NOAA's National Marine Fisheries Service
Endangered Species Act Section 7 Consultation

Biological and Conference Opinion

Agency: Permits, Conservation, and Education Division of the Office of Protected Resources, NOAA's National Marine Fisheries Service

Activity Considered: Biological and Conference Opinion on the proposal to issue Permit Number 1596-03 to the NMFS Southwest Fisheries Science Center to authorize research on leatherback sea turtles off the California, Oregon, and Washington coasts in the North Pacific Ocean, pursuant to Section 10(a)(1)(A) of the Endangered Species Act of 1973

Consultation Conducted by: Endangered Species Division of the Office of Protected Resources, NOAA's National Marine Fisheries Service

Approved by: _____

Date: APR 2 1 2011

Section 7(a)(2) of the Endangered Species Act (ESA) (16 U.S.C. 1536(a)(2)) requires that each federal agency shall ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When the action of a federal agency "may affect" a listed species or critical habitat designated for them, that agency is required to consult with either NOAA's National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service, depending upon the listed resources that may be affected. For the action described in this document, the action agency is the NMFS' Office of Protected Resources – Permits, Conservation, and Education Division. The consulting agency is the NMFS' Office of Protected Resources – Endangered Species Division.

This document represents the NMFS' biological and conference opinion (Opinion) of the effects of the proposed research on the endangered leatherback sea turtles, and this species' proposed critical habitat, as has been prepared in accordance with Section 7 of the ESA. This Opinion is based on our review of the Permits, Conservation, and Education Division's draft Environmental Assessment, draft permit 1596-03, the permit application from NMFS Southwest Fisheries Science Center, annual reports of past research completed by the applicant and holders of similar permits, recovery plans for listed species, scientific and technical reports from government agencies, peer-reviewed literature, biological opinions on similar research, and other sources of information.

Consultation history

The NMFS' Permits, Conservation, and Education Division (Permits Division) requested initiation of section 7 consultation with the NMFS' Endangered Species Division on the proposal to issue a third amendment to permit 1596. Issuance of the permit constitutes a federal action, which may affect marine species listed under the ESA

In 2007, the Permits Division issued permit 1596, authorizing the NMFS Southwest Fisheries Science Center to conduct research on leatherback sea turtles. The Endangered Species Division conducted a formal section 7 consultation on the issuance of this permit and determined that it was not likely to jeopardize the continued existence of the leatherback sea turtle.

Subsequently, the Permits Division issued two amendments to the original permit. In 2008, the Permits Division substituted suction-cup tag attachments to replace the harness attachment for satellite tags. It was determined that this action did not require formal consultation, as it did not cause effects to the listed species that were not considered in the previous Opinion. In 2009, the Permits Division authorized a suite of sampling and tagging procedures for captured turtles. The Endangered Species Division concluded in its Opinion that this action was not likely to jeopardize the continued existence of the leatherback sea turtle.

On September 15, 2010, the Permits Division requested initiation of section 7 consultation with the NMFS' Endangered Species Division on the proposal to issue a third amendment to permit 1596, to use the method of medial ridge attachment for satellite tags.

During September and October, the Endangered Species Division requested additional information, and on October 15, 2010, the Endangered Species Division formally initiated consultation with the Permits Division.

Description of the proposed action

NMFS' Permits Division proposes to amend a permit for scientific research pursuant to section 10(a)(1)(A) of the ESA (16 U.S.C. 1531 et seq). Issuance of permit amendment 1596-03 to NMFS Southwest Fisheries Science Center would replace the current permit and authorize research on leatherback sea turtles off the California, Oregon, and Washington coasts in the North Pacific Ocean.

The current Permit No. 1596-02 authorizes the SWFSC to capture, measure, weigh, blood and tissue sample, photograph, flipper and passive integrated transponder (PIT) tag, fat biopsy, ultrasound, and attach a satellite tag, using a harness, with a VHF/TDR/sonic tag/video system, VHR/TDR/sonic tag/GPS unit, or VHR/TDR/sonic tag/GPS/video camera system to leatherback sea turtles during research activities conducted off the western coast of the continental United States. Animals with the video camera system can be re-approached to collect the unit and then sampled, tagged, and have another video camera unit attached.

The SWFSC requests that its permit be amended to use a direct tag attachment method in place of the previously authorized harness attachments to conform to recent studies demonstrating that the new method of tag attachment directly to the medial ridge of the

turtle carapace lessens hydrodynamic impacts to the sea turtle (Fossette *et al.* 2008). In addition, to maximize the data the SWFSC could obtain from an individual, the applicant also requests to attach a VHF/TDR/Sonic tag/GPS/Video camera system by suction cup to the free-swimming turtle prior to capture. The research would continue to occur in waters off the coast of the western United States through February 1, 2012. The proposed actions and "take"[1] authorizations can be found in Table 1. Bold indicates the changes to the take table from the previous permit.

Table 1: Take Table

Table 1: Maximum annual takes of leatherback sea turtles (*Dermochelys coriacea*) under Permit No. 1596-**03**.

Number of Turtles	Life Stage	Research Take Activities
10	Adult or Large Immature	Capture, measure, weigh, blood and tissue sample, photograph, flipper and PIT tag, fat biopsy, ultrasound.
8	Adult or Large Immature	**Close approach turtle in water, attach VHF/TDR/Sonic tag/GPS/Video camera system by suction cup AND** Capture, measure, weigh, blood and tissue sample, photograph, flipper and PIT tag, and satellite tag (**direct medial ridge tag attachment**), fat biopsy, ultrasound.
20	Adult or Large Immature	Close approach turtle in water, attach VHF/TDR/Sonic tag/GPS/Video camera system by suction cup AND capture, measure, weigh, fat biopsy, ultrasound, blood and tissue sample, photograph, flipper and PIT tag, and attach VHF/TDR/GPS/Sonic tag/Video camera system by suction cup before release.
20	Adult or Large Immature	Close approach turtle in water, attach VHF/TDR/Sonic tag/GPS unit by suction cup to free-swimming animal, track AND tissue sample with biopsy pole. Does not include capture of animals.

Researchers would conduct aerial surveys (at 650 to 1000 feet, depending on regulations) off the coasts of California, Oregon, and Washington to determine abundance and distribution of leatherbacks. Because of the altitude at which the aerial surveys would occur, the Permits Division does not include any permitted "take" of listed species in the permit.

Capture and release operations off central California would be conducted aboard a 30' x 10' PackCat aluminum hull landing craft. In areas outside of the coastal central California and Oregon/Washington study areas that are too far for access by the small landing craft vessel the captured turtle would be quickly brought alongside to the stern of a small capture boat (approximately 10 meters) and guided up a short ramp onto a raised platform.

[1] The ESA defines "take" as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." The term "harm" is further defined by regulations (50 CFR §222.102) as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including breeding, spawning, rearing, migrating, feeding, or sheltering."

Leatherback sea turtles, no smaller than 100 cm in curved carapace length, would be captured by the break-way hoop net procedure, and their physical condition would be evaluated and monitored during the procedure. All other handling, monitoring, and release protocols would be conducted as currently authorized in the permit, including weighing, measuring, photographing, flipper and PIT, tagging, blood sampling, fat biopsy, ultrasound, and suction-cup tagging.

Co-investigator Scott Benson, who has been trained in the method of medial ridge direct attachment by researchers at the Canadian Sea Turtle Network, would perform the attachment procedure. The site for satellite transmitter attachment would be the medial ridge of the carapace, at the point where the ridge is most prominent, generally posterior to the widest area of the carapace to lessen the drag effect of the tag on the turtle, relative to attachment near the leading edge of the carapace. The site would be sterilized with three applications of Betadine antiseptic and isopropyl alcohol and then desensitized with topical anesthetic (ethyl chloride).

