outweighed by local extirpations, especially of island populations, and the demise of once large populations throughout the Pacific, such as in Malaysia and Mexico. The decline can be attributed to many factors, including fisheries interactions, direct harvest, egg collection, and degradation of habitat. On some nesting beaches, nearly 100% of the eggs are harvested.

The diet of the leatherback turtle generally consists of cnidarians and other gelatinous zooplankton including jellyfish (e.g., medusae and siphonophores) in the pelagic environment (Bjorndal 1997).

3.1.1.4 Loggerhead Turtle

The loggerhead turtle is listed as a threatened species under the ESA. It is also classified as endangered on the IUCN Red List (IUCN 2009) and is listed in Appendix I of CITES, as are all cheloniidae. The greatest threats are loss of nesting habitat due to coastal development, predation of nests, and human disturbances (such as coastal lighting and housing developments) that cause disorientation during the emergence of hatchlings. Other major threats include incidental capture in shrimp trawling and pollution. Shrimping is thought to have played a significant role in population declines.

Loggerheads are circumglobal, inhabiting continental shelves, bays, estuaries and lagoons in the temperate, subtropical, and tropical waters of the Atlantic, Pacific and Indian Oceans (Dodd 1990). Major nesting grounds are generally located in warm temperate and subtropical regions, generally north of 25ºS or south of 25ºN latitude (NMFS and USFWS 1998d), with some scattered nesting in the tropics. The largest loggerhead nesting colonies in the world are found at Masirah Island, Oman, and along the Atlantic coast of Florida (Groombridge 1982). An estimated 30,000 loggerheads nest on Masirah Island each year (Ross and Barwani 1982), while an estimated 14,150 nest annually on the beaches of Florida (Murphy and Hopkins 1984, Ehrhart 1989). Loggerhead nesting in the Pacific basin is restricted to the western and southern region, primarily Japan and Australia. In the western Pacific the only major nesting beaches are in the southern part of Japan (Dodd 1988). Nesting also takes place in Yucatan, Mexico, Bahia, Brazil and in the Mediterranean Sea. Upon reaching maturity, adult females migrate long distances from resident foraging grounds to their preferred nesting beaches.

After leaving the beach, hatchlings apparently swim directly offshore and eventually become associated with sargassum and/or debris in pelagic drift lines that result from current convergences (Carr 1986a, 1986b, 1987). The evidence suggests that when post-hatchlings become a part of the sargassum raft community they remain there as juveniles, riding current gyres for several years and growing to 40 to 50 cm straight carapace length. At that point they abandon the pelagic habitat, migrate to the near-shore and estuarine waters along continental margins and utilize those areas as the developmental habitat for the subadult stage. Both juvenile and subadult loggerheads feed on pelagic crustaceans, mollusks, fish, and algae.

3.1.1.5 Olive Ridley Turtle

The olive ridley is one of the smallest living sea turtles (carapace length usually between 60 and 70 cm (24-28 in) and rarely weighing over 50 kg (110 lb)) (NMFS and USFWS 1998e). Under the ESA, the olive ridley turtle is listed as threatened in the Pacific, except for the Mexican nesting population, which is listed as endangered, primarily because of over-harvesting of females and eggs. It is listed as vulnerable on the IUCN Red List (IUCN 2009), and is listed in Appendix I of CITES, as are all cheloniidae.

The olive ridley sea turtle is widely regarded as the most abundant sea turtle in the world (Carr 1972, Zwinenberg 1976). Until recent historical times and the advent of modern commercial exploitation of sea turtles, the olive ridley was superabundant in the eastern Pacific, undoubtedly outnumbering all other sea turtle species combined in the area. Cliffton et al. (1982) estimated that a minimum of 10,000,000 olive ridleys swam in the seas off Pacific Mexico before the recent era of exploitation.

The olive ridley turtle is omnivorous and identified prey include a variety of benthic and pelagic prey items such as shrimp, jellyfish, crabs, snails, and fish, as well as algae and sea grass (Marquez 1990).

Preferred nesting areas occur along continental margins and, rarely, on oceanic islands. The largest nesting aggregation in the world occurs in the Indian Ocean along the northeast coast of India (Orissa), where in 1991 over 600,000 turtles nested in a single week (Mrosovsky 1993). The second most important nesting area occurs in the eastern Pacific, along the west coast of Mexico and Central America. Elsewhere, olive ridleys nest in much smaller numbers including along the Atlantic coast of South America and western Africa, as well as in the western Pacific and Indian Oceans (Sternberg 1981, Groombridge 1982, Carr and Carr 1991). In the eastern Pacific, the largest nesting concentrations occur in southern Mexico and northern Costa Rica, with stragglers nesting as far north as southern Baja California (Fritts et al. 1982) and as far south as Peru (Brown and Brown 1982).

3.1.1.6 Kemp's Ridley Turtle

The Kemp's ridley turtle is one of the smallest sea turtles, with adults generally weighing less than 45 kg (99 pounds), with a straight carapace length of approximately 65 cm (26 inches), with their shells being almost as wide as they are long (USFWS and NMFS, 1992). Neonatal Kemp's ridley turtles presumably feed on the available sargassum and associated infauna or other epipelagic species found in the Gulf of Mexico. In the post-pelagic stages, the Kemp's ridley diet consists mainly of swimming crabs, but may also include jellyfish, fish, and mollusks. From studies of stomach contents, usually of stranded dead turtles, the Kemp's ridley appears to be shallow water, benthic feeder (Shaver 1991).

Nesting occurs from April into July and is essentially limited to the beaches of the western Gulf of Mexico, primarily in the Mexican state of Tamaulipas near Rancho Nuevo, although some smaller nesting sites have been recorded in Veracruz, Mexico, and Texas. The Kemp's ridley, together with the flatback turtle of Australia, has the most restricted distribution of any sea turtle.

The species occurs mainly in coastal areas of the Gulf of Mexico and the northwestern Atlantic Ocean from Florida to New England. The adults are commonly found dwelling over crab-rich sandy or muddy bottoms while juveniles frequent bays, coastal lagoons, and river mouths. Kemp's ridley turtles rarely travel into waters deeper than 160 ft (50 m) (Byles and Plotkin, 2004).

Less than fifty years ago, the Kemp's ridley was an abundant sea turtle in the Gulf of Mexico. Populations were able to generate a reproductive effort that resulted in an estimated 40,000 females nesting in one day on the single known nesting beach on the northeastern coast of Mexico (Carr 1963, Hildebrand 1963). However, the Kemp's ridley has experienced one of the most dramatic declines in population numbers recorded for an animal, due in part to the growth of the trawling industry in the Gulf of Mexico. Incidental take by the shrimp industry has been identified as the largest source of mortality (between 500 and 5,000 killed annually) for the Kemp's ridley (Magnuson et al. 1990). Tag returns for adult turtles indicated that 75% were caught in shrimp trawls, 7% in gill nets, 4% in fish trawls, 1% on hook and line, 0.7% by purse seines, 0.7% by beach seines, and 0.7% unknown (Marquez et al. 1987).

