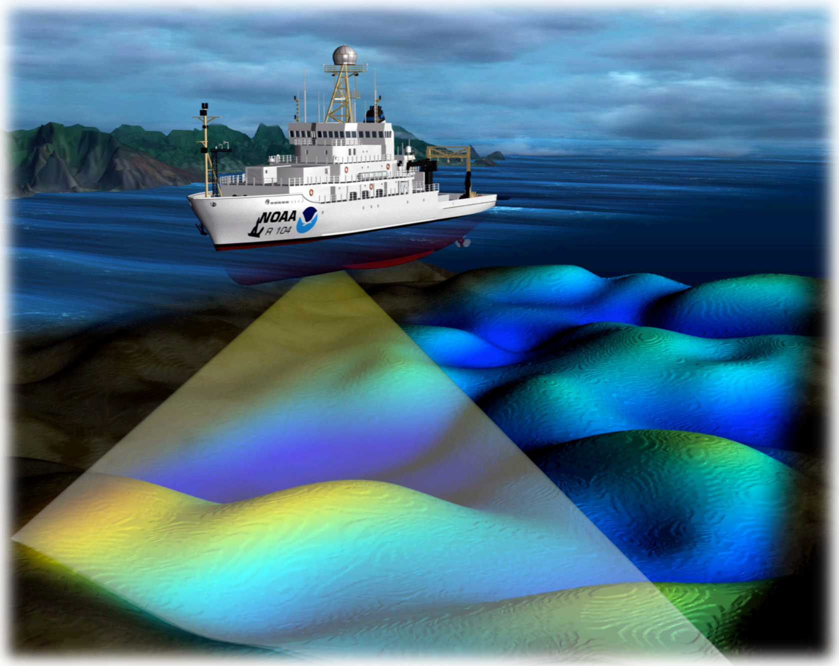
Biological and Conference Opinion

Action Agency: Office of Coast Survey, National Ocean Service, NOAA
Prepared by: Office of Protected Resources, National Marine Fisheries Service, NOAA
Action: Nationwide hydrographic survey of coastal waters
PCTS #: FPR-2013-9029



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National Marine Fisheries Service
Endangered Species Act Section 7 Consultation
Biological Opinion and Conference Opinion
FPR-2013-9029

Agencies:	Office of Coast Survey, National Ocean Service, NOAA
Activities Considered:	Nationwide hydrographic survey of coastal waters
Consultation Conducted by:	Endangered Species Act Interagency Cooperation Division Office of Protected Resources, National Marine Fisheries Service, NOAA
Approved by:	Perry Gayaldo
Date:	APR 30 2013

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1536(a)(2)), requires Federal agencies to insure that any action they authorize, fund, or carry out 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. When a Federal agency's action may affect listed species or critical habitat, formal consultation with National Marine Fisheries Service (NMFS) and/or the Fish and Wildlife Service is required (50 CFR 402.14(a)). Federal agencies may request a conference on a proposed action that may affect proposed species or proposed critical habitat.

The Office of Coast Survey of the NOAA National Ocean Service (OCS or Coast Survey) proposes to conduct ongoing hydrographic (i.e., mapping) surveys in coastal waters nationwide, beginning in May 2013. We, the ESA Interagency Cooperation Division of NMFS, consulted with Coast Survey on their action. This document represents our biological and conference opinion (Opinion) on their action and its effects on ESA-listed and proposed species and designated critical habitat. We based our Opinion of the action, as described in the draft Programmatic Environmental Assessment (PEA) provided by Coast Survey (NOAA 2012) and subsequent conversations, on the best scientific and commercial data available, as found in: ESA listing documents, recovery plans, scientific publications, and other sources of information. We prepared our Opinion in accordance with section 7(a)(2) of the statute (16 U.S.C. 1536(a)(2)), associated implementing regulations (50 CFR 402), and agency policy and guidance (USFWS and NMFS 1998).

1.0 Consultation History

On June 8, 2010, we began informal consultation with Coast Survey on their proposed action.

On June 24, 2010, Coast Survey requested initiation of formal section 7 consultation. In response, we sent OCS a list of questions and items that we need prior to initiation.

On March 16, 2011, Coast Survey requested a list of ESA-listed and proposed resources in their action area. In response, we sent OCS the list along with a request for information needed to clarify their action.

On November 21, 2012, Coast Survey requested, and we initiated, section 7 consultation and conference.