Two 4.5-mm diameter holes would be drilled into the medial ridge at a horizontal angle with an orthopedic drill bit; the drill bit would not enter the body cavity and each hole would only penetrate a few millimeters into the carapace ridge. Prior to and between each use, the drill bit would be sterilized with Betadine. Surgical tubing, also sterilized prior to use in Betadine, would then be inserted into the holes to act as a sheath for the tether.

Plastic-coated flexible braided stainless steel wire (1.8 mm diameter) would be slid into the surgical tubing inside the holes. Each end of the wire would be looped by a corrodible stainless steel crimp after insertion through the sheath (Figure 1). To form the base on the carapace for the satellite tag, a fast-setting, non-adhesive, cold curing silicone putty would be place over the medial ridge; this putty was selected for this purpose because it would not compress at depth and it would conform to the shape of the ridge.

Figure 1: Plastic-coated flexible braided stainless steel wire.

The transmitter (Wildlife Computers, model Mk10 “ridgemount”) has been designed for direct attachment to the medial ridge of a leatherback turtle, in the shape of an inverted “V” (Figure 2). The tag weighs approximately 8 ounces and is 130 mm in length, 80 mm wide, and 40 mm high. The transmitter would be placed on the putty base, and the wire

tether line tightened over the tag with the loops at each end secured with cable ties on top of the tag. One week prior to attachment, the transmitter would be painted with a non-toxic anti-fouling marine paint (e.g., ceramic epoxy) (Johnson and Gonzalez 2004). Photos would be taken of the mounted transmitter to document position on the medial ridge and included in each turtle's medical record to evaluate wound healing at the attachment site should recapture occur.

Figure 2: Transmitter model and attachment. Photos courtesy of UNH Large Pelagics Research Center

Based on the results of a lab study conducted by the NMFS Pacific Islands Fisheries Science Center, researchers expect that the crimps in the tether would corrode after one year. Therefore, it is expected that the transmitter would remain attached for one year. With the crimps gone, the tag would fall out, pulling the tethers out of the drill tract.

Medial ridge attachments would only be performed by properly trained individuals on healthy turtles based on observations of behavior and movement. Healthy turtles are defined as those animals that are able to actively swim and dive, show evidence of recent foraging activity (i.e., bits of jellies in or around mouth), demonstrate symmetrical use of the head and limbs, are mentally alert, in good nutritional condition, and have no evidence of recent debilitating traumatic injury or epibiont loads that compromised normal movement.

Permit conditions

The proposed permit lists general and special conditions to be followed as part of the proposed research activities. These conditions are intended to minimize the potential adverse effects of the research activities on targeted endangered species and include the following that are relevant to the proposed permit:

- In the event of serious injury or mortality or if the permitted “take” is exceeded, researchers must suspend permitted activities and contact the Permits Division by phone within two business days, and submit a written incident report. The Permits Division may grant authorization to resume permitted activities.
- Permit holders must exercise caution when approaching animals and must retreat from animals if behaviors indicate the approach may be interfering with reproduction, feeding, or other vital functions.
- All equipment used for invasive procedures, including drill bits, must be cleaned and sterilized between animals. A separate set of sampling equipment for handling animals displaying fibropapillomas tumors/or lesions.
- All turtles must be examined for existing tags before attaching or inserting new ones. If existing tags are found, the tag identification numbers must be recorded and included in the annual report.
- Turtles are to be protected from temperature extremes of heat and cold, provided adequate air flow, and kept moist during sampling. Turtles must be placed on pads for cushioning and this surface must be cleaned and disinfected between turtles. The area surrounding the turtle may not contain any materials that could be accidentally ingested.
- The number of attempts to capture a turtle is limited to 6 in a 24-hour period. If researchers are unsuccessful after the first 4 attempts they must wait a minimum of 3 hours before making the final 2 attempts for the day. During release, turtles must be lowered as close to the water’s surface as possible to prevent potential injuries. Researchers must carefully observe newly released turtles and record observations on the turtle’s apparent ability to swim and dive in a normal manner. This information must be included in the annual reports.
- Blood samples shall be taken by experienced personnel that have been authorized under this permit and new sterile disposable needles must be used on each animal. Care should be taken to ensure no injury results from the sampling. If an animal cannot be adequately immobilized for blood sampling, efforts to collect blood must be discontinued. Attempts to extract blood (needle insertions) from the dorsal sinus shall be limited to a total of 4, 2 on either side of the neck, and attempts from the hind flipper shall be limited to a total of 4, 2 on each side. A single sample shall not exceed 3 ml per 1 kg of animal. Severely compromised or injured turtles must not be sampled unless specifically authorized by NMFS or during treatment by a veterinarian for a specific health problem. Researchers must, to the maximum extent practicable, attempt to determine if any of the turtles they blood sample may have been sampled within the past 3 months or will be sampled within the next 3 months by other researchers.
- For biopsy sampling, a new biopsy punch must be used on each turtle. For turtles brought on-board for sampling, sterile techniques must be used at all times. Turtles too large to bring on-board must be sampled using a pole biopsy in the most safely and easily accessible location for the researcher.

- For TDRs, VHF, sonic or satellite tags, total weight of transmitter attachments must not exceed 5% of the body mass of the animal. Each attachment must be made so that there is no risk of entanglement. The transmitter attachment must either contain a weak link (where appropriate) or have no gap between the transmitter and the turtle that could result in entanglement. The lanyard length (if used) must be less than 1/2 of the carapace length of the turtle. It must include a corrodible, breakaway link that will corrode and release the tag-transmitter after the tag-transmitter life is finished. Transmitters and transmitter attachments must be as hydrodynamic as possible. Researchers must not use putty with an exothermic hardening reaction that may damage the carapace.
- Leatherbacks must only be brought on board if it can be done easily and safely. Leatherback turtles must be handled by at least two people, one on either side of the turtle, and precautions must be taken to ensure that animals are supported from underneath. Leatherback turtles must not be turned on their back.
- This permit would only authorize the attachment of satellite transmitters by the medial ridge method on up to 8 leatherbacks annually. Use of this technique beyond the fifth year would be authorized only after review of the results of the fifth year and issuance of written authorization from the Chief, Permits, Conservation and Education Division, NMFS PR for additional attachment takes.
- Detailed information must be provided to NMFS PR describing the effects of each individual attachment of these tags to the turtle, the condition of the carapace attachment site after attachment, condition of the turtle upon release, and the behavior and survival of each individual turtle as determined from observations and tag data.
- If at any time researchers discover that the attachment of a transmitter to a turtle is compromising the health of the animal (e.g., animal exhibits infection due to attachment, unusual behavior, etc.) the Permit Holder must attempt to recapture the animal to remove the transmitter and any wounds must be debrided and cleaned. No additional transmitters of the type causing problems must be attached until the Permit Holder has consulted with the Chief of the Permits Division.

Approach to the assessment

NMFS approaches its section 7 analyses of agency actions through a series of steps. The first step identifies those aspects of proposed actions that are likely to have direct and indirect physical, chemical, and biotic effects on listed species or on the physical, chemical, and biotic environment of an action area. As part of this step, we identify the spatial extent of these direct and indirect effects, including changes in that spatial extent over time. The result of this step includes defining the *Action area* for the consultation. The second step of our analyses identifies the listed resources that are likely to co-occur with these effects in space and time and the nature of that co-occurrence (these represent our *Exposure analyses*). In this step of our analyses, we try to identify the number, age (or life stage), and gender of the individuals that are likely to be exposed to an action's effects and the populations or subpopulations those individuals represent. Once we identify which listed resources are likely to be exposed to an action's effects and the nature of that exposure, we examine the scientific and commercial data available to

determine whether and how those listed resources are likely to respond given their exposure (these represent our *Response analyses*).