3.1.2 Non-target Species

Benson et al. (2007b) reported that leatherback turtles forage on seasonally abundant dense aggregates of gelatinous zooplankton, or jellyfish (Phylum Cnidaria, Scyphomedusae, Orders Semaeostomeae, Rhizostomeae, and Coronatae) in the California Current. As such, jellyfish may be collected for research purposes to support ecosystem level energetic studies of leatherback turtles. In the northern California Current, populations of large medusae appear seasonally each year, with maxima occurring in late summer or early fall (Shenker 1984). There is evidence that these taxa may be increasing in abundance and expanding to new areas. 'Jellyfish blooms,' or unusual densities of these animals, can be caused either by a sustained increase in reproductive output, or physical aggregation events leading to apparent increases in population size (Mills 2001). Shifts in climate, eutrophication, new introductions, and overfishing may lead to changes in populations of gelatinous zooplankton, which in turn may change predation on or competition with other components of the food web (Jackson et al. 2001, Mills 2001, Parsons and Lalli 2002). Recent research shows an increase in biomass, shifts in distribution, and unusually dense aggregations of large medusae in various coastal environments (Suchman and Brodeur 2005).

Scyphozoans are classified into three planktonic orders and one that is entirely benthic. Most of the scyphozoan medusae along the U.S. west coast near shore habitats are of the Order Semaeostomeae. The Order Coronatae is also well represented along the U.S. west coast, and are generally deep water dwellers. Several species in the tropical Order Rhizostomeae occasionally frequent southern California waters, but rarely occur farther north near central California.

Eight species of midwater scyphomedusae were observed on video in subsurface waters along the central coast of the U.S. from 1990 to 1998 (Osborn et al. 2007). These included five species in the order Coronatae (*Atolla wyvillei*, *Atolla vanhoeffeni*, *Periphylla periphylla*, *Paraphyllina intermedia* and *Nauphantopsis diomedeae*) and three species in the order Semaeostomeae (*Poralia rufescens*, *Tiburonia granrojo* and *Deepstaria enigmatica*). Four species of large medusae are abundant in surface waters off the coast of Oregon: three scyphomedusae (*Aurelia labiata*, *Chrysaora fuscescens*, and *Phacellophora camtschatica*) and one hydromedusa (*Aequorea* sp.) (Suchman and Brodeur 2005). In the case of *C. fuscescens*, some 22,000 individuals were counted in a single cruise. None of these species are listed under the ESA.

Other non-target marine mammal, bird, shark, fish, and invertebrate species occur within the proposed action areas. However, research is not directed at these species and impacts, if any, would be considered incidental to the proposed action. Interactions with non-target species is not anticipated to occur with any significance due to preventive strategies aimed at avoiding such interactions. Known interactions have occurred on a limited basis with Bat rays (*Myliobatis californica*), but the impacts have been minimal. Each animal has been released alive and either unharmed or with minor abrasions from the net.

Examples of non-target species that are most likely to frequent research locations include:

- Sea otters (*Enhydra lutris*)[ESA listed as ‘threatened’]
- Least tern (*Sterna antillarum*) [ESA listed as ‘endangered’]
- California sea lions (*Zalophus californianus*)
- Gray smoothhound shark (*Mustelis californicus*)
- Bat ray (*Myliobatis californica*)
- California barracuda (*Sphyraena argentea*)
- California corbina (*Menticirrhus undulatus*)
- White seabass (*Atractoscion nobilis*)
- Striped mullet (*Mugil cephalus*)
- Yellowfin croaker (*Umbrina roncador*)
- California halibut (*Paralichthys californicus*)
- Diamond turbot (*Hypsopsetta guttulata*)
- Spotted turbot (*Pleuronichthys ritteri*)
- Tilapia (*Oreochromis spp*.)
- Striped shore crab (*Pachygrapsus crassipes*)
- Various seagrasses

Unless otherwise specified, these non-target species are not listed under the ESA or designated as depleted under the Marine Mammal Protection Act (MMPA).

3.2 Marine Protected Areas

3.2.1 National Marine Sanctuaries

There are 13 national marine sanctuaries created under the U.S. Marine Protection, Research and Sanctuaries Act of 1972. NOAA’s National Marine Sanctuaries Program (NMSP) has regulations regarding low flights over a sanctuary or reserve and a permit is required for such activities, in addition to a scientific research permit. All holders of NMFS’s scientific research permits conducting work within a National Marine Sanctuary are required to obtain appropriate authorizations from and coordinate the timing and location of their research with the NMSP to ensure that the research would not adversely impact marine mammals, birds or other animals within the sanctuaries. In addition, permit actions including those in the proposed action are sent to the NMSP for review if research is to occur in sanctuary waters. This PEA only pertains to the following National Marine Sanctuaries.

The *Channel Islands National Marine Sanctuary* (1,658 square miles) was designated in September 1980 and is located 25 miles off the coast of Santa Barbara, California. The sanctuary encompasses the waters surrounding Anacapa, Santa Cruz, Santa Rosa, San Miguel and Santa Barbara Islands, extending from mean high tide to seven miles offshore. Thirty four species of marine mammals including whales, dolphins, seals, sea lions and southern sea otters and 60 species of marine birds have been sighted in the sanctuary.

The *Cordell Bank National Marine Sanctuary* (526 square miles) off the northern California coast was designated in 1989. The Cordell Bank is the dominant feature of the sanctuary and is approximately nine miles long and five miles wide. Deep light penetration combined with upwelling nutrients leads to high productivity and abundant forage species such as krill. With a huge amount of krill this area is an important summer feeding ground for whales, pacific salmon and bottom fishes. There are 25 species of marine mammals and more than 47 species of seabirds found in this sanctuary.

The *Gulf of the Farallones National Marine Sanctuary* was designated in 1981 and encompasses 1,255 square miles off the northern and central California coast. Spring and early summer upwellings of cold, nutrient-rich waters create a highly productive ocean environment rich in plankton and other forage species. The Sanctuary supports an abundance of various species, including 33 species of marine mammals and 15 species of breeding seabirds.

