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

Biological Opinion

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

Activity Considered: Biological Opinion on the proposal to issue Permit Number 15672 to Molly Lutcavage to authorize research on leatherback sea turtles off the New England coast in the Atlantic Ocean, pursuant to Section 10(a)(1)(A) of the Endangered Species Act of 1973

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

Approved by: Helen Golde for J. H. Lecky

Date: March 7, 2012

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 Act Interagency Cooperation Division.

This document represents the NMFS' biological opinion (Opinion) of the effects of the proposed research on the endangered leatherback sea turtles and 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 15672, the permit application from the researcher, 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 Act Interagency Cooperation Division on the proposal to issue to permit 15672. Issuance of the permit constitutes a federal action, which may affect marine species listed under the ESA.

On August 12, 2011 the Permits Division requested initiation of section 7 consultation with the NMFS' Endangered Species Act Interagency Cooperation Division on the proposal to issue permit 15672, to use the method of medial ridge attachment for satellite tags. After requesting additional information regarding the action area, the Endangered Species Act Interagency Cooperation Division formally initiated consultation with the Permits Division on August 29, 2011.

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 15672 to Molly Lutcavage would replace the current permit and authorize research on leatherback sea turtles off the coast of New England and New York in the Atlantic Ocean.

Table 1: Take Table

Table 1: Maximum annual takes of leatherback sea turtles (*Dermochelys coriacea*) under Permit No. 15672.

Number of Turtles	Species and lifestage	Research Take Activities	Notes
10	Leatherback; adult, sub-adult, juvenile	Capture; handle; examine; measure; photograph and video; flipper and PIT tag; blood, tissue, and fecal sample; drill carapace attachment and instrument with satellite tag; cloacal, nasal, and oral swab; release; track; and recapture.	-Turtles could be located by Sea Turtle Disentanglement Network. -Turtles would be captured by hoop-net technique only. -Recapture of tagged animals to address health issues related to attachment is only authorized if needed to examine attachment and treat turtle for complications due to attachment.
15	Leatherback; adult, sub-adult, juvenile	Approach (by boat); photograph and video; suction-cup attachment of archival daily diary tag (includes VHF tag-sonic tag to retrieve); track; re-approach.	-Re-approach would only occur if the mechanism to release the suction-cup tag malfunctions. Researchers would approach and gently prod the tag off the carapace with the same poll applicator used to apply the tag.

Under the proposed permit, researchers would capture by hoopnet, handle, identify, photograph, measure, tag with Passive Integrated Transponder (PIT), flipper, and satellite tags, take tissue, fecal and blood samples, and take nasal, cloacal, and oral swab samples from leatherback sea turtles as part of a habitat utilization study in the waters off of New England.

Capture

Researchers would use chartered fishing vessels that meet certain criteria: an open stern/transom (lobster or tuna boats) and a gear davit with lifting capacity of at least 2,000 lbs. Aerial surveys would be conducted to obtain locations of leatherbacks (minimum altitude of 500 feet). A tuna harpoon boat or lobster boat (38-42 ft) is able to close in on the turtle's location with sufficient speed, taking into account distance from shore and weather conditions.

Researchers would use a breakaway hoop net to capture leatherbacks at the surface. The breakaway hoop net would be custom made so that the hoop fits easily over a leatherback with front flippers loosely held at its side. One of the researchers would be positioned on the bow, ready to guide the hoop net (fitted to a long guiding pole) over the leatherback. The hoop net would be fitted with breakaway stays to a cast net, which would be pursed over the turtle. Large turtles (> 500 lbs) would remain in this net to be brought aboard, while smaller turtles would be placed in a padded sea turtle stretcher and lifted carefully onto the flat deck by a davit. Modified by NMFS from a Sea World Australia design (Nielsen 1995), the stretcher would consist of non-abrasive and washable vinyl material, internal light foam padding, heavy-duty Velcro binding flaps, and seat belt webbing for handles and lifting straps.

The current version of the stretcher (designed for smaller cheloniid sea turtles) has been used successfully by the Sea Turtle Stranding and Salvage Network and several sea turtle research projects. This specific stretcher design has not been used for leatherbacks at sea, but the New England Aquarium rescue rehabilitation personnel have designed and used a variety of stretchers for work on marine mammals and sharks. The cheloniid design would be modified to accommodate the larger dimensions and weight of a leatherback, with a minimum handle breaking strength of 2000 lbs. James et al. (2005) used a pulley system to pull netted leatherbacks on board via drop-down stern ramp. For the proposed permit, the vertical distance that must be cleared would be minimal because research vessels would have an open transom or large tuna door. The distance from water to vessel would be no greater than 0.5 meters.