The final steps of our analyses – establishing the risks those responses pose to listed resources – are different for listed species and designated critical habitat (these represent our *Risk analyses*). Our jeopardy determinations must be based on an action's effects on the continued existence of threatened or endangered species as those "species" have been listed, which can include true biological species, subspecies, or distinct population segments of vertebrate species. The continued existence of these "species" depends on the fate of the populations that comprise them. Similarly, the continued existence of populations are determined by the fate of the individuals that comprise them – populations grow or decline as the individuals that comprise the population live, die, grow, mature, migrate, and reproduce (or fail to do so).

Our risk analyses reflect these relationships between listed species, the populations that comprise that species, and the individuals that comprise those populations. Our risk analyses begin by identifying the probable risks actions pose to listed individuals that are likely to be exposed to an action's effects. Our analyses then integrate those individual risks to identify consequences to the populations those individuals represent. Our analyses conclude by determining the consequences of those population-level risks to the species those populations comprise.

We measure risks to listed individuals using the individual's "fitness," or the individual's growth, survival, annual reproductive success, and lifetime reproductive success. In particular, we examine the scientific and commercial data available to determine if an individual's probable lethal, sub-lethal, or behavioral responses to an action's effect on the environment (which we identify during our *Response analyses*) are likely to have consequences for the individual's fitness.

When individual listed plants or animals are expected to experience reductions in fitness in response to an action, those fitness reductions are likely to reduce the abundance, reproduction, or growth rates (or increase the variance in these measures) of the populations those individuals represent (see Stearns 1992). Reductions in at least one of these variables (or one of the variables we derive from them) is a necessary condition for reductions in a population's viability, which is itself a necessary condition for reductions in a species' viability. As a result, when listed plants or animals exposed to an action's effects are not expected to experience reductions in fitness, we would not expect the action to have adverse consequences on the viability of the populations those individuals represent or the species those populations comprise (e.g., Brandon 1978; Anderson 2000; Mills and Beatty 1979; Stearns 1992). As a result, if we conclude that listed plants or animals are not likely to experience reductions in their fitness, we would conclude our assessment.

Although reductions in fitness of individuals is a necessary condition for reductions in a population's viability, reducing the fitness of individuals in a population is not always sufficient to reduce the viability of the population(s) those individuals represent. Therefore, if we conclude that listed plants or animals are likely to experience reductions in their fitness, we determine whether those fitness reductions are likely to reduce the viability of the populations the individuals represent (measured using changes in the

populations' abundance, reproduction, spatial structure and connectivity, growth rates, variance in these measures, or measures of extinction risk). In this step of our analysis, we use the population's base condition (established in the *Environmental baseline* and *Status of listed resources* sections of this Opinion) as our point of reference. If we conclude that reductions in individual fitness are not likely to reduce the viability of the populations those individuals represent, we would conclude our assessment.

Reducing the viability of a population is not always sufficient to reduce the viability of the species those populations comprise. Therefore, in the final step of our analyses, we determine if reductions in a population's viability are likely to reduce the viability of the species those populations comprise using changes in a species' reproduction, numbers, distribution, estimates of extinction risk, or probability of being conserved. In this step of our analyses, we use the species' status (established in the *Status of listed resources* section of this Opinion) as our point of reference. Our final determinations are based on whether threatened or endangered species are likely to experience reductions in their viability and whether such reductions are likely to be appreciable.

To conduct these analyses, we rely on all of the evidence available to us. This evidence consists of monitoring reports submitted by past and present permit holders, reports from the NMFS Science Centers, reports prepared by natural resource agencies in States and other countries, reports from non-governmental organizations involved in marine conservation issues, the information provided by the NMFS Permits Division when it initiates formal consultation, the general scientific literature. We supplement this evidence with reports and other documents – environmental assessments, environmental impact statements, and monitoring reports – prepared by other federal and state agencies.

During the consultation, we conducted electronic searches of the general scientific literature. We supplemented these searches with electronic searches of doctoral dissertations and master's theses. These searches specifically tried to identify data or other information that supports a particular conclusion as well as data that do not support that conclusion. When data were equivocal or when faced with substantial uncertainty, our decisions are designed to avoid the risks of incorrectly concluding that an action would not have an adverse effect on listed species when, in fact, such adverse effects are likely (i.e., Type II error).

Action Area

Activities would be conducted year-round, off the California, Oregon, and Washington coasts in the North Pacific Ocean.

Status of listed resources

NMFS has determined that the actions considered in this Opinion may affect the following listed resources provided protection under the ESA, as amended (16 U.S.C. 1531 *et seq*.):

Pinnipeds

Guadalupe fur seal	*Arctocephalus townsendi*	Threatened
Steller sea lion – Eastern DPS	*Eumetopias jubatus*	Threatened

Cetaceans		
Blue whale	*Balaenoptera musculus*	Endangered
Fin whale	*Balaenoptera physalus*	Endangered
Humpback whale	*Megaptera novaeangliae*	Endangered
Killer whale - Southern Resident	*Orcinus orca*	Endangered
North Pacific right whale	*Eubalaena japonica*	Endangered
Sei whale	*Balaenoptera borealis*	Endangered
Sperm whale	*Physeter macrocephalus*	Endangered
Sea Turtles		
Green sea turtle – most areas	*Chelonia mydas*	Threatened
Florida and Mexico's Pacific coast breeding colonies		Endangered
Hawksbill sea turtle	*Eretmochelys imbricate*	Endangered
Leatherback sea turtle	*Dermochelyts coriacea*	Endangered
Loggerhead sea turtle	*Caretta caretta*	Threatened
Olive ridley sea turtle – most areas	*Lepidochelys olivacea*	Threatened
Mexico's Pacific coast breeding colonies		Endangered
Fish		
Chinook salmon ESUs	*Oncorhynchus tshawytscha*	Threatened Endangered
Chum salmon ESUs	*Oncorhynchus keta*	Threatened
Coho salmon ESUs	*Oncorhynchus kisutch*	Threatened Endangered
Green sturgeon – Southern DPS	*Acipenser medirostris*	Threatened
Pacific eulachon/smelt – Southern DPS	*Thaleichthys pacificus*	Threatened
Sockeye salmon ESUs	*Oncorhynchus nerka*	Threatened Endangered
Steelhead trout ESUs	*Oncorhynchus mykiss*	Threatened Endangered
Invertebrates		
Black abalone	*Haliotis cracherodii*	Endangered
White abalone	*Haliotis sorenseni*	Endangered

Species not considered further in this opinion

To refine the scope of this Opinion, NMFS used two criteria (risk factors) to determine whether any endangered or threatened species or critical habitat are not likely to be adversely affected by vessel traffic, aircraft traffic, or human disturbance associated with the proposed actions. The first criterion was *exposure*: if we conclude that particular endangered or threatened species or designated critical habitat are not likely to be exposed to vessel traffic, aircraft traffic, or human disturbance, we must also conclude that those listed species or designated critical habitat are not likely to be adversely affected by the proposed action. The second criterion is *susceptibility* upon exposure: species or critical habitat may be exposed to vessel traffic, aircraft traffic, or human disturbance, but may not be unaffected by those activities—either because of the

circumstances associated with the exposure or the intensity of the exposure-- are also not likely to be adversely affected by the vessel traffic, aircraft traffic, or human disturbance. This section summarizes the results of our evaluations.

The ESA-listed species of pinnipeds and cetaceans, as well as green, hawksbill, loggerhead, and olive ridley sea turtles may occur in the action area, but are not expected to be exposed to the proposed activities. If a protected whale or pinniped is observed in the action area, it would be avoided and the vessel would operate at a reduced speed, following marine mammal viewing guidelines, and therefore the species are not likely to be adversely affected by the proposed action. Aerial surveys would be flown at altitudes to avoid harassment of marine mammals. Only leatherback sea turtles would be targeted for this research, and because of the manner the researchers would attempt to close approach and capture the targeted species, and because of the unique appearance of leatherback sea turtles, it is not likely that they would mistakenly interact with a non-targeted listed sea turtle.