The *Monterey Bay National Marine Sanctuary* was designated in 1992 and is the largest marine sanctuary in the National Marine Sanctuary Program. This sanctuary encompasses the waters of Monterey Bay and the adjacent Pacific Ocean off the central California coast covers over 5,300 square miles and is inhabited by 26 species of marine mammals, 94 species of seabirds, and 4 species of sea turtles (leatherback, green, olive ridley, and loggerhead).

The *Olympic Coast National Marine Sanctuary* was designated in 1994 and covers over 3,300 square miles of ocean waters off Washington State's peninsula coastline. More species of whales, dolphins, and porpoises spend time in these waters and more varieties of kelp are found here than anywhere else in the world. Twenty-nine species of marine mammals inhabit these sanctuary waters.

3.2.2 Other Conservation Areas or World Heritage Sites

Several of the proposed research areas and research activities may occur near or within expansive designated marine conservation areas or World Heritage Sites. This PEA seeks only to consider those areas that fall within the scope of the proposed action, specifically in Costa Rica, Colombia, Mexico, and Ecuador.

World Heritage Site *Area de Conservación Guanacaste* and the associated *Las Baulas National Park* on the Pacific coast of Costa Rica is one of the world's few remaining sites of significant leatherback turtle nesting activity. It supports the largest nesting colony of leatherback turtles in the Pacific Ocean with a population size of about 800 female turtles nesting per year in non-El Niño years. Protection of turtles and their nests is the responsibility of National Park guards, and conservation projects are aimed in part at understanding sea turtle biology through quality scientific research.

Also a World Heritage Site, the *Whale Sanctuary of El Vizcaino* in Baja Mexico is located in the central part of the peninsula of Baja California. The coastal lagoons of Ojo de Liebre and San Ignacio are important reproduction and wintering sites for the gray whale, harbor seal (*Phoca vitulina*), California sea lion (*Zalophus californianus*), northern elephant seal (*Mirounga angustirostris*) and blue whale (*Balaenoptera musculus*). The lagoons are also frequented by all five species of endangered marine turtles found in the Pacific Basin (Etnoyer et al. 2006).

The *Galapagos Islands*, located approximately 1,000 km from the South American coast off of Ecuador and its associated Marine Reserve are designated World Heritage Sites, covering a land area of about 8,000 square kilometers and surround ocean areas of about 138,000 square kilometers. The Galapagos is home to many endemic species of reptiles, birds, mammals, and invertebrates.

A designated World Heritage Site, the *Cocos Island National Park* is located 550 km off the Pacific Coast of Costa Rica, and is the first point of contact with the northern equatorial current. The marine areas of the park are important habitats for large pelagic species including sharks, rays, dolphins and tunas.

The *Malpelo Fauna and Flora Sanctuary*, including Malpelo Island and its surrounding marine environment, is located 506 km off of the coast of Colombia and was named a World Heritage Site in 2006. This extensive marine park is the largest no-fishing zone in the Eastern Tropical Pacific, providing critical habitats for internationally threatened marine species. These deep waters support important populations of large predators and pelagic species including various species of sharks (e.g., silky sharks, whale sharks), billfish, giant groupers, and tunas.

The *Loreto Bay National Park* covers 2,065 square kilometers in the Sea of Cortez, ranging from Isla Coronado in the north to Isla Catalana in the south. The marine park was named a World Heritage Site as part of the Islands and Protected Areas of Baja California in 2005. The entire site hosts more than 800 species of marine life, and many of them are currently endangered. Moreover, this site contains 39% of the world’s total number of species of marine mammals and a third of the world’s marine cetacean species.

3.2.3 Critical Habitats

Critical habitat designations have not been defined by the ESA and Secretary of the Interior or Commerce for the loggerhead, olive ridley, or Kemp’s ridley sea turtles. Critical habitats have been defined for the green turtle, specifically coastal waters surrounding Culebra Island, Puerto Rico, and hawksbill sea turtles, specifically coastal waters surrounding Mona and Monito Islands in Puerto Rico, all designated for the protection of important nesting beaches. Because none of the proposed research programs are planning to work with green or hawksbill turtles in or around Puerto Rico, these areas will not be affected.

Critical habitat designations have been established for the leatherback turtle in waters adjacent to Sandy Point Beach, St. Croix, US Virgin Islands. According to federal regulations (50 CFR 17.95 and 50 CFR 226.207), this area encompasses a strip of land 0.2 miles wide (from mean high tide inland) at Sandy Point Beach on the western end of the island of St. Croix beginning at the southwest cape to the south and running 1.2 miles northwest and then northeast along the western and northern shoreline, and from the southwest cape 0.7 miles east along the southern shoreline as well as the waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands, up to and inclusive of the waters from the hundred fathom curve shoreward to the level of mean high tide with boundaries at 17º 42’12" North and 64º 50’00" West.

There is a current proposal to include three open ocean marine areas off of the coasts of California, Oregon, and Washington totaling an area of approximately 70,000 square miles as critical habitat for leatherbacks (NMFS and NOAA, 2010). Any research conducted within critical habitat designated in the future would require appropriate compliance with the Endangered Species Act.

4 Environmental Consequences

4.1 Alternative 1: No Action Alternative

The No Action Alternative would not conduct specific research activities through the Marine Turtle Genetics Program and Marine Turtle Ecology & Assessment Program as proposed and outlined in this PEA. Under this alternative there would be no direct impacts to biological resources. However, domestic and foreign longline fisheries would continue to operate, and large numbers of all species of sea turtles would likely continue to be taken as bycatch without the benefit of further research data and methods specifically designed to address the Final Recovery Plans for the U.S. populations of marine turtle species.

The No Action Alternative does not facilitate methods for collecting physiological and genetic data needed to adequately monitor health status, trends in reproductive rates, and other goals as outlined for recovery of sea turtle populations, which does not fully support NOAA's shared responsibility for the conservation and recovery of sea turtles pursuant to ESA mandates. The Final Recovery Plans for the U.S. populations of the loggerhead, leatherback, olive ridley, and green turtles all state that necessary recovery actions for these species include: reduction of incidental harvest by commercial and artisan fisheries; determination of population size and status based on regular censuses; identification of stock home ranges using DNA analysis; support conservation and biologically viable management of marine turtle populations in countries that share U.S. turtle stocks; and identify and protect primary nesting and foraging areas for turtle species (NMFS and USFWS 1998a-e). Because all of these required elements are key components of both the Marine Turtle Genetics Program and the Marine Turtle Ecology & Assessment Program at the SWFSC, by not implementing the research activities as outlined, NOAA would not be satisfying its commitment to marine turtle conservation and recovery.

The No Action Alternative as outlined has the potential to result in continued significant adverse cumulative impacts on protected sea turtle species, including the possibilities of increased incidence of bycatch, increased incidence of nesting beach disturbances and downstream effects on population structure, and lack of regulatory outcomes based on responsible, empirical data collection.