Photograph, video, and measuring

On deck, the leatherback would be examined, photographed, and briefly secured by the stretcher so that its limbs are held close to its body to prevent injuries to the turtle and personnel, but breathing would be unrestricted. The leatherback would be covered and shaded with wet toweling. Leatherbacks would be measured using a flexible fiberglass measuring tape.

Flipper and PIT tagging

All turtles would be checked for existing external flipper tags or internal Passive Integrated Transponders (PIT tags). If a previously tagged turtle were missing any of its original tags, replacement tags would be applied.

The skin in the target area would be scrubbed with 10% povidone-iodine and isopropyl alcohol-infused gauze pads. Tags would be cleaned and soaked in alcohol to remove any residue, and antibiotic ointment would be applied to the cutting tip of each tag just prior to attachment.

The Inconel flipper tag (Model 681) would be applied to the thin fold of skin between the tail and the rear flipper. These tags are expected to last up to several years. A PIT tag (BioMark TX1440L) would be inserted, using a sterile syringe implanter, into the dorsal shoulder musculature.

Oral, nasal, and cloacal swabs

Oral swabs would be limited to those turtles exhibiting oral lesions. Oral swabs would be taken using a sterile culture swab inserted into the oral cavity. Nasal and cloacal swabs for aerobic and fungal culture samples would be taken from leatherbacks. Nasal swabbing would be conducted using a sterile culture swab and would be gently inserted 1-2cm into the nares. The swab would be gently extracted and enclosed in its protective holder for labeling and transport to the lab. Swabs from the cloaca would be collected by inserting sterile culture swabs approximately 5-10cm into the cloaca (Miller 2006).

Tissue, blood, and fecal samples

Two skin samples (4-6mm) would be collected from each leatherback – one for stable isotope analysis (long-term diet) and one for genetic identity. Both samples would be taken from the posterior margin of the rear flippers, one from the right, the other from the left flipper. The sampling sites would be disinfected before sampling and sites would receive 1 mL of 2% lidocaine for local anesthesia. Samples would be taken with sterile, disposable 6 mm biopsy punches and each sample would be preserved in a pre-labeled vial. Biopsy punches would be disposed of between turtles in a sharps container (one punch per turtle).

Blood samples would be taken from the dorsal cervical sinus as described in Lutcavage et al. (1992) or venapuncture via the saphenous venous complex of all turtles immediately after they are safely situated on deck. Two blood samples would be taken, one to be obtained immediately upon securing the turtle after capture and another right before release. The skin at the blood sampling site would be scrubbed for a minimum of 30 seconds with Betadine prior to sampling. The blood sample would be taken using an 18-21 gauge 1.5-3" vacutainer needle and a 7-ml heparinized vacutainer tube, processed and frozen. Blood samples would be used for health analysis and sex determination.

Voided fecal samples would be opportunistically collected.

Medial ridge attachment of satellite transmitter

The satellite transmitter would be attached to the turtle's carapace along the leading edge near the nuchal bone. This method is already authorized for use under the applicant's current permit number 1557-03. The attachment site would be sterilized with Betadine and desensitized with a topical anesthetic (ethyl chloride, a topical freeze spray). A moist cloth would be placed over the leatherback's eyes to eliminate visual stimuli.

Two to three small (4.5 mm) diameter holes would be drilled using an orthopedic drill bit into the medial ridge toward the front of the carapace. Monofilament line (300 lb test) or plastic-coated flexible braided steel (1.8 mm diameter) would be inserted into the drill tracts cushioned with surgical tubing. One end of this line would have a loop (secured with a corrodible stainless steel crimp) prior to insertion and a loop would be crimped to the other end after insertion.

A tag base would be formed over the ridge using a cold-curing, non-adhesive silicone putty base. The putty would not compress at depth and would conform perfectly to the shape of the ridge. The 250-gram tag would be placed on the putty base and the line tightened over the tag; the loops would be secured with cable ties on top of the tag. The corrodible crimps used to secure the tag to the ridge would provide a weak link for eventual tag shedding after approximately one year.

The entire procedure for attachment would take 10-15 minutes to complete, and the leatherbacks released within 30-45 minutes of capture. 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.

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.