For ESA-listed black and white abalone, green sturgeon (Southern DPS), Pacific salmon and eulachon ESUs that may be present in the action area, the proposed activities would target other species and would be conducted in a manner that is not expected to adversely affect these species.

Critical habitat designated for ESA-listed Pacific salmon and the Southern DPS of green sturgeon occurs within the action area. Designated critical habitat for several ESUs of steelhead and chinook, sockeye, and chum salmon includes nearshore marine waters contiguous with the shoreline from the line of extreme high water out to a depth no greater than 30 m (98 ft) relative to mean lower low water (70 FR 52630; September 2, 2005). The primary constituent elements (PCEs) for these habitat designations include nearshore marine areas free of obstruction and excessive predation with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; natural cover; and offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. Any potential effects to this critical habitat would be insignificant because the proposed activities would not cause obstruction or significantly affect predation, would not cause any significant changes to water quality in designated critical habitat, would not affect forage or the ability for critical habitat areas to support growth and maturation of listed salmon, and would not affect the natural cover in these areas. Therefore, the proposed activities are not expected to adversely affect the conservation value of designated critical habitat for these species.

Designated habitat for the Southern DPS green sturgeon generally includes coastal U.S. marine waters within 60 fathoms depth, from Monterey Bay, California, north to Cape Flattery, Washington, as well as certain rivers, bays, and estuaries (74 FR 52300; October 9, 2009). PCEs are designated for each of the three different systems that green sturgeon at specific life stages; the action area intersects the coastal marine critical habitat, for which the PCEs area migratory corridor, water quality, and food resources. Any potential effects to this critical habitat would be insignificant because the proposed activities would not disrupt the migratory behavior of the fish, would not cause any significant changes to water quality in designated critical habitat, and would not affect food availability.

Therefore, the proposed activities are not expected to adversely affect the conservation value of designated critical habitat for the Southern DPS green sturgeon.

Areas proposed for designation as critical habitat for leatherback also occur within the action area. The proposed areas include approximately 70,600 square miles (182,854 square km) of marine habitat in the Pacific Ocean off the U.S. coast, including two adjacent areas stretching along the California coast from Point Arena to Point Vincente, and one area stretching from Cape Flattery, Washington, to the Umpqua River-Winchester Bay, Oregon, east of a line approximating the 2,000-meter depth contour (75 FR 319). PCEs have been proposed, which may include, but are not limited to, the following: occurrence of prey species of sufficient condition, distribution, diversity, and abundance to support individual as well as population growth, reproduction, and development; and migratory pathway conditions to allow for safe and timely passage and access to/from/within high use foraging areas. The critical habitat review team has determined that only permanent or long-term structures that alter the habitat would be considered as having potential effects on passage, and does not consider fishing gear or vessel traffic as potential threats to passage. The proposed action would not affect the occurrence of prey species or the conditions of leatherbacks' migratory pathways. After reviewing the current status of the areas, and the effects of the proposed research activities, it is NMFS' conference opinion that the proposed activities are not expected to adversely affect the conservation value of proposed leatherback critical habitat.

Although these listed resources may occur in the action area, we believe they are either not likely to be exposed to the proposed research or are not likely to be adversely affected. Therefore, they will not be considered further in this Opinion.

Status of species considered in this opinion

The species narrative that follows focuses on attributes of life history and distribution that influence the manner and likelihood that the species may be exposed to the proposed action, as well as the potential response and risk when exposure occurs. Consequently, the species' narrative is a summary of a larger body of information on localized movements, population structure, feeding, diving, and social behaviors. A summary of the status and trends of the endangered leatherback sea turtle is presented to provide a foundation for the analysis of the species as a whole. We also provide a brief summary of the species' status and trends as a point of reference for the jeopardy determination, made later in this Opinion. That is, we rely on a species' status and trend to determine whether an action's direct or indirect effects are likely to increase the species' probability of becoming extinct. Similarly, the species narrative is followed by a description of its critical habitat with particular emphasis on any essential features of the habitat that may be exposed to the proposed action and may warrant special attention.

Leatherback sea turtle

Description of species

Leatherbacks range farther than any other sea turtle species, having evolved physiological and anatomical adaptations that allow them to exploit cold waters (Frair *et al.* 1972; Greer *et al.* 1973; NMFS and USFWS 1995). Leatherbacks typically associate with continental shelf and pelagic environments and are sighted in offshore waters of 7-27˚ C

(CETAP 1982). However, juvenile leatherbacks usually stay in warmer, tropical waters >21˚ C (Eckert 2002). Males and females show some degree of natal homing to annual breeding sites (James *et al.* 2005).

Population designations

Leatherbacks break into four nesting aggregations: Pacific, Atlantic, and Indian oceans, and the Caribbean Sea. Detailed population structure is unknown, but is likely dependent upon nesting beach location.

Pacific Ocean. Leatherbacks are found from tropical waters north to Alaska within the North Pacific and is the most common sea turtle in the eastern Pacific north of Mexico (Eckert 1993; Stinson 1984; Wing and Hodge 2002). The west coast of Central America and Mexico hosts nesting from September-March, although Costa Rican nesting peaks during April-May (Chacón-Chaverri and Eckert 2007; LGL Ltd. 2007). Leatherback nesting aggregations occur widely in the Pacific, including Malaysia, Papua New Guinea, Indonesia, Thailand, Australia, Fiji, the Solomon Islands, and Central America (Limpus 2002; Dutton *et al.* 2007). Significant nesting also occurs along the Central American coast (Márquez 1990).

Atlantic Ocean. Nesting aggregations have been documented in Gabon, Sao Tome and Principe, French Guiana, Suriname, and Florida (Márquez 1990; Bräutigam and Eckert 2006; Spotila *et al.* 1996). Widely dispersed but fairly regular African nesting also occurs between Mauritania and Angola (Fretey *et al.* 2007). Many sizeable populations (perhaps up to 20,000 females annually) of leatherbacks are known to nest in West Africa (Fretey 2001).

Indian Ocean. Nesting is reported in South Africa, India, Sri Lanka, and the Andaman and Nicobar islands(Hamann *et al.* 2006).

Caribbean Sea. Nesting occurs in Puerto Rico, St. Croix, Costa Rica, Panama, Colombia, Trinidad and Tobago, Guyana, Suriname, and French Guiana (Márquez 1990; Bräutigam and Eckert 2006; Spotila *et al.* 1996). Beaches bordering the action area along the western Puerto Rican coast are home to roughly 15-30 nests per year (Scharer pers. comm.).

Migration

Leatherback sea turtles migrate throughout open ocean convergence zones and upwelling areas, along continental margins, and in archipelagic waters (Morreale *et al.* 1994; Eckert 1998; Eckert 1999). In a single year, a leatherback may swim more than 9,600 km to nesting and foraging areas throughout ocean basins (Eckert 1998; Eckert 2006; Eckert *et al.* 2006; Hays *et al.* 2004; Ferraroli *et al.* 2004; Benson *et al.* 2007a; Benson *et al.* 2007b; Sale *et al.* 2006). However, much of this travel may be due to movements within current and eddy features, moving individuals along (Sale and Luschi 2009). Return to nesting beaches may be accomplished by a form of geomagnetic navigation and use of local cues (Sale and Luschi 2009). Leatherback females will either remain in nearshore waters between nesting events, or range widely, presumably to feed on available prey (Byrne *et al.* 2009; Fossette *et al.* 2009).