4.2 Alternative 2: Proposed Action

The Proposed Action (Preferred Alternative) is for the SWFSC to conduct scientific research activities and data gathering through the Marine Turtle Genetics Program and the Marine Turtle Ecology & Assessment Program in order to improve sea turtle conservation and management strategies pursuant to the U.S. Recovery Plans for sea turtles using the general methods outlined in section 2. The potential impacts to affected resources are described in the following sections.

Precautions are in place and extra care is taken to protect against the possibility of nets and other gear becoming marine debris or pollutants. Additionally, the SWFSC and contracted researchers are careful to ensure compliance with all state, Territorial, Federal and foreign (country-specific) regulations and permit requirements regarding protected species research including ESA Section 10(a)(1)(A) permits, and Institutional Animal Care and Use Committee (IACUC) approvals, with existing permits for current and proposed research activities described in section 4.5 of this document.

4.2.1 Biological Impacts on Sea Turtles

The proposed research programs involve activities that range from non-invasive computer analysis and outreach to collecting blood and tissue samples and attaching tags and transmitters to sea turtles in the field. Standard operating procedures, as described in section 2.2.2, are specifically designed to minimize the impacts of these research techniques on turtles and the surrounding marine environment.

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 NMFS immediately should a sea turtle mortality event or a serious injury occur. This would allow for a careful review 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.

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, and expected number of turtle mortalities to result annually from research techniques are depicted in Table 3. 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 stress and 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 and maintaining and increasing endangered and threatened populations.

4.2.1.1 Impacts of aerial surveys

Aerial surveys are not expected to have a significant adverse impact on sea turtles. The approach of a research vessel or aircraft 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 and 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.

Aerial surveys over open ocean areas are expected to be transient in time and space. Low survey flights in a Partenavia or Twin Otter twin-engine fixed-wing aircraft would generally occur during daylight hours at an altitude between 500 and 1,000 feet unless otherwise restricted or specified in related permits. Low overflights are not expected to have any significant impact on sea turtles or other wildlife, as they are strictly for observational purposes. However, should officials conclude that flight operations are in danger of creating a disturbance to seabirds, marine mammals, or other natural resources of the National Marine Sanctuaries, the aircraft would increase altitude to a non-threatening distance. Aerial flights would not be conducted over marine mammal haul out areas, and researchers would conduct research so as to avoid harassment of any marine mammal or other target or non-target species.

The National Marine Sanctuary Program has approved the issuance of permits for the SWFSC to conduct research activities within the Olympic Coast National Marine Sanctuary, Cordell Bank National Marine Sanctuary, Gulf of the Farallones National Marine Sanctuary, Monterey Bay National Marine Sanctuary, and the Channel Islands National Marine Sanctuary, except as specified in the Special Conditions which are outlined in detail in the permits (section 4.5). The permitted activities in these regions are: to conduct low overflights at altitudes between 500 and 1,000 feet above sea level (unless otherwise specified), in order to conduct marine mammal and sea turtle assessment research, and to discharge expendable bathythermographs. Specific overflight rules and restrictions are provided in the permit and would be adhered to during any research activities conducted in any of these areas.

4.2.1.2 Impacts of capturing and handling live adult sea turtles

Handling live adult sea turtles that have been stranded or entrained, captured incidental to longline fisheries, or captured by entanglement or hoop nets is an essential component of the proposed research programs. As with any marine research and monitoring program, there is a possibility that captured turtles could experience adverse impacts from capture, ranging from near drowning to drowning by entanglement. Although these are not expected events, mitigation measures to minimize the potential for adverse impacts are in place, and include nets being regularly monitored when in the water and turtles immediately retrieved from the net if encountered (Ehrhart and Ogren 1999). Uninjured sea turtles that are lightly entangled in fishing gear will be disentangled, worked up, and released on site. Injured turtles that are captured by trained staff and collaborators may be transported to a facility for diagnosis and treatment by a licensed veterinarian. If a turtle is encountered during capture activities in a comatose state, resuscitation is attempted. Whenever possible, turtles are rehabilitated and ultimately released back into their natural environment. 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/or tagging. Data from 135 previously tagged and released turtles from 1982 through February 2006 showed that no tagged turtles found stranded were determined to have died from capture-related activities (NMFS and NOAA 2006). Therefore, no injury or mortality is predicted to occur from capturing or handling during any of the proposed research activities, and measures are in place to minimize the risk to the animals. Additional safety mitigation and experimental design evaluation measures are in place such that researchers must suspend all activities in the event of a serious injury (defined as impacts to the animal not normally expected from authorized activities, that could seriously impair the animal's ability to functional normally in terms swimming, foraging, or reproductive abilities) or turtle mortality pending review of the methods and procedures. While rare, single animal mortality may occur coincidental to, but not directly resulting from, the research activity due to prior individual injury, disease, or other condition(s) unrelated to the research activity. If this occurs, experiments would be immediately halted to verify that experimental design is not a contributing factor. No significant adverse impacts are expected.

4.2.1.3 Impacts of capturing and handling hatchlings

Hatchling turtle work in the field is conducted with animals that are leaving a natural nest or with hatchlings from specifically designated hatcheries. Turtles are handled as described for the collection of samples and tagging for approximately two to four hours before being released at the site of capture well before sunrise. Staff and observers ensure that the hatchlings enter the surf unimpeded by any predators or any light cues that may misdirect them on their beach crawl. Related nesting beach monitoring activities have been safely conducted for over 20 years with no reported adverse impacts on adult turtles or hatchlings (Lohmann et al. 1990, Salmon et al. 1992, Bourgeois et al. 2009). No significant adverse impacts are expected.

4.2.1.4 Impacts of invasive procedures such as tissue sampling, tagging, and transmitter attachment

Tissue sampling (e.g., blood, skin, scute, and fat) is essential for genetic, stable isotope, and health assessment studies to assist in understanding sea turtle population dynamics, biology, and life history. Blood samples are taken using a sterile medical grade needle and syringe and tissue and fat biopsy samples are taken using a biopsy punch or sterile surgical scissors. These routine techniques have been proven to not cause harm to the animal (Bolten *in* Eckert et al. 1999, Owens *in* Eckert et al. 1999, Dutton and Balazs 1996). While fat biopsies are slightly invasive, when performed by skilled personnel using sterile technique, there are no long term adverse impacts expected to occur to individual animals as a result. Diet samples are obtained using gastric lavage by trained personnel according to Forbes and Limpus (1993), and when done properly this technique is considered harmless to the animals. Individual turtles have been lavaged multiple times without detrimental effect, and have been recaptured from the day after the procedure to many years later and appear to be thriving, healthy and feeding normally (Forbes *in* Eckert et al. 1999). The effects of handling on turtles during tissue sampling can result in raised levels of stressor hormones and may cause some discomfort during sampling procedures. However, no adverse effects have been noted when sampling animals, and researchers who examined turtles re-captured two to three weeks after initial capture and sample collection noted that the sample collection site was almost completely healed (Witzell and Dutton, NMFS, pers. comm., 2008).