Suction cup attachment of daily diary tags

Researchers also request permission to use a suction cup attachment for daily diary tags (DDTs) (120x20x35mm; mass 90g) or a time depth recording (TDR) tag (MK-9 Wildlife Computers, 67x17x17mm; mass 30g). Use of the DDTs will be prioritized over the TDR tags, and TDR tags would only be used in the event that a DDT is unavailable.

Both tags are a non-invasive tagging method and would be employed for short-term attachments on leatherbacks in their foraging grounds. The DDTs record very high-resolution data on the orientation of the turtle. The tags have the capacity to record depth, speed, temperature, mouth opening behavior and compass heading. The sampling frequency is sufficiently high that individual flipper beats can be determined during dives.

Suction cups would allow researchers to attach DDTs and TDR tags without drilling holes into the turtle (non-invasive), and without direct capture (pole deployment on turtle at surface), and allow them to retrieve the tag. DDTs would allow researchers to examine leatherback behavior on a much finer scale and in three planes, which is not possible with satellite tags. Highly detailed spatial information will help researchers to understand regional movement and behavior, particularly in regards to how leatherbacks become entangled in fixed fishing gear.

Tags, housed in positively buoyant material, would have a remote release mechanism similar to the D-tag that was developed for use on cetaceans (Johnson and Tyack 2003). Leatherbacks at the surface would either be approached using the same methods as for hoopnet capture and the tag deployed from the vessel with a pole applicator, or the tag would be attached to a recently disentangled leatherback.

Tags would include a VHF and sonic transmitter for tracking and relocation. Based on other studies employing suction cup attachment with leatherbacks (Harvey *et al.* 2006) and cetaceans, researchers do not expect the tag to stay on for more than 6-12 hours.

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" limit 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.
- All equipment used for invasive procedures, including drill bits, must be cleaned and sterilized between animals.
- 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.
- Use care when handling live animals to minimize any possible injury; use appropriate resuscitation techniques on any comatose turtle prior to returning it to the water; and when possible, transfer injured animals to rehabilitation facilities and allow them an appropriate period of recovery before return to the wild.
- The permit holder may conduct the activities authorized by this permit on compromised or injured sea turtles, but only if the activities will not further compromise the animal. Care must be taken to minimize handling time and reduce further stress to the animal.
- 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.
- 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.
- The Permit Holder must ensure that only a researcher experienced with the hoop net capture technique conducts the capture using this technique. The Permit Holder must also ensure that only researchers that are well trained in the transmitter attachment technique are allowed to conduct this activity.

- Researchers must only use turtles that have been freed by the disentanglement network if they are in vigorous condition and if there is no chance that further stress from the research may compromise the animal.
- 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. If a turtle is not behaving normally within one hour of release, the turtle must be recaptured and taken to a rehabilitation facility
- Blood samples will be taken by experienced personnel 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 neck will be limited to a total of 4, 2 on either 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.
- Within a 45-day period of time, the cumulative blood volume taken from a single turtle will not exceed the maximum safe limit described above. If more than 50% of the maximum safe limit is taken, in a single event or cumulatively from repeat sampling events, from a single turtle within a 45-day period that turtle will not be re-sampled for 3 months from the last blood sampling event.
- Researchers will, 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. The Permit Holder will contact the other researchers working in the area that could capture the same turtles to ensure that none of the above limits are exceeded
- For biopsy sampling, a new biopsy punch must be used on each turtle, and sterile techniques must be used at all times.
- For TDRs, VHF, sonic or satellite tags, the 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 and must be as hydrodynamic as possible. Attachment must have a "weak link" (e.g., corrodible link, corrodible material) that will ensure the transmitter falls off the animal shortly after the duty cycle of tag is completed. 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.
- 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. The Permit Holder must attempt to relocate animals that have been tagged and released in order to observe the transmitter attachment and animal behavior.

- 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.
- Aerial flights must not be conducted over marine mammal haul out areas. The permit holder must conduct research in a manner so as to avoid harassment of any marine mammal.
- While conducting research activities, staff must monitor for whales, including North Atlantic right whales. Monitoring is required on all vessels and aircraft, and must be conducted by research staff with at-sea large whale identification experience. The Permit Holder may not get within 500 yards of a right whale. If a right whale is sighted within 500 yards of the vessel or aircraft, immediate avoidance measures must be taken. While interaction with North Atlantic right whales is not anticipated, the permit includes this condition as a precautionary measure.