Reproduction

Leatherback sea turtles probably mate outside of tropical waters (Eckert and Eckert 1988). Mating may occur starting at 3-6 years (Rhodin 1985). However, this is disputed at least in the western North Atlantic and may not occur until 29 years (Rhodin 1985; Pritchard and Trebbau 1984; Avens and Goshe 2007; Dutton *et al.* 2005; Zug and Parham 1996). Leatherback turtles tend to forage in temperate waters except for nesting females; males are generally absent from nesting areas. Females can deposit up to seven nests per season of 100 eggs or more and return to nest every 2-3 years, although this varies geographically, and some eggs in each clutch are infertile. Nesting along the Pacific coast of Mexico runs from November-February, but may occur as early as August and as late as March (Fritts *et al.* 1982; NMFS and USFWS 1998; EuroTurtle 2006). In the late 1970's, roughly one-half of the world's leatherbacks nested along these shores (Pritchard 1982). Here, females deposit from 1-11 nests per season at 9- to 10-day intervals (NMFS and USFWS 1998). Nesting in other Pacific locations occurs in China from May-June, Malaysia from June-July, and Queensland, Australia from December-January.

Temperature is important to leatherback egg survival, with higher temperatures increasing mortality (Tomillo *et al.* 2009). Along Costa Rica, eggs laid earlier in the nesting season have higher hatching success than those deposited later in the season. Possibly because of this, females who nest more frequently (for more years) appear to lay their nests earlier in the season than leatherback females who nest less frequently. Survival is extremely low in early life, but greatly increases with age.

Feeding

Leatherbacks may forage in high-invertebrate prey density areas formed by favorable features (Ferraroli *et al.* 2004; Eckert 2006). Although leatherbacks forage in coastal waters, they appear to remain primarily pelagic through all life stages (Heppell *et al.* 2003). The location and abundance of prey, including medusae, siphonophores, and salpae, in temperate and boreal latitudes likely has a strong influence on leatherback distribution in these areas (Plotkin 1995). Leatherback prey are frequently found in the deep-scattering layer in the Gulf of Alaska (Hodge and Wing 2000). North Pacific foraging grounds contain individuals from both eastern and western Pacific rookeries, although leatherbacks from the eastern Pacific generally forage in the Southern Hemisphere along Peru and Chile (Dutton *et al.* 2000; Dutton *et al.* 1998; Dutton 2005-2006). Mean primary productivity in all foraging areas of western Atlantic females is 150% greater than in eastern Pacific waters, likely resulting in twice the reproductive output of eastern Pacific females (Saba *et al.* 2007). Leatherbacks have been observed feeding on jellyfish in waters off Washington State and Oregon (Stinson 1984; Eisenberg and Frazier 1983).

Status and trends

Leatherback sea turtles were protected on June 2, 1970 (35 FR 8491) under the Endangered Species Conservation Act and since 1973 have been listed as endangered under the ESA. However, recent declines in nesting have continued worldwide. Breeding females were initially estimated at 29,000-40,000, but were later refined to ~115,000 (Pritchard 1971; Pritchard 1982). Spotila et al. (1996) estimated 34,500 females, but later

issued an update of 35,860 (Spotila 2004). The species as a whole is declining and local populations are in danger of extinction (NMFS 2001).

Heavy declines have occurred at all major Pacific basin rookeries, as well as Mexico, Costa Rica, Malaysia, India, Sri Lanka, Thailand, Trinidad, Tobago, and Papua New Guinea. This includes a nesting decline of 23% between 1984-1996 at Mexiquillo, Michoacán, Mexico (Sarti *et al.* 1996). Fewer than 1,000 nesting females nested on the Pacific coast of Mexico from 1995-1996 and fewer than 700 females are estimated for Central America (Spotila *et al.* 2000). Decline in the western Pacific is equally severe. Nesting at Terengganu, Malaysia is 1% of that in 1950s (Chan and Liew 1996). The South China Sea and East Pacific nesting colonies have undergone catastrophic collapse. Overall, Pacific populations have declined from an estimated 81,000 individuals to <3,000 total adults and subadults (Spotila *et al.* 2000). Drastic overharvesting of eggs and mortality from fishing activities is likely responsible for this tremendous decline (Sarti *et al.* 1996; Eckert 1997).

Critical habitat

On March 23, 1979, leatherback critical habitat was identified adjacent to Sandy Point, St. Croix, U.S.V.I. from the 183 m isobath to mean high tide level between 17° 42’12” N and 65°50’00” W (44 FR 17710). This habitat is essential for nesting, which has been increasingly threatened since 1979, when tourism increased significantly, bringing nesting habitat and people into close and frequent proximity. However, studies do not currently support significant critical habitat deterioration. The proposed research would not take place in designated leatherback sea turtle critical habitat.

On January 5, 2010, NMFS proposed and sought comments on the expansion of critical habitat to include approximately 70,600 square miles (182,854 square km) of marine habitat in the Pacific Ocean off the U.S. coast, including two adjacent areas stretching along the California coast from Point Arena to Point Vincente, and one area stretching from Cape Flattery, Washington, to the Umpqua River-Winchester Bay, Oregon, east of a line approximating the 2,000-meter depth contour (75 FR 319).

Environmental baseline

By regulation, environmental baselines for Opinions include the past and present impacts of all state, federal, or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR §402.02). The *Environmental baseline* for this Opinion includes the effects of several activities affecting the survival and recovery of ESA-listed leatherback sea turtles in the action area. The *Environmental baseline* focuses primarily on past and present impacts to these species.

A number of human activities have contributed to the current status of ESA-listed leatherback sea turtles in the action area. Although some of those activities occurred extensively in the past the effects persist today. Other human activities, such as commercial fishing and vessel operations, are ongoing and continue to affect this species.

The following discussion summarizes the natural and human phenomena in the action area that may affect the likelihood this species will survive and recover in the wild. These include predation, habitat degradation and climate change, bycatch, directed harvest, contaminants, marine debris, and scientific research.

Predation

Sea turtles face predation primarily by sharks and to a lesser extent by killer whales (Pitman and Dutton 2004). Hatchlings are preyed upon by herons, gulls, dogfish, and sharks. Leatherback hatching success is particularly sensitive to nesting site selection, as nests that are overwashed have significantly lower hatching success and leatherbacks nest closer to the high-tide line than other sea turtle species (Caut *et al.* 2009).

Habitat degradation and climate change

Leatherback nesting and marine environments are facing increasing impacts through widespread development and tourism along nesting beaches (Maison 2006; Hernández *et al.* 2007; Santidrián Tomillo *et al.* 2007; Hamann *et al.* 2006). Structural impacts to beaches include building and piling construction, beach armoring and renourishment, and sand extraction (Lutcavage *et al.* 1997; Bouchard *et al.* 1998). In some areas, timber and marine debris accumulation as well as sand mining reduce available nesting habitat (Chacón Chaverri 1999; Laurance *et al.* 2008; Formia *et al.* 2003; Bourgeois *et al.* 2009). Lights on or adjacent to nesting beaches alter nesting adult behavior and is often fatal to emerging hatchlings as they are drawn to light sources and away from the sea (Witherington and Bjorndal 1991; Witherington 1992; Cowan *et al.* 2002; Deem *et al.* 2007; Bourgeois *et al.* 2009).

Although global warming may expand foraging habitats into higher latitude waters, increasing temperatures may increase feminization of nests (Hawkes *et al.* 2007; James *et al.* 2006; Mrosovsky *et al.* 1984; McMahon and Hays 2006). Rising sea levels may also inundate nests on some beaches.