Flipper tagging has been used for more than 20 years in various sea turtle populations to track sea turtle movement and growth. Turtles are tagged with iconel metal tags or PIT tags using standard techniques (Balazs *in* Eckert et al. 1999). To date, adverse effects from tag attachment have not been observed on any recaptured turtles tagged by the SWFSC (Seminoff and Dutton, NMFS SWFSC, pers. comm., 2009). The small wound-site resulting from a tag applied to a flipper has been observed to heal completely in a short period of time in animals recaptured, and the risk of infection is low, especially because the equipment and tag are sterilized prior to tagging each turtle. PIT tags have the advantage of being encased in glass, which makes them inert, and are positioned inside the turtle where loss or damage over time due to abrasion, breakage, corrosion or age is virtually non-existent (Balazs *in* Eckert et al. 1999, MacDonald and Dutton 1996). Currently available PITs are designed with a coating that promotes growth of muscle fibers to heal and hold the PIT in place when injected into muscle. The application of all types of tags will produce some level of pain to the turtle receiving the tag. The discomfort displayed is usually short and highly variable between individuals. Balazs (*in* Eckert et al. 1999) states that most turtles barely seem to notice when being tagged, while others may exhibit a marked response. Based on past research projects using flipper and PIT tagging techniques conducted by SWFSC scientists in San Diego Bay, CA, Bahia de Los Angeles, Mexico, and St. Croix, US Virgin Islands, no post-tagging infection has been noted (Dutton and Seminoff, NMFS, pers. comm, 2009). In addition, animals tagged in San Diego Bay, for example, have been observed in the initial capture area for over 19 years, indicating that tagging has had no lasting effects on the animals. There are no mortality or long-term adverse effects to the turtle anticipated due to attachment of the flipper tags or insertion of PIT tags. In addition, it is not expected that the collection of a tissue sample will cause any additional stress or discomfort to the turtle beyond what was experienced during the capture, collection of measurements, and tagging.

Transmitters continue to decrease in size as technology advances. The transmitters available for use today weigh approximately 0.1 – 0.2 kg and measure 6.5 cm x 3.5 cm x 2.5 cm. The small size of the transmitters reduces the likelihood that the animals' ability to mate or swim will be adversely affected. To date, more than 100 ultrasonic transmitters have been deployed on turtles in San Diego Bay and no adverse effects from the devices have been noted (Dutton and Seminoff, NMFS, pers. comm., 2009). The attachment of transmitters to the shell of a female sea turtle does not obstruct mating. Females with satellite tags attached to their shell prior to the nesting season have been observed nesting, and examination of the nests after hatching indicated that successful mating and fertilization had occurred (NMFS and NOAA 2006).

For TDRs and video cameras, captive trials and one recapture of a wild turtle demonstrated that base plates are shed from the carapace within ten days of TDR or camera detachment (Seminoff et al. 2006b). Units weigh 0.8 kg out of water, but are neutrally buoyant in water due to a counter weighting system described in section 2.2.2. The attachment location does not interfere with flipper or head movements. With respect to the turtles that will be equipped with multiple large devices (e.g. satellite tag and video camera), such packages are only applied to the largest of turtles (≥90 cm straight carapace length) to reduce any relative drag. Furthermore, the fact that the video camera apparatus detaches within one day suggests that any cumulative effects from multiple tags are very short-term. Turtles outfitted with satellite tags and ultrasonic tags during the same interaction in San Diego Bay have been recaptured in the original capture area indicating that applications of more than one type of transmitter does not have a negative effect on the turtles' behavior (Dutton and Seminoff, NMFS, pers. comm., 2009).

The total weight of transmitter attachments would not exceed 5% of the body mass of the animal and each attachment is made so that there is minimal risk of entanglement. The transmitter attachment must either contain a weak link or have no gap between the transmitter and the turtle that could result in entanglement. Transmitters (TDR, video camera, satellite tags, ultrasonic tags, GPS) used are expected to have negligible effects on the movements of turtles outfitted with them. In previous studies, video camera equipped green turtles exhibited normal diving behavior and swimming speeds (Seminoff et al. 2006b); a study of sonic tracked turtles by Seminoff et al. (2002b) showed that green turtles returned to areas of initial capture, suggesting that the transmitters and the tagging experience left no lasting effect on habitat use patterns; the use of transmitters with angled edges have been shown to substantially reduce hydrodynamic drag of backpack mounted satellite transmitters in experimental conditions (Watson and Granger 1998); and during previous tracking sessions, both telemetered and non-telemetered turtles were seen in the same areas exhibiting roughly similar surface behavior, thus suggesting negligible effects of the transmitter packages.

A programmatic environmental assessment for the Marine Turtle Research Program at the PIFSC reached the conclusions that satellite tagging poses no harm or threat to sea turtles (NMFS and NOAA 2006). The SWFSC does not perform unnecessary sampling on sick or injured animals unless a veterinarian determines the animal is sufficiently healthy for samples to be taken. No mortality or adverse effects to turtles are expected from tagging or tissue sampling. All methods used are performed by trained personnel and have been peer-reviewed and used by sea turtle researchers worldwide.

Table 3. Estimated number of turtles to be directly affected annually by various research techniques in support of proposed research programs, and expected mortalities that may occur as a direct result. * indicates species where the lavage technique is used.

Research Techniques	Anticipated # of Turtles Directly Affected Annually by Species					Expected # of Turtle Mortalities
	Green*	**Hawksbill**	**Leatherback**	**Loggerhead***	**Olive Ridley***	
Aerial surveys	unlimited	unlimited	unlimited	unlimited	unlimited	0
Capture, external inspection, measure, weigh, tissue collection, photograph, flipper and PIT tag, release, lavage*	2,500	500	1,000	1,500	500	0
Fat biopsy and ultrasound	25	0	50	25	0	0
Hatchling tagging and blood sampling	0	0	10,000	0	0	0
Opportunistic sampling of individuals as a result of an incidental encounter (fishery bycatch, entrainment, or other)	10	10	3	5	10	0
Attachment of Transmitters						
Sonic	50	10	20	1	1	0
Satellite	20	10	20	10	10	0
Video Camera	20	0	20	10	10	0
TDR	20	0	20	0	0	0
Sonic + Satellite	5	5	0	1	1	0
Sonic + Video Camera	5	0	0	0	0	0
Sonic + TDR	10	0	0	0	0	0

4.2.2 Biological Impacts on Non-target Species

The risks of incidentally catching or disturbing a marine mammal or other marine vertebrate or invertebrate with the gear used to evaluate turtle biology and behavior are considered very slim, and precautions are in place to avoid these interactions entirely. For example, nets are not set out when marine mammals are known to be in the vicinity, nets are immediately pulled from the water if marine mammals are sighted, and any incidentally caught marine mammal or marine vertebrate or invertebrate that is caught is immediately untangled and released back into the water away from the nets to prevent recapture.