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 requests formal consultation, and the general scientific literature. We supplement this evidence with reports and other documents, including 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 from June to October in Atlantic waters off of Massachusetts, New York, New Hampshire, Connecticut, Rhode Island, and Maine. Research could include waters up to the Continental Shelf of New England and New York (~100km offshore), with an emphasis on the nearshore waters of Cape Cod.

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*.):

Cetaceans		
Blue whale	*Balaenoptera musculus*	Endangered
Fin whale	*Balaenoptera physalus*	Endangered
Humpback whale	*Megaptera novaeangliae*	Endangered
North Atlantic right whale*	*Eubalaena glacialis*	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
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	Endangered

Loggerhead sea turtle	*Caretta caretta*	Threatened
Fish		
Atlantic salmon	*Salmo salar*	Endangered
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	Proposed threatened and endangered
Shortnose sturgeon		Endangered

* Indicates species has critical habitat within Action Area

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 cetaceans, as well as green, hawksbill, Kemp's, and loggerhead sea turtles may occur in the action area, but are not expected to be exposed to the proposed activities. If a protected whale 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 of at least 500 feet to avoid harassment of marine mammals. Critical habitat designated for North Atlantic right whale occurs within the action area, but the proposed action is not expected to interfere with or interrupt breeding, feeding, or calving of North Atlantic right whales. 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 Atlantic salmon and shortnose sturgeon, as well as Atlantic sturgeon (which is proposed for listing) 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.

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.

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).

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).

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).

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.

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

In the western Atlantic, adults routinely migrate between boreal, temperate and tropical waters, presumably to optimize both foraging and nesting opportunities (Bleakney 1965; Lazell 1980). Leatherbacks feed primarily on jellyfish such as *Stomolophus, Chryaora,* and *Aurelia* (Rebel 1974) and tunicates (salps, pyrosomas). Leatherbacks are deep divers, with recorded dives to depths in excess of 1000 m (Eckert *et al.* 1989), but they may come into shallow waters if there is an abundance of jellyfish nearshore. TDR data recorded by Eckert *et al.* (1989) indicate that leatherbacks are night feeders.

Status and trends

Leatherback sea turtles were protected on June 2, 1970 (35 FR 8491) under the Endangered Species Conservation Act and have been listed as endangered under the ESA since 1973. Estimates of total population size for Atlantic leatherbacks are difficult to ascertain due to the inconsistent nature of the available nesting data. In 1980, the leatherback population was estimated at approximately 115,000 adult females globally (Pritchard 1982). The most recent population estimate for leatherback sea turtles from just the North Atlantic breeding groups is a range of 34,000-90,000 adult individuals (20,000- 56,000 adult females) (TEWG 2007). The species as a whole is declining and local populations are in danger of extinction (NMFS 2001).

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; Hernandez *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 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.

Gillnet, longline, other types of hook-and-line gear, trawl gear, and pot fisheries have all been documented as interacting with sea turtles. Available information suggests sea turtles can be captured in any of these gear types when the operation of the gear overlaps with the distribution of sea turtles.

The American lobster, Atlantic bluefish, Atlantic mackerel/squid/butterfish, Atlantic sea scallop, highly migratory species, monkfish, red crab, skate, spiny dogfish, summer flounder/scup/black sea bass, and tilefish fisheries employ gear in a time, area, and manner that has been known to capture, injure, and kill sea turtles. A summary of the impacts of each of these fisheries that has been subject to section 7 consultation is provided below.

The only fishery that has been determined by NMFS to reduce the reproduction, numbers, or distribution of ESA-listed sea turtles, and reduce appreciably their likelihood of survival and recovery, is the pelagic longline component of the Atlantic highly

migratory species fishery. On June 14, 2001, NMFS released an Opinion that found that the continued operation of the Atlantic pelagic longline fishery was likely to jeopardize the continued existence of both loggerhead and leatherback sea turtles. To avoid jeopardy to these species, a Reasonable and Prudent Alternative (RPA) was developed. The RPA required the closure of the Northeast Distant (NED) Statistical Area of the Atlantic Ocean to pelagic longlining and the enactment of a research program to develop or modify fishing gear and techniques to reduce sea turtle interactions and mortality associated with such interactions. On June 1, 2004, NMFS released another Opinion on the Atlantic pelagic longline fishery which stated that the fishery was still likely to jeopardize the continued existence of leatherback sea turtles. Another RPA was then developed to attempt to remove jeopardy. The RPA required that NMFS (1) reduce post-release mortality of leatherbacks, (2) improve monitoring of the effects of the fishery, (3) confirm the effectiveness of the hook and bait combinations that are required as part of the proposed action, and (4) take management action to avoid long-term elevations in leatherback takes or mortality. The Opinion specified an RPA that allows the continuation of the Atlantic highly migratory species fishery without jeopardizing ESA-listed species.