Bycatch

Bycatch, particularly by longline fisheries, is a major source of mortality for leatherback sea turtles (Fossette *et al.* 2009; Crognale *et al.* 2008; Gless *et al.* 2008; Petersen *et al.* 2009). Wallace et al. (2010) estimated that between 1990 and 2008, at least 85,000 sea turtles were captured as bycatch in fisheries worldwide. This estimate is likely at least two orders of magnitude low, resulting in a likely bycatch of nearly half a million sea turtles annually (Wallace *et al.* 2010); many of these turtles are expected to be leatherbacks. Donoso and Dutton (2010) found that 284 leatherbacks were bycaught between 2001 and 2005 as part of the Chilean longline fishery, with two individuals observed dead; leatherbacks were the most frequently bycaught sea turtle species.

Directed harvest

Directed harvest of sea turtles and their eggs for food and other products has existed for years and was a significant factor causing the decline of leatherback. At present, despite conservation efforts such as bans and moratoriums by the responsible governments, the harvest of turtles and their eggs still occurs throughout the world. Countries including

Mexico, Peru, Ecuador, and the Philippines have made attempts to reduce the threats to sea turtles, but illegal harvesting still occurs. In Vietnam and Fiji, harvest of turtle meat and eggs remains largely unregulated.

Contaminants

We know little about the effects of contaminants on leatherback sea turtles. The metals arsenic, cadmium, copper, mercury, selenium, and zinc bioaccumulate, with cadmium in highest concentration in leatherbacks versus any other marine vertebrate (Gordon *et al.* 1998; Caurant *et al.* 1999). A diet of primarily jellyfish, which have high cadmium concentrations, is likely the cause (Caurant *et al.* 1999). Organochlorine pesticides have also been found (Mckenzie *et al.* 1999). PCB concentrations are reportedly equivalent to those in some marine mammals, with liver and adipose levels of at least one congener being exceptionally high (PCB 209: 500-530 ng/g wet weight Oros *et al.* 2009; Davenport *et al.* 1990).

Marine Debris

Ingestion of marine debris can be a serious threat to sea turtles. When feeding, sea turtles can mistake debris (e.g., tar and plastic) for natural food items. Some types of marine debris may be directly or indirectly toxic, such as oil. Other types of marine debris, such as discarded or derelict fishing gear, may entangle and drown sea turtles. Plastic ingestion is very common in leatherbacks and can block gastrointestinal tracts leading to death (Mrosovsky *et al.* 2009).

Scientific research

Three other NMFS research permits authorize the take of leatherback sea turtles throughout the Pacific Ocean. Two of these permits, Nos. 14510 and 14097, are held by the SWFSC. No. 14097 authorizes standard activities on animals caught offshore in conjunction with cetacean research surveys. No. 14510 authorizes research on stranded animals off the coast of California. The remaining permit, No. 14381, is held by the NMFS Pacific Islands Fisheries Science Center for studying animals captured in commercial fisheries around Hawaii and American Samoa. None of these permits authorize the medial ridge tag attachment method. Combined these permits authorize a total of 57 annual takes of leatherback sea turtles during research.

Effects of the proposed actions

Pursuant to Section 7(a)(2) of the ESA, federal agencies are required to ensure that their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. The proposed permit by the Permits Division would expose leatherback sea turtles to actions that constitute "take" from tagging activities. In this section, we describe the potential physical, chemical, or biotic stressors associated with the proposed actions, the probability of individuals of listed species being exposed to these stressors based on the best scientific and commercial evidence available, and the probable responses of those individuals (given probable exposures) based on the available evidence. As described in the *Approach to the assessment* section, for any responses that would be expected to reduce an individual's fitness (i.e., growth, survival, annual reproductive success, and lifetime

reproductive success), the assessment would consider the risk posed to the viability of the population. The purpose of this assessment is to determine if it is reasonable to expect the proposed studies to have effects on leatherback sea turtles affected by this permit that could appreciably reduce the species' likelihood of surviving and recovering in the wild.

For this consultation, we are particularly concerned about behavioral disruptions that may result in animals that fail to feed or breed successfully or fail to complete their life history because these responses are likely to have population-level, and therefore species level, consequences. The proposed permit would authorize non-lethal "takes" by harassment of listed species during research activities.

Potential stressors

The Permits Division proposes to authorize the researchers attach a satellite tag by direct medial ridge attachment while conducting the previously authorized capture, measure, weigh, blood and tissue sample, photograph, flipper and PIT tag, fat biopsy, and ultrasound, as well as to close approach sea turtles in the water to attach a VHF/TDR/Sonic tag/GPS/Video camera system by suction cup (currently authorized as a separate action within the existing permit).

During this consultation, we considered several stressors: boat, ship, and aircraft noise; ship strike; and pollution from fuel/trash, but concluded that these stressors are not likely to occur and, if they occurred, would have negligible effect on leatherback sea turtles that might be exposed to them. Because aerial surveys would be flown at altitude unlikely to disturbance to sea turtles or other species, we expect this activity to have no effects or minimal effects on animals. Therefore, we focus the remainder of our effect analyses on the stressors we identified above.

Exposure analysis

Exposure analyses identify the co-occurrence of ESA-listed species with the action's effects in space and time, and identify the nature of that co-occurrence. The *Exposure analysis* identifies, as possible, the number, age or life stage, and gender of the individuals likely to be exposed to the action's effects and the populations(s) or subpopulation(s) those individuals represent.

The Permits Division proposes to issue an amendment to permit No 1596 to the Southwest Fisheries Science Center to authorize the use of direct medial ridge tag attachment on leatherback sea turtles. Researchers are currently authorized to capture, measure, weigh, blood and tissue sample, photograph, flipper and PIT tag, fat biopsy, ultrasound, and satellite tag with a harness 8 leatherback sea turtles per year. This amendment would replace the use of a harness with the direct medial ridge attachment, as well as authorize close approach sea turtles in the water to attach a VHF/TDR/Sonic tag/GPS/Video camera system by suction cup.

If the permit amendment is issued before the end of the 4th year of the permit (January 31, 2011), it would only authorize the medial ridge attachment for the 4th year, and the continuation of the method would be contingent upon written approval from the Permits Division. Because the continuation of the medial ridge attachment method would not require re-initiation of section 7 consultation (there would be no change in the level or

manner of “take”), we assume for the purposes of this Opinion that if the proposed methods are authorized, they would also be authorized for the 5th year of the permit. The permit is set to expire February 1, 2012.

The number of sea turtles that could be exposed to this suite of actions would remain unchanged. Additionally, other takes of leatherback sea turtles (see Table 1) would remain unchanged from the current version of the permit.

The proposed action would take place year-round in the waters off the coasts of California, Oregon, and Washington. A close approach, capture, and direct attachment of satellite tags would take approximately 10 minutes. Based on the results of a lab study conducted by the NMFS Pacific Islands Fisheries Science Center, researcher expect that the crimps in the tether would corrode after approximately one year, at which point the tag would fall out, pulling the tethers out of the drill tract.

A close approach and attachment of suction-cup tags would take approximately 10 seconds. If the suction-cup mounted tag doesn't fall off by itself, the turtle would be re-approached to collect the tag. The batteries and memory of the video camera have a duration of one hour. Researchers might leave the unit attached an extra 30 minutes to obtain some extra TDR data before re-approaching the turtle to retrieve the camera unit. They would use a blunt hook to pull the suction cup unit off the carapace. Deployments without the camera (TDR & VHF only) would usually be longer duration events. Researchers might choose to leave the satellite tags attached overnight to obtain dive data during the dark hours. The longest suction cup attachment under the current permit has been about five days, after which the tag fell off, but suction cup attachments could remain attached for as long as ten days.

Response analysis

As discussed in the *Approach to the assessment* section of this Opinion, response analyses determine how listed resources are likely to respond after being exposed to an action’s effects on the environment or directly on listed species themselves. For the purposes of consultation, our assessments try to detect potential lethal, sub-lethal (or physiological), or behavioral responses that might reduce the fitness of individuals. Ideally, response analyses would consider and weigh evidence of adverse consequences as well as evidence suggesting the absence of such consequences.