Due to the relatively large mesh size of the capture nets and the relatively small fish and invertebrates that are expected to be found in most study areas, taking or harassing fish or other wildlife by use of the capture net is not anticipated. The short duration of soak time between net checks (30 minutes) helps ensure that any animal that is caught or entangled in the capture net will be removed relatively quickly, which minimizes the potential stress and risk of injury or mortality for non-target species.

No sea birds or marine mammals are anticipated to be taken incidental to these research programs. Protocols are in place such that the area would be scanned for any marine mammals prior to setting nets to reduce the risk of entanglement. Should any marine mammals be seen in the research areas, researchers would wait until the animals leave the area prior to setting the net. None of the ESA-listed animals or those protected under the MMPA are expected to be directly affected or adversely impacted as a result of the proposed action.

Cartilaginous fishes that may be incidentally taken include the gray smoothhound shark (*Mustelis californicus*) and the bat ray (*Myliobatis californica*). Bony fish species of any significant size that are found in the area and may be incidentally taken include: California barracuda (*Sphyraena argentea*), California corbina (*Menticirrhus undulatus*), white seabass (*Atractoscion nobilis*), striped mullet (*Mugil cephalus*), yellowfin croaker (*Umbrina roncador*), California halibut (*Paralichthys californicus*), diamond turbot (*Hypsopsetta guttulata*), spotted turbot (*Pleuronichthys ritteri*), and tilapia (*Oreochromis spp*.). We anticipate that no more than 10 of each of these species would be caught in the net annually due to the large mesh size of the sampling net. No mortality would be expected due to the anticipated short duration of capture time for any animals because of the constant monitoring of the sample net.

The invertebrate striped shore crab (*Pachygrapsus crassipes*) may be incidentally taken during routine netting operations. While it is unlikely that this small crab would be captured by the net, it is possible that crabs might be exploring the net for food and could latch on to it with their claws during net retrieval. It is estimated that up to 500 crabs may be brought up out of the water annually during experimentation. Careful handling of all bycatch species will help ensure that no mortality will be associated with their release.

An estimated 200 to 500 individual jellyfish would be permanently removed from their habitat annually for research purposes. However, given the existing biomass of gelatinous zooplankton and their increasing abundance and ability to rapidly replenish as described in section 3.1.2, this small scale sampling is not expected to adversely impact populations of jellyfish.

No significant adverse impacts to non-target species are expected.

4.2.3 Impacts on Marine Protected Areas

None of the National Marine Sanctuaries, World Heritage Sites, or other marine conservation areas nor their protected species would be adversely impacted by the proposed research programs and their associated activities. The proposed research activities in the regions described in section 3.2 occur offshore in open ocean areas, are transient in time and space, and would not impact nesting beaches or near shore areas. Responsible sea turtle research within these areas is encouraged and supported. Additionally, nesting beaches in Costa Rica and the waters surrounding the Galapagos Islands are protected and closely monitored as conservation areas and as such are carefully regulated. Aerial surveys in or around the National Marine Sanctuaries specified have already been approved by permits. Specific regulations and special conditions such as overflight altitudes and restriction zones for different marine sanctuaries to prevent disturbances to wildlife are provided in the permit and would be adhered to during any research activities conducted in any of these areas.

Research involving sampling and genetic fingerprinting of leatherback hatchlings in designated critical habitat at the Sandy Point National Wildlife Refuge in St. Croix by the SWFSC in cooperation with the West Indies Marine Animal Research and Conservation Service has been approved by USFWS permits to perform research (section 4.5). Specific regulations are provided in the permit including: all researchers must be properly trained to conduct research activities; authorized personnel will only retrieve naturally emerging hatchlings from the surface of the sand; hatchlings will be held in a container lined with damp sand with minimal disturbance; hatchlings will be released within two hours of initial collection, and sooner if possible; coordination of hatchling release; and no more than 8,000 hatchlings will be sampled for the duration of the project. These and other regulations as specified would be adhered to during any research activities conducted in this critical habitat.

Should the current proposal to include open ocean marine areas off of the coasts of California, Oregon, and Washington totaling an area of approximately 70,000 square miles as critical habitat for leatherbacks be approved, any research conducted within this area would require appropriate compliance with the ESA.

4.3 Cumulative Impacts

Though difficult to accurately quantify, the incremental impact of the effects of the research activities at the Marine Turtle Genetics Program and the Marine Turtle Ecology & Assessment Program when added to other past, present, and reasonably foreseeable future actions is likely to be positive in nature. 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 sections 2.2.2 and 4.2, research designs, research approaches, and standard operating research procedures are crafted to minimize the impact on the environment and turtles in particular. Section 4.2 provides details on potential environmental impacts that could result from implementation of the research on sea turtles and the surrounding marine environment, and section 1.4 outlines the resources that would not be affected at all. Chief among these are risks of adverse impacts to sea turtles from invasive research procedures and potential for injury or mortality during capture or handling. However, as outlined in section 4.2.1, while short term transient effects may occur as a result of handling, no significant long term impacts are expected to occur to individual sea turtles as a result of the proposed research programs or their related research activities.

The proposed research activities are likely to have net cumulative effects that are positive in that they: a) support current sea turtle monitoring programs in various parts of the world; b) establish community outreach programs and positive partnerships with foreign governmental agencies and non-governmental organizations to encourage a sense of environmental stewardship; and c) are highly likely to develop into usable strategies to help reduce sea turtle interactions and incidental mortalities.

The proposed research programs and their related research activities 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.

The goals of the proposed research programs are intertwined with unpredictable ongoing activities in the environment such as natural predation, weather-related habitat disturbances, and other forces that may influence affected ecosystems, all of which have unquantifiable influences and impacts on achieving such a goal. Domestic and foreign longline fisheries would continue to operate, and large numbers of all species of sea turtles would likely continue to be taken as bycatch. However, cooperation with U.S. and international regulatory agencies also aiming to reduce sea turtle bycatch and increase sea turtle stocks worldwide through fishing regulations, increased protection and awareness, anti-poaching laws, and research-based gear modifications increases the likelihood that cumulative effects from these sources will be influential, as opposed to adverse, in the conservation of sea turtle species and habitats worldwide.