Section 7 consultation on the *Skate FMP* was completed in October 2010, and concluded that the continued operation of the skate fishery within the constraints of the current Skate FMP, may adversely affect, but is not likely to jeopardize, the continued existence of 4 species of listed whales and 4 species of sea turtles, including leatherbacks. The Incidental Take Statement included an exemption of the take of 4 leatherbacks.

The *Northeast Multispecies fishery* operates throughout the year with peaks in spring, and from October through February. Multiple gear types are used in the fishery. However, the gear type of greatest concern is sink gillnet gear that can entangle whales and sea turtles (*i.e.*, in buoy lines and/or net panels). Data indicate that sink gillnet gear has seriously injured or killed loggerhead and leatherback sea turtles, as well as several species of whales. The most recent reinitiation of the Northeast Multispecies consultation was completed in October 2010, and concluded that continued implementation of the Multispecies FMP may adversely affect, but is not likely to jeopardize, the continued existence of 3 species of whale and 4 species of sea turtles, including leatherbacks. The Incidental Take Statement included an exemption of the take of 4 leatherbacks.

The federal *Monkfish fishery* occurs in all waters under federal jurisdiction from Maine to the North Carolina/South Carolina border. The monkfish fishery uses several gear types that may entangle protected species. The most recent reinitiation of the monkfish consultation was completed in October 2010, and concluded that continued implementation of the Monkfish FMP may adversely affect, but is not likely to jeopardize, the continued existence of 4 species of whale and 4 species of sea turtles, including leatherbacks. The Incidental Take Statement included an exemption of the take of 4 leatherbacks.

The *Summer flounder, scup and black sea bass fisheries* are known to interact with sea turtles. The most recent reinitiation of this consultation was completed in October 2010, and concluded that continued authorization of this fishery may adversely affect, but is not likely to jeopardize, the continued existence of 4 species of whale and 4 species of sea

turtles, including leatherbacks. The Incidental Take Statement included an exemption of the take of 6 leatherbacks.

The primary gear types for the *Spiny dogfish fishery* are sink gillnets, otter trawls, bottom longline, and driftnet gear. Sea turtles can be incidentally captured in all gear sectors of this fishery. The most recent reinitiation of this consultation was completed in October 2010, and concluded that continued authorization of this fishery may adversely affect, but is not likely to jeopardize, the continued existence of 4 species of whale and 4 species of sea turtles, including leatherbacks. The Incidental Take Statement included an exemption of the take of 4 leatherbacks.

The *American lobster trap fishery* has been identified as a source of gear causing serious injuries and mortality of endangered whales and leatherback sea turtles. American lobster occur within U.S. waters from Maine to Virginia. They are most abundant from Maine to New Jersey with abundance declining from north to south (ASMFC 1997). An Interstate Fishery Management Plan developed through the Atlantic States Marine Fisheries Commission (ASMFC) provides management measures for the fishery that are implemented by the states. NMFS has issued regulations for the Federal waters portion of the fishery based on recommendations from the ASMFC. Management measures include a limited access permit system, gear restrictions, and other prohibitions on possession (*e.g.*, of berried or scrubbed lobsters), landing limits for lobsters caught by non-trap gear, a trap tag requirement, and trap limits. These measures include reduction of effort and capping of effort.

The most recent reinitiation of the lobster fishery consultation was completed in October 2010, and concluded that continued authorization of this fishery may adversely affect, but is not likely to jeopardize, the continued existence of 4 species of whale and 2 species of sea turtles, including leatherbacks. The Incidental Take Statement included an exemption of the take of 5 leatherbacks.

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

Four other NMFS research permits authorize the take of leatherback sea turtles in the North Atlantic from New York to Maine, not including the permit that the proposed permit 15672 would replace. None of these permits authorize the medial-ridge tag attachment method; only the applicant and the NMFS Southwest Fisheries Science Center have authorization to use this method of tagging leatherbacks.

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 to capture leatherback sea turtles and handle, examine, measure, photograph/video, flipper and PIT tag, blood, tissue, and fecal sample, drill for carapace attachment and instrument with satellite tag, cloacal, nasal, and oral swab, track, and release them. Other leatherback sea turtles

would be approached (by boat), photographed/videoed, instrumented via suction cup attachment archival daily diary tag (includes VHF tag and sonic tag to retrieve it), and tracked.