On January, 7, 2013, Coast Survey contacted the Permits and Conservation Division of NMFS to request authorization for the incidental harassment of marine mammals. The Permits and Conservation Division is in the process of evaluating their request. We will reinitiate consultation when the Permits and Conservation Division requests initiation and proposes to authorize incidental take of marine mammals, pursuant to Federal regulations under the Marine Mammal Protection Act (MMPA) 101(a)(5).

On March 8, 2013, we agreed upon an extension (April 30, 2013), to incorporate newly-agreed upon protective measures into the action.

2.0 Description of the Action

Pursuant to the Coast and Geodetic Survey Act (33 U.S.C. §§ 883a *et seq.*) and the Hydrographic Services Improvement Act, as amended (33 U.S.C. §§ 892), OCS surveys and charts U.S. waters to provide reliable nautical charts and other navigation products. Coast Survey proposes to map approximately 3,000 square nautical miles (SNM) of coastal waters nationwide, annually. If OCS proceeds with its action as proposed, which is expected, specific activities would include: vessel transits, anchoring, hydrographic surveys, sound speed data collection, bottom sampling, tide gauge operations, testing of new survey products, and light detection and radar (LIDAR) survey. These activities are fully described in the PEA (NOAA 2012); we summarize each below and add additional protective measures that Coast Survey has since incorporated into their proposed action.

2.1 Vessel activity (including transits)

To perform coastal surveys, OCS proposes to use NOAA and contracted vessels. The NOAA vessels include: four NOAA ships (*Rainier, Fairweather, Thomas Jefferson*, and *Ferdinand Hassler*), a 54-ft research vessel (*Bay Hydro II*), six 28-ft survey boats, and navigation response team small boasts for nearshore work. Coast Survey contracts the use of approximately18 privately owned vessels; contracts for use of these vessels will be issued in 2013. All vessels would transit to and from survey sites before, during, and after survey operations. They would also transit to and from port for tie-up, resupply, fuel, and crew changes.

2.2 Anchoring

For some vessels, Coast Survey proposes to anchor in or near project areas, when not performing survey operations, to reduce daily transit time and fuel consumption. Vessel operators would select the anchor location based on depth, protection from seas and wind, and bottom type. Preferred bottom types include sticky mud or sand; they would not anchor on rocky or coral reefs. When working in a previously unsurveyed area or an area that has not been surveyed in many years, the vessel would first collect hydrographic data to provide information on where to drop the anchor (i.e., to avoid coral reefs and rocky seabed areas). Survey launches, navigation response team boats, the *Bay Hydro II*, and some contractor vessels return to port daily, eliminating the need for anchoring.

2.3 Hydrographic surveys

Coast Survey proposes to use high-frequency echosounders to conduct hydrographic surveys of the action area. An echosounder transmits an acoustic pulse, which travels through the water column, reflects off the seafloor, and returns to the echosounder receiver. The time elapsed is multiplied by the speed of sound in water, measured independently throughout the survey, to measure water depth and ensonify (or visualize) the seafloor bottom.

Survey vessels would make a series of linear transects ("mowing the lawn") at slow speeds (4 – 8 knots), using towed or mounted side scan sonars, single beam echosounders, and multibeam echosounders. Generally, Coast Survey uses high-frequency, multibeam systems (≥ 200 kHz). For mapping in deeper waters (≥ 100 m), the on-site surveyor selects the frequency to achieve the best resolution; however, multibeam frequencies are always ≥ 50 kHz (NOAA 2012; K. Jamison pers. comm.). Coast Survey sets the power to the lowest possible level that achieves high-resolution mapping (190 –210 dB re: 1 μPa); they set the "ping rate" to the lowest possible level (10-30 Hz).

In uncharted waters less than 20 m, surveyors would use single beam systems with frequencies ≥ 30 kHz (K. Jamison pers. comm.). Coast Survey sets the power to the lowest possible level, typically 185 dB re: 1 μPa; they maintain a 12° beam angle, which focuses the sound downward, with a small beam width.

2.4 Soun spee dat collection

Coast Survey proposes to collect sound speed data throughout the survey to determine the speed of sound in water at a given time and location to correct for refraction errors in the echosounder data. Sound speed data is collected in one of two ways: 1) deploying and recovering a sound speed profiler (known as a "conductivity, temperature and depth" instrument or CTD) every one to four hours, from a stationary vessel; or 2) towing a moving vessel profiler (MVP) through the water column.