4.4 Summary of Impacts by Alternative

Alternative 1, the No Action Alternative, would have no direct, indirect, or cumulative impacts on most resources; however, its implementation has potentially significant negative impacts on sea turtle populations over time. Under Alternative 2, the Proposed Action, and Preferred Alternative, there are no impacts expected in marine protected areas including world heritage sites and critical habitats and for non-target species, and there are no significant long term impacts on individual sea turtles expected as a result of the proposed research. Positive impacts over time, both indirect and cumulative, are anticipated for sea turtle individuals and populations as a result of Alternative 2. Positive impacts include the maintenance and monitoring of endangered and threatened sea turtle populations worldwide through the information discovered via data collection and implementation of research-based conservation strategies.

4.5 Existing Permits

The SWFSC and contracted researchers ensure compliance with all state, Territorial, Federal and foreign (country-specific) regulations and permit requirements regarding protected species research.

Permits authorizing endangered species takes for scientific research subject to the provisions of the Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq*.), the regulations governing the taking, importing and exporting of endangered and threatened species (50 CFR Parts 222-226), and specific terms and conditions set forth in individual permits are already in place for the research programs outlined in this PEA. Appropriate permits to conduct aerial surveys and related research activities within specific National Marine Sanctuaries in accordance with the National Marine Sanctuaries Act (NMSA; 16 U.S.C. 1431 *et seq*.) and regulations thereunder (15 CFR Part 922) have also been obtained in support of research program activities. ESA implementing regulations at 50 CFR § 222.310 for threatened and endangered species provides permit authority for the federal research that opportunistically samples stranded or incidentally captured animals.

Jurisdiction under the ESA for sea turtle research extends up to the territorial limits of another country, such that any research conducted on foreign nesting beaches or offshore within that country's territorial waters is not subject to the provisions of the ESA and thus a U.S. ESA permit is not required for those research activities. Table 4 outlines the active permits that have been approved and would be maintained for proposed and future research activities in support of the research activities outlined in the Proposed Action. Note that where permits are not required under the ESA, in-country laws and regulations are upheld, and approval for proposed research has been granted.

All research would be conducted in compliance with all State (such as institutional Animal Care and Use Committee) and Federal regulations and international agreements and permit requirements regarding scientific research and trials within federal waters and within the EEZs of other cooperating nations. No actions would be taken in areas protected by any country with which SWFSC works.

Table 4. Description of permits currently in place in support of outlined current and proposed research activities.

Project	Location	Permit Number	Expiration Date
Marine mammal and sea turtle assessment research involving low-altitude overflights and deployments of expendable bathythermographs from vessels	Within the Olympic Coast, Cordell Bank, Monterey Bay, Gulf of the Farallones, and Channel Islands National Marine Sanctuaries, except as specified in permit Special Conditions.	MULTI-2008-003	12-31-2013
Permit to take endangered species for scientific research	Pacific Ocean waters off the coasts of California, Oregon, and Washington	NMFS Research Permit 1596-02	2-1-2012
Permit to take endangered species for scientific research	San Diego Bay	NMFS Research Permit 1591	10-31-2012
Permit to take endangered species for scientific research	San Gabriel River and Alamitos Bay in Long Beach, California	NMFS Research Permit 14510	04-30-2015
Sampling and genetic fingerprinting of leatherback hatchlings on St. Croix for measuring life history parameters of the leatherback turtle	Sandy Point National Wildlife Refuge, St. Croix	Special Use Permit 41526-2009-006	12-31-2010 (renewable yearly)
CITES Import Permit	Authorizes import of biological samples from live captured or salvaged dead sea turtles	10US844694/9	05-19-2011 (renewable yearly)

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Finding of No Significant Impact
Marine Turtle Genetics Program and Marine Turtle Ecology and Assessment Program at the Southwest Fisheries Science Center
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National Oceanic and Atmospheric Administration Administrative Order 216-6 (NAO 216-6) (May 20, 1999) contains criteria for determining the significance of the impacts of a proposed action. In addition, the Council on Environmental Quality (CEQ) regulations at 40 C.F.R. 1508.27 state that the significance of an action should be analyzed both in terms of "context" and "intensity." Each criterion listed below is relevant in making a finding of no significant impact and has been considered individually, as well as in combination with the others. The significance of this action is analyzed based on the NAO 216-6 criteria and CEQ's context and intensity criteria. These include:

Can the proposed action reasonably be expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat as defined under the Magnuson-Stevens Act and identified in Fishery Management Plans (FMPs)?

Response: No. Methods that would be used relative to this proposed action are conducted primarily offshore or in near shore areas that do not contact the bottom, thus there are no effects on benthic habitat, including benthic portions of Essential Fish Habitat (EFH) designated under Section 305(b) of the Magnuson Stevens Fishery Conservation and Management Act (Magnuson Stevens Act or MSA). The nature of the proposed research projects involves removing sea turtles from pelagic or near shore habitats for short periods of time for serum or tissue sampling, tagging and subsequent release, and the projects would not pose any measurable impact on surrounding environments, the water column, and benthic habitats. Similarly, research involving nesting beaches would involve short-term work directly with sea turtles and hatchlings, and would not pose any measurable impacts on surrounding environments and habitats.

Can the proposed action be expected to have a substantial impact on biodiversity and/or ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.)?

Response: No. The proposed research activities are not expected to have substantial impacts on biodiversity or ecosystem function because the proposed research activities deal primarily with biological data collection from individual animals rather than at the ecosystem level. Any sampling or involvement at the ecosystem level would be extremely limited in time and scope, such as removal of a turtle from its natural environment for a short period of time, thus no adverse impacts are expected to occur.

Can the proposed action be reasonably expected to have a substantial adverse impact on public health or safety?

Response: No. The proposed research activities are not expected to have any impacts on public health or safety. Any research efforts involving areas open to the public ensures that, while members of the public may watch activities involving stranded sea turtles or sea turtle examinations and releases from a distance, they are not allowed to assist or approach in any way. Any research activities that are conducted on the open ocean would not generate any effects (e.g., pollution plumes) that would migrate to population centers. The safety of research personnel is considered first and foremost in all program sponsored activities, and continuous safety training is conducted for all personnel in the implementation of techniques and protocols in the laboratory and the field. As a result, the general public would not be affected in any way by the proposed action.