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 permit No. 15672 to Molly Lutcavage to authorize the research on leatherback sea turtles. The proposed action would take place from June to October in the Atlantic waters off of Massachusetts, New York, New Hampshire, Connecticut, Rhode Island, and Maine.

Under the proposed permit, up to 10 leatherback sea turtles could be captured and be instrumented with satellite tags via medial-ridge attachment; up to 15 leatherback sea turtles could have suction-cups applied (see Table 1). Based on previous years' annual reports, we believe that it is reasonable that the researcher could expose this many turtles to the proposed action. Both sexes of adult, sub-adult, and juveniles would be targeted for this research.

Based on past annual reports, the close approach, capture, and direct attachment of satellite tags would take an average of 49 minutes, although the time has varied from 35 to 88 minutes. Captures using the hoop-net approach were shorter (average 44 minutes) compared to captures associated with disentanglement (average 58 minutes). The direct attachment of the satellite tag would take approximately 10-15 minutes.

Medial-ridge attachments could last between 6 and 12 months, based on previous annual reports. Suction cups could last 6-12 hours. If the suction-cup tag has not detached on its own, researchers would re-approach to gently prod off the suction-cup.

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.

Approach and capture

The harassment of turtles during approach and 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, photographing

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.

Oral, cloacal, and nasal swabs, and fecal sample

Oral, cloacal, and nasal swabs are minimally invasive. NMFS expects that the animal would experience discomfort but that the stress from these procedures would be insignificant and short-term. No injury would be expected to occur from these procedures. Voided fecal samples would be collected from opportunistically.

Flipper and PIT tagging

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).

PIT tags have greater retention rate compared to external tags, although infection and irritation have been reported in PIT tagged leatherbacks (Dutton and McDonald 1994). Depending on their placement, PIT tags can also migrate. Wyneken et al. (2010) found that tags placed in the triceps muscle were less likely to move than in flipper blades; the proposed permit would allow for PIT tags to be placed in the shoulder muscle, a location the authors suggest would be stable.

Blood and tissue sampling

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).

We expect that individual turtles would experience no more than short-term stresses during a tissue biopsy. We expect 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).

Medial ridge attachment of satellite tags in leatherbacks is a relatively new technique developed by researchers after concerns were raised about the effects of the use of traditional harness attachment. 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 the applicant's previous permit No. 1557, a suite of veterinarians and sea turtle experts reviewed the medial ridge attachment method and provided the following input (NMFS 2007). 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 sea 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 NMFS Southwest Fisheries Science Center (SWFSC) conducted trials at St. Croix, Virgin Islands, with suction cup tagging on leatherbacks. SWFSC 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.

Suction cups could last 6-12 hours. If the suction-cup tag has not detached on its own, researchers would re-approach to gently prod off the suction-cup within that time frame. However, suction-cup tags have stayed attached for as long as ten days. During SWFSC trials at St. Croix during June 2003, 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 medial-ridge 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 2010-2011 and pending bills under consideration were included as further evidence that actions "are reasonably certain to occur."

Relevant legislation from Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, and New York includes bills aimed to reduce ocean erosion; restore ocean sanctuaries; promote or regulate commercial and recreational fishing and aquaculture; promote alternative or renewable energy; protect water resources; promote conservation of fish, wildlife, and habitat; prevent the spread of invasive species, prepare for oil spill response.

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, Atlantic populations have suffered declines, likely in part 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 NMFS Permits Division proposes to issue a research permit under Section 10 of the Endangered Species Act to authorize the use of a medial ridge attachment for satellite tags and of suction-cup tags, as well as the associated actions of approach, capture, handle, examine, measure, photograph/video, flipper and PIT tag, blood, tissue, and fecal sample, cloacal, nasal, and oral swab, and release them.

We considered the effect of attaching the tags by medial-ridge attachment and by suction-cup attachment, as well as the other actions that will be conducted on up to 25 leatherback sea turtles (up to 10 medial ridge, up to 15 suction-cup tag). Capture and handling, as well as the various methods of sampling, swabbing, and tagging, could cause some amount of short-term stress, and the minimally invasive procedures such as PIT tagging have a small risk of infection.

Based on the results from the applicants and other researchers 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 opinion that the issuance of scientific research permit 15672 to Molly Lutcavage 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 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. 15672 to the Molly Lutcavage for studies of leatherback sea turtles off the New England coast in the Atlantic 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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