2.5 Bottom sample collection

Coast Survey proposes to collect samples of seafloor sediment during survey operations to characterize and chart substrates, so mariners can better select anchorages. The surveyors would avoid rocky and coral reef areas for this activity. They would not collect samples in Johnson's seagrass critical habitat. The surveyors would use a clamshell bottom snapper or similar grab sampler. As the sampler is lowered, two hinged upper lids swing open to let water pass through. When the sampler reaches the bottom, the overlapping spring-loaded scoops are tripped, and the lids close to encase the sediment sample (approximately the size of a softball). The line is lowered and raised, at a rate of about one meter per second. After the sediment is collected, analyzed, and photographed, the crew releases it from the sampler, underwater.

2.6 Tide gauge installation, maintenance, and removal

Coast Survey proposes to install tide gauges to measure water levels referenced to a tidal datum, producing a correction value for depth soundings collected during a hydrographic survey. Tide gauge sites are chosen based on a number of factors, including: available water level data from historical site locations, proximity to long-term water level stations, and dynamic environmental variables. Coast Survey proposes to install, maintain, and remove tide gauges, as needed.

Surveyors would attach acoustic sensors (within a six-inch diameter PVC housing) to piers with stainless steel brackets. In the absence of existing infrastructure, they would install a bottom-mounted pressure gauge. This gauge requires a shore-based data collection platform, which is connected to the underwater sensor with a 50-100 ft tube. Surveyors would secure the sensor in place by driving a stake into the seabed, weighting the sensor, attaching the sensor to a large piece of iron, or enclosing the sensor in an iron framework. The maximum footprint would be 4 ft^2. They would not install the bottom-mounted pressure gauge within the habitat ranges of coral or Johnson's seagrass.

They would also install microwave radar sensors, which use radar waves to measure the distance from the sensor to the water (these sensors would be installed on land, overlooking the water surface). They would also deploy tide buoys, which measure horizontal and vertical position using GPS technology.

2.7 Testing of new survey products

Coast Survey proposes to test new cartographic, hydrographic, and oceanographic systems to determine accuracy and usefulness of emerging technologies. They would evaluate techniques and equipment on NOAA survey vessels, including the *Bay Hydro II* in the Chesapeake Bay.

2.7.1 Ellipsoidally referenced surveys

To evaluate the efficacy of ellipsoidally referenced surveys, Coast Survey proposes to use a ship-based inertially-aided GPS system and a shore-based GPS reference station. In some instances, they would need to establish a new shore-based reference station site, which would require installing a tripod, antenna, receiver housed in a hardened waterproof "suitcase," data storage and connectivity capacity, and possibly a set of 12-volt marine, deep-cycle re-chargeable batteries and a solar panel array.

2.7.2 GPS tide buoys

Coastal Survey proposes to install GPS tide buoys. They currently own two Hydrolevel™ GPS tide buoys, which are approximately 26" in diameter and weigh 128 lbs. The buoys use LED lights, powered by sealed lithium batteries, and are visible from three miles away. A typical mooring configuration includes 100-150 lbs. of anchoring mass (usually a combination of a 50 lb. primary anchor and several 15 lb. "mushroom" anchors) and a heavy chain, with a total footprint of approximately 1 m^2.

Coastal Survey would deploy buoys in water depths of approximately10 m. They would tether the buoy to the anchoring hardware with a 15 m, 1" diameter rubber cord, followed by a section of 3/16" Amsteel rope. The rubber cord attaches to the bottom of the buoy, and the rope attaches the rubber cord to the anchor. The combined length of the rubber cord and the rope exceeds the nominal water depth by a factor of approximately two (i.e., "mooring scope" = 2). The GPS buoy is deployed by floating the buoy away from the vessel to the extent of the rubber cord and rope. The anchor is then lowered slowly and released. During recovery, the GPS buoy is brought aboard the vessel along with the length of the rubber cord. The total anchoring hardware is then hauled in by rope.

Coast Survey would occasionally replace or recharge the batteries must be replaced or recharged, bringing the buoy on board and attaching a temporary float to the end of the mooring until replacement. At the end of the survey, the field unit would recover all components of the buoy.