Can the proposed action reasonably be expected to adversely affect endangered or threatened species, their critical habitat, marine mammals, or other non-target species?

Response: No. The proposed research activities are not expected to adversely affect endangered or threatened species or critical habitat, as defined under the Endangered Species Act of 1973. The proposed research programs are anticipated to benefit endangered and threatened species of sea turtles by gathering data aimed at long term recovery and conservation using research techniques that have been proven to be safe, as described in sections 2.2 and 4.2.1 of this PEA. Research involving sampling and genetic fingerprinting of leatherback hatchlings in designated leatherback critical habitat at the Sandy Point National Wildlife Refuge in St. Croix has been approved by USFWS permits to perform research (section 4.5), and related activities are not expected to adversely affect this critical habitat due to adherence to the specific rules and regulations outlined in the permit and the short-term, transient nature of the research. With respect to other species, the risks of incidentally catching or disturbing a marine mammal or other marine vertebrate or invertebrate with the gear used to evaluate turtle biology and behavior are considered very slim, and precautions are in place to avoid these interactions entirely, as described in section 4.2.2.

Are significant social or economic impacts interrelated with natural or physical environmental effects?

Response: No. The proposed research programs and their associated research activities are not expected to adversely impact economies of foreign nations, nor are they expected to affect any social customs and/or fishing and other related livelihoods of the communities involved. Any effects on the economies of domestic and foreign nations whose communities are cooperating with the research programs would be extremely minor and primarily positive in nature (e.g., through the employment of local guides and training programs).

Are the effects on the quality of the human environment likely to be highly controversial?

Response: No. There are no effects on the quality of the human environment that are likely to be controversial as a result of the proposed research programs and related research activities, especially considering that the research programs are likely to have overall positive effects on endangered and threatened sea turtle species. In addition, there is an active program at the SWFSC promoting public education and awareness which allows for the open explanation of various aspects of ongoing research activities.

Can the proposed action reasonably be expected to result in substantial impacts to unique areas, such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers or ecologically critical areas?

Response: No. No unique terrestrial areas would be affected by the proposed action. None of the National Marine Sanctuaries, World Heritage Sites, or other marine conservation areas nor their protected species would be adversely impacted by the proposed research programs and their associated activities. The proposed research activities in the regions described in section 3.2 are transient in time and space, and would not impact nesting beaches or nearshore areas. Additionally, nesting beaches in Costa Rica and the waters surrounding the Galapagos Islands are protected and closely monitored as conservation areas and as such are carefully regulated. Responsible sea turtle research within these areas is encouraged and supported. Aerial surveys in or around the National Marine Sanctuaries specified have already been approved by permits. Specific regulations and special conditions such as overflight altitudes and restriction zones for different marine sanctuaries to prevent disturbances to wildlife are provided in the permit and would be adhered to during any research activities conducted in any of these areas.

Are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?

Response: No. The procedures, methods, and mitigation measures that are proposed and outlined in section 2.2.2 are accepted worldwide in the sea turtle research scientific community and have proven effective in various parts of the world over many years. The proposed research programs are primarily a continuation of studies that have well-understood and minimal direct effects on the human environment and similarly well-understood and minimal risks to target and non-target species.

Is the proposed action related to other actions with individually insignificant, but cumulatively significant impacts?

Response: No. The past, present, and future research activities are not likely to have had or have any significant adverse cumulative effects on the environment. In conjunction with the conservation goals of other agencies, any cumulative impacts of the proposed research activities would likely be beneficial to sea turtle populations.

Is the proposed action likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural or historical resources?

Response: No. The proposed research programs and related research activities would not take place at any districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places. Similarly, the proposed research activities are not likely to cause any loss or destruction of scientific, cultural or historical resources primarily because the proposed activities will not involve any cultural or historical resources, and any involvement of scientific resources, such as endangered sea turtles, are limited in time and scope, non-destructive, and minimally invasive.

Can the proposed action reasonably be expected to result in the introduction or spread of a non-indigenous species?

Response: No. The proposed research activities are not expected to result in the introduction or spread of non-indigenous species. The species involved in the proposed research activities are native to the study region, and any equipment used is either disposable or sanitized between uses.

Is the proposed action likely to establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration?

Response: No. The purpose of the research programs is to gather information that may be used to benefit conservation efforts for marine turtle species. The basic methods and procedures for research activities sponsored by the proposed research programs are widely accepted in the scientific research community and have already been published in peer-reviewed scientific literature. Any additional methods to be used as part of the research programs builds upon existing techniques or information in an attempt to further improve data collection and analysis and results obtained from the proposed research will be subject to further review and potential modification, which is an integral part of the scientific research process. To the extent that these methods establish a precedent for future studies, the precedent will be based on the quality of the data obtained, and will consider the minimization of the adverse impacts to the resources being studied. As such, this research continues research already completed and/or parallels research being conducted in other areas, and therefore does not represent a precedent for future actions.

Can the proposed action reasonably be expected to threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment?

Response: No. The proposed research programs would only operate with all the necessary and required permits and approvals from Federal, state, local, and foreign agencies and thus are not expected to violate such laws and requirements. As described in section 4.5, permits are already in place in support of research activities, including a Section 10 (a)(1)(A) permit authorizing sea turtle takes and scientific research under the Endangered Species Act. Jurisdiction under the ESA for sea turtle research extends up to the territorial limits of another county, such that any research conducted on foreign nesting beaches or offshore within that country's territorial waters is not subject to the provisions of the ESA and thus a U.S. ESA permit is not required for those research activities, although appropriate in-country regulations are upheld.

Can the proposed action reasonably be expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?

Response: No. The proposed research activities are not expected to have adverse cumulatively significant impacts. The goal of the proposed research programs are to generate new data and information on strategies that have the potential for supporting the recovery of sea turtle populations worldwide. Field research activities focus on individual sea turtles rather than non-target species, and as such are not expected to have any adverse cumulative effects on surrounding ecosystems or species inhabiting them. In conjunction with the conservation goals of other agencies, any cumulative impacts of the proposed research activities would likely be beneficial to sea turtle populations.

DETERMINATION

In view of the information presented in this document and the analysis contained in the supporting Programmatic Environmental Assessment prepared for the Marine Turtle Genetics Program and the Marine Turtle Ecology & Assessment Program at the Southwest Fisheries Science Center, it is hereby determined that the proposed research programs will not significantly impact the quality of the human environment. In addition, all beneficial and adverse impacts of the proposed action have been addressed to reach the conclusion of no significant impacts. Accordingly, preparation of an EIS for this action is not necessary.

Acting Director, Southwest Fisheries Science Center
Responsible Program Manager

9/23/10
Date