The proposed amendment does not change the capture, measuring, weighing, blood and tissue sampling, photographing, flipper and PIT tagging, fat biopsy, and ultrasound that were previously authorized for the harness method of satellite tagging. These stressors were previously assessed in a Biological Opinion in 2007 (NMFS 2007a), and are summarized below.

Therefore, our effects analysis will focus on the potential effects of proposed medial ridge method of attachment for the satellite tag, and the addition of suction-cup tagging for those individuals. However, we take into consideration that these effects would be additive to the effects of the currently authorized actions (approach, capture, and handling listed above), which the leatherback sea turtles will be exposed to, and therefore the proposed actions cannot be considered independently.

Previously authorized actions: approach, capture, and handling

The harassment of turtles during capture can result in raised levels of stress hormones and can cause some discomfort. Based on past observations of similar research, these effects are expected to dissipate within a day (Stabenau and Vietti 1999). NMFS would not anticipate any mortality or long-term adverse effect to the turtles due to the capture and activities to bring captured turtles aboard the research vessel.

Handling, measuring, weighing, and photographing can result in raised levels of stress hormones in sea turtles. However, the procedures are simple and not invasive. We expect that individual turtles would normally experience no more than short-term stresses as a result of these activities. No injury would be expected from these activities, and turtles would be measured and weighed as quickly as possible to minimize stresses resulting from their capture. The applicant would also be required to follow procedures designed to minimize the risk of either introducing a new pathogen into a population or amplifying the rate of transmission from animal to animal of an endemic pathogen when handling animals.

Tagging activities are minimally invasive and all tag types have negatives associated with them, especially concerning tag retention. Plastic tags can become brittle, break and fall off underwater, and titanium tags can bend during implantation and thus not close properly, leading to tag loss. Tag malfunction can result from rusted or clogged applicators or applicators that are worn from heavy use (Balazs 1999). Turtles that have lost external tags would be re-tagged if captured again at a later date, which subjects them to additional effects of tagging. Turtles would experience some discomfort during the tagging procedures and these procedures would produce some level of pain. The discomfort would usually be short and highly variable between individuals (Balazs 1999). Most barely seem to notice, while a few others exhibit a marked response. However, we expect the stresses to be minimal and short-term and that the small wound-site resulting from a tag would heal completely in a short period of time. Similarly, turtles that must be re-tagged would also experience minimal short-term stress and heal completely in a short period of time. Re-tagging would not be expected to appreciably affect these turtles. The proposed tagging methods have been regularly employed in sea turtle research with little lasting impact on the individuals tagged and handled (Balazs 1999).

Taking a blood sample from the sinuses in the dorsal side of the neck is now a routine procedure (Owens 1999). According to Owens (1999), with practice it is possible to obtain a blood sample 95% of the time and the sample collection time would be expected to be about 30 seconds in duration. Sample collection sites would be disinfected with alcohol or other antiseptic prior to sampling. Blood sampling volume would be conditioned to only allow a conservative amount of blood (conditioned in the permit) to be drawn. Blood hormones and heart rate have been measured in animals that have had this amount of blood drawn from them and no stress has been observed (E. Stabenau, pers. comm. to P. Opay, NMFS, 2005).

NMFS expects that individual turtles would experience no more than short-term stresses during a tissue biopsy. NMFS expects that the collection of a tissue sample would not cause any additional significant stress or discomfort to the turtle beyond what was experienced during the other research activities. Sterile techniques would help prevent

infection from pathogens. All tissue biopsy samples would be collected, handled, stored, and shipped in such a manner as to ensure human safety from injury or zoonotic disease transmission as well as provide for the protection of the sea turtles that are sampled.

Medial ridge attachment (satellite tagging)

Due to the unique nature of their shell, leatherback sea turtles pose difficulties to researchers who want to affix satellite tags to the turtles for telemetry studies. To deal with this logistical constraint, researchers devised a harness system consisting of vinyl-covered straps encircling the turtle's shoulders and midsection, with the satellite tag positioned on top of the carapace (Eckert and Eckert 1986). For years, this method was considered a reliable way to ensure tag retention and was utilized by biologists to obtain valuable information on leatherback movement and behavior (Byrne *et al.* 2009).

A harness-tagged female leatherback was re-sighted in Costa Rica after two years at liberty and provided an opportunity to examine the long-term effects of this attachment method. Troëng et al. (2006) observed that the straps had cut into the lateral ridges and caused callusing around the shoulders. Although the researchers doubted that the turtle was permanently harmed by the harness (it had been observed nesting twice, indicating successful mating), they still expressed concerns that the harness could affect the turtle's migrating and foraging abilities (Troëng *et al.* 2006).

In response to the concerns about using a harness and after discussions with NMFS PR, the NMFS Southwest Fisheries Science Center discontinued the telemetry portion of their study that used the harness attachment method. The Science Center now proposes to update their methodology by directly attaching the satellite transmitter to the medial ridge of the carapace.

In a telemetry study, Fossette et al. (2008) monitored five leatherback sea turtles, three that had the satellite attached by a harness, and two which had the tag directly attached to the carapace. The mean locomotor travel rate was 16% slower for turtles equipped with a harness. The researchers proposed several explanations for this finding, including that the harness could increase hydrodynamic drag, or the harness could cause discomfort. While the dives were similar between the two groups, the harnessed group's dives were 12% shorter in duration. Harnessed sea turtles also had longer dives in the 20-40 m range, compared to sea turtles with the direct attachment; however for dives deeper than 80 m, the harnessed leatherbacks' dives were shorter in duration. Although Sherrill-Mix and James (2008) reported migrating harnessed leatherback turtles that had estimated average speeds 25% faster than the direct-attachment turtles in Fossette et al. (2008), the authors commented that further evaluation of the direct attachment technique could benefit both researchers and leatherbacks.

Doyle et al. (2008) fitted one male leatherback sea turtle with a satellite tag using the same direct attachment method described in Fossette et al. (2008), and reported that there was no visible sign of discomfort during drilling, and that the animal did not react or flinch in any way. Byrne et al. (2009) made similar observations after tagging two female leatherbacks.

In evaluating this technique for another NMFS permit (No. 1557-03, to Molly Lutcavage, University of New Hampshire), a suite of veterinarians and sea turtle experts reviewed

the medial ridge attachment method and provided the following input (NMFS 2007b). Dr. George (veterinarian) suggested that the medial ridge location is a good location for attachment. He has often drilled small holes in the medial ridge to attach EKG wires running along the carapace to a transmitter on the peduncle, and stated that it provides enough dense tissue for an anchor and is far removed from any vital structures. He suggested that the best feature of the ridge is its superficial nature, stating that even in a worse-case scenario, infection around the device with the device pulling out, the area affected would be minimal and superficial. He added that such a lesion would be easily dealt with by the turtle's immune system and should heal without problem. He was able to monitor turtles with the wires attached to the medial ridge and the equipment was removed after ten days when the turtles re-nested. There was no problem noted in the short term and when several of these turtles returned to nest two years later no problems were detected by the biologists who observed them. He stated that all things considered he has very positive feelings about this attachment system and feels the benefits from easily deployment, minimal invasiveness, and its attachment in a location that would cause minimal problems for the animal in the event of a system failure would make it worth using.

Dr. Rhodin (orthopedic surgeon) suggested that the risk for carapacial infection or osteomyelitis (bone infection) is extremely low even in the case of hardware failure and breakout due in large part to the leatherback's inherent natural ability to heal from major natural injuries encountered in the environment. He suggested that the overall risks of the deployments are less than the risks animals (e.g., females) face from courting males, fishing gear, and other natural or human-induced trauma. Dr. Wyneken (sea turtle physiologist) stated that assuming they are careful to use aseptic techniques, she sees no reason to think this method would create greater problems than existing alternative techniques and it is likely to increase the data collected if the tags will stay on longer [than other tag units authorized for Permit No. 1557].