2.7.3 Autonomous underwater vehicles

Coast Survey proposes to evaluate the use of autonomous underwater vehicles (AUVs) for mapping activities. The AUVs have depth ratings of 100-600 m, can travel at speeds up to 4 knots, and be submerged for 16 hours. They would be programmed to avoid known obstructions, avoid striking the sea floor, and to pause and reverse or surface in the event of a collision.

2.7.4 Phase measuring bathymetric sonars

Coast Survey proposes to test phase measuring bathymetric sonar systems, also referred to as interferometric sonar or swath bathymetry sonar. These systems measure acoustic signal phase at each of several receive elements, spaced at precisely known distances, to determine the angle from which the acoustic return originates. This angle of origin, in combination with range calculated from the two-way travel time, provides a discrete location on the seafloor. This sampling is done thousands of times per acoustic ping, providing a cross-track profile of bathymetry. A number of consecutive profiles are then combined to build a three-dimensional model of the seafloor. Coast Survey is currently testing the 455 kHz Klein HydroChart 5000 Swath Bathymetry Sonar System, which has an increased swath width over traditional multibeam systems and would provide greater coverage.

2.8 LIDAR surveys

In the Gulf of Mexico and Caribbean, Coast Survey proposes to use aircraft-mounted lasers to perform light detection and ranging (LIDAR) surveys. Airborne LIDAR bathymetry measures depths of nearshore waters using laser pulses emitted from a scanner on board a low-altitude, twin-engine 17-turbo prop airplane flying at speeds of 140 - 175 knots. The aircraft flies at altitudes of 1,000-1,200 feet for an average duration of up to 5 hours per flight (plus transit to and from the survey site). One LIDAR project is conducted each year.

The LIDAR system transmits pulses of laser light toward the survey area. It measures the lengths of time required to detect returning infrared light, reflected at the sea surface, and green light, reflected off the seafloor. Multiplying the difference in time by the speed of light in water provides an accurate estimate of water depth.

2.9 Protective Measures Incorporated int th Action

Coast Survey proposes to incorporate several activities into their action to avoid and protect ESA-listed and proposed species and critical habitat. They would require NOAA and contracted vessels to implement all activities, which would be included as part of the Statement of Work requirements in the new contracts for private vessels, to be issued in 2013.

1. Minimize vessel disturbance and ship strike potential
    - Slow speeds (4 – 8 knots), when mapping
    - Reduced speeds (<13 knots) when transiting through ranges of ESA-listed cetaceans (unless otherwise required, e.g., NOAA Sanctuaries)
    - Reduced speeds (<13 knots) while transiting through designated critical habitat (unless slower speeds are required, e.g., < 10 knots in right whale critical habitat and management areas)
    - Trained observers aboard all vessels; 100% observer coverage
    - Species identification keys (for marine mammals, sea turtles, corals, abalone, and seagrasses) available on all vessels

2. Minimize noise
    - Reduced speed (see above)
    - Multibeam surveys using ≥ 50 kHz frequencies, lowest possible power and ping-rate
    - Single beam surveys using ≥ 30 kHz frequencies, lowest possible power and ping-rate, and 12° beam angle.

3. Minimize vessel discharges (including aquatic nuisance species)
    - Meet all EPA Vessel General Permits and Coast Guard requirements
    - Avoid discharge of ballast water in designated critical habitat
    - Use anti-fouling coatings
    - Clean hull regularly to remove aquatic nuisance species
    - Avoid cleaning of hull in critical habitat
    - Avoid cleaners with nonylphenols
    - Rinse anchor with high-powered hose after retrieval

4. Minimize anchor impact to corals, abalone, and seagrass
    - Use designated anchorage area when available
    - Use mapping data to anchor in mud or sand, to avoid anchoring on corals
    - Avoid anchoring in abalone habitat (California vessels return to port, rather than anchor)
    - Avoid anchoring in seagrass critical habitat
    - Minimize anchor drag

5. Avoid collecting bottom samples in seagrass critical habitat

6. Avoid using tertiary tide gauges (i.e., pressure gauge component) throughout the ranges of ESA listed and proposed coral, abalone and seagrass species

7. Cetaceans

- Avoid approaching within 200 yards (182.9 m), 500 yards for right whales
- Avoid critical habitat, when possible
- Avoid using sonar frequencies < 180 kHz, when possible
- Suspend multibeam sonar transmissions of < 125 kHz, when susceptible ESA-listed species (i.e., Southern Resident killer whale and Cook Inlet beluga whale) are within hearing range
- Suspend single beam sonar transmissions of 30 kHz when ESA-listed species are within hearing range

8. Pinnipeds
   - Avoid approaching in-water pinnipeds within 100 yards (182.9 m)
   - When possible, maintain a vessel distance of at least 3 nautical miles (5.5 km) and a land-based distance of 0.5 miles (0.8 km) of Steller sea lion rookeries listed in 50 CFR 223.202 or Marmot Island
   - Avoid nearshore surveys when Steller sea lions are observed onshore
   - When possible, suspend sonar transmissions when ESA-listed species are within hearing range

9. Sea turtles
   - Avoid approaching within 50 yards

Coast Survey would require any observations of marine mammals and sea turtles (the only ESA-listed species likely to be observed) to be recorded in their Observation Log (NOAA 2012), including the date, time, location, species, number of individuals, and response behavior (if any). They would also take a digital photograph. The information from the Observation Logs would be compiled, summarized, and provided to us at the end of each year.

Coast Survey will provide the list of protective measures to all vessel captains and crew. They will explain that these measures are required to fulfill their ESA section 7 requirements, i.e., to insure that their action does not jeopardize endangered or threatened species and does not adversely modify or destroy critical habitat. They will ensure compliance during surveys conducted aboard NOAA ships. They will strongly encourage compliance during transits aboard NOAA ships and record any instances of non-compliance. They will require compliance as a condition of their contracts for private vessels.

In the event of unauthorized incidental take, Coast Survey would suspend all activities causing such take and immediately contact us. They would request reinitiation in the event of unauthorized take, systematic noncompliance, unanticipated adverse effects, or modification of the action, as described above.

3.0 Action Area

Coast Survey proposes to survey approximately 3,000 SNM annually, choosing from 500,000 SNM of navigationally significant, coastal waters in the continental United States and Alaska. Coast Survey would not conduct these surveys in the Pacific Islands, including Hawaii (K.

Jamison, pers. comm.) They would survey approximately 30 discreet locations annually. Project locations would be determined at the beginning of each year, dependent upon agency mapping priorities. Project priorities are available in the appendices of the PEA (NOAA 2012). Surveyed water depths range from 4 – 200 m but are generally less than 100 m in depth.

Coast Survey conducts hydrographic surveys year-round in some areas and seasonally in others. They operate in the Arctic or Bering Sea between June and September to avoid dangerous, icy conditions. They conduct surveys in Southeast, Central, and Southwest Alaska between March and November. West Coast, Northeast, and Mid-Atlantic surveys are also conducted between March and November. They conduct surveys in the Southeast and Gulf of Mexico year round.

Surveys are conducted 15 days per month on average, although larger ships can often survey 20 – 25 days per month under good conditions. Surveys are often cancelled as a result of bad weather or equipment failure. Large ships often survey 24 hours per day. Smaller boats operate 8 – 12 hours per day. Project durations vary from a few days to several months over multiple years.

4.0 Approach to the Assessment

Section 7(a)(2) requires every Federal agency, in consultation with and with the assistance of NMFS, to insure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. This consultation was initiated as a result of a "may affect" determination for species occurring in the action area.

During the consultation, we first reviewed all relevant information provided by Coast Survey to describe the action, including interrelated and interdependent actions. Interrelated actions are part of a larger action and depend on the larger action for their justification. Interdependent actions have no independent utility apart from the proposed action. We also described the action area, which includes all areas affected directly and indirectly by the action.

Second, we evaluated the current status of listed species and critical habitat that occur within the action area. We also evaluated the environmental baseline (i.e., past and present anthropogenic impacts within the action area) to determine how species and critical habitat are likely to be affected by the action.

Third, we evaluated the direct and indirect effects of the action on listed species and designated critical habitat as well as proposed species and proposed critical habitat. Indirect effects are caused by the proposed action and are later in time, but still are reasonably certain to occur. We assessed the exposure to physical, chemical, or biotic stressors produced by the proposed action, whether such exposure is likely to reduce the survival and reproduction of individuals, and whether fitness reductions would threaten the viability of populations and species. We assessed whether the action is likely to reduce the conservation value of critical habitat. We did not rely on the regulatory definition of "destruction or adverse modification of critical habitat (50 CFR 402.02); instead, we relied upon the statutory provisions of