Transmitters attached to the carapace of turtles would have the potential to increase hydrodynamic drag and affect lift and pitch. For example, Watson and Granger (1998) performed wind tunnel tests on a full-scale juvenile green turtle and found that at small flow angles representative of straight-line swimming, a transmitter mounted on the carapace increased drag by 27-30%, reduced lift by less than 10%, and increased pitch moment by 11-42%. It is likely that this type of transmitter attachment would negatively affect the swimming energetics of the turtle. However, NMFS believes the attachment technique would be at least as or possibly more hydrodynamic than other attachments already authorized and in use (e.g., harness) (Fossette *et al.* 2008). Based on the results of past tracking of hardshell sea turtles equipped with this tag set-up, NMFS is unaware of the transmitters resulting in any serious injury to this species. The permit would require that that total weight of transmitter attachments for any one turtle not exceed 5% of the body mass of the animal and that they be as hydrodynamic as possible. The transmitters would be expected to remain attached no longer than approximately one year.

The sonic transmitters used to retrieve the tags once they release would have a frequency of approximately 34 to 75 kHz. Sea turtles have low-frequency hearing sensitivity and are potentially affected by sound energy in the band below 1,000 Hz (Bartol *et al.* 1999; Lenhardt 2003; Ridgeway *et al.* 1969). NMFS does not expect the transmitters to

interfere with turtles' normal activities after they are released or any other turtles in the area. NMFS does not expected that the sonic transmitters would attract the predators of sea turtles, as sharks are most sensitive to low (sub-1000 Hz) frequency sounds (Banner 1967; Kritzler and Wood 1961; Casper *et al.* 2003).

Suction-cup attachment (satellite tagging)

The applicant also proposes to attach VHF/TDR and sonic tags by suction cup to free-swimming leatherback turtles. The applicant is already authorized to use suction-cup tags, and these tags would be applied to leatherbacks that are tagged with the medial ridge attachment to maximize the data that can be collected from the individuals.

During the applicant's trials at St. Croix, Virgin Islands, they attached the suction cups with their fingers (i.e. extremely limited pressure was needed). The pole proposed under this research acts as an extension of the researchers' arms. Suction cups would be attached by hand if researchers are able to reach the turtle from the bow of the small boat. No injury to the turtle would be expected from the attachment procedure.

From past experience, the suction cups generally remain on the carapace for about one day, although they can stay on for as long as ten days. During the applicant's trials at St. Croix during June 2003, the researchers did not observe any evidence of skin damage from suction cups that remained in place for one to nine days. While the tags could affect the hydrodynamics of the turtle, any effects would be expected to be less than those for the harness attachment particularly because of the shorter attachment duration. Attachment of several tags to leatherbacks in Monterey Bay under Permit No. 1227 has shown no apparent ill effects of this methodology.

Cumulative effects

Cumulative effects include the effects of future state, tribal, local or private actions that are reasonably certain to occur in the action area considered by this Opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Sources queried include state legislature websites and Nexis. We reviewed bills passed from 2008-2010 and pending bills under consideration were included as further evidence that actions "are reasonably certain to occur."

Legislation from California, Oregon, and Washington address efforts to reduce marine debris; efforts to control contaminants and agricultural, stormwater, and municipal effluents; alternative energy development; oil spill prevention and response; prevention of invasive species; promotion of policies to decrease greenhouse gas emission; climate change and sea level rise; ecosystem, natural resource, and endangered species recovery and protection; and regulation of commercial and recreational use of ocean waters.

After reviewing available information, NMFS is not aware of effects from any additional future non-federal activities in the action area that would not require federal authorization or funding and are reasonably certain to occur during the foreseeable future.

Integration and synthesis of the effects

As explained in the *Approach to the Assessment* section, risks to listed individuals are measured using changes to an individual's "fitness" – i.e., the individual's growth, survival, annual reproductive success, and lifetime reproductive success. When listed plants or animals exposed to an action's effects are not expected to experience reductions in fitness, we would not expect the action to have adverse consequences on the viability of the population(s) those individuals represent or the species those populations comprise (Anderson 2000; Brandon 1978; Mills and Beatty 1979; Stearns 1992). As a result, if the assessment indicates that listed plants or animals are not likely to experience reductions in their fitness, we conclude our assessment.

The *Status of listed resources* and *Environmental baseline* described the factors that have contributed to the reduction in population size for the leatherback sea turtle. Overall, Pacific populations have suffered drastic declines, likely due to overharvesting of eggs and mortality from fishing activities (bycatch). Other threats include predation, habitat degradation and climate change, contaminants, and marine debris. NMFS expects that the current natural anthropogenic threats described in the *Environmental baseline* will continue. The *Cumulative effects* section provided examples of state legislation that is likely to occur and could have an effect on the action area.

The Southwest Fisheries Science Center is currently authorized to capture, measure, weigh, blood and tissue sample, photograph, flipper and PIT tag, fat biopsy, ultrasound, and attach a satellite tag using a harness 8 leatherback sea turtles annually. The NMFS Permits Division proposes to issue an amendment to the current permit to authorize the use of a medial ridge attachment for the satellite tags, with concurrent suction-cup tags, due to concerns about the effects of using a harness to attach the tags.

The proposed amendment would not change the number of leatherback sea turtles being satellite tagged. We considered the effect of attaching the tags by direct attachment, as well as the addition of suction cup tags, in the context of the larger suite of actions that will be conducted on the 8 individuals. Based on the results from researchers currently using the medial ridge attachment technique, as well the experts who had reviewed the procedure for previous permits, there is some risk of infection, but that given the leatherback's ability to heal from major natural injuries, the effects of infection would be minimal. Although all satellite tags are likely to have some negative effects on the swimming energetics of turtles, we believe that this attachment technique would be at least as or possibly more hydrodynamic than the currently authorized harness attachment.

Suction cup tags have been successfully used for leatherback sea turtles and there does not appear to be a risk of skin damage from the suction cup. As mentioned above, satellite tags can affect the hydrodynamics of a turtle, but in the case of the suction-cup tags, the duration that they would remain attached would mean that these effects would be minimal.

Conclusion

NMFS has reviewed the best available scientific and commercial information, the current status of leatherback sea turtles, the environmental baseline for the action area, the effects of the proposed research activities under the proposed permit, and the knowledge to be

gained from the proposed research. Based on this analysis, it is NMFS' biological and conference opinion that the issuance of scientific research permit 1596-03 to the Southwest Fisheries Science Center and the activities it authorizes, as proposed, are not likely to jeopardize the continued existence of leatherback sea turtles, and are not likely to destroy or adversely modify designated or proposed critical habitat within the action area.

Incidental take statement

Section 9 of the ESA and federal regulation pursuant to Section 4(d) of the ESA prohibit the "take" of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the NMFS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Sections 7(b)(4) and 7(o)(2), taking that is incidental and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

As discussed in the accompanying Opinion, only the species targeted by the proposed research activities would be harassed as part of the intended purpose of the proposed action. Therefore, NMFS does not expect the proposed action would incidentally take threatened or endangered species.

Conservation recommendations

Section 7(a)(1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

No additional Conservation Recommendations have been placed on this permit.

Reinitiation notice

This concludes formal consultation on the proposal to issue scientific research permit No. 1596-03 to the Southwest Fisheries Science Center for studies of leatherback sea turtles in the North Pacific Ocean. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of authorized take is exceeded, the NMFS Permits Division must immediately request reinitiation of Section 7 consultation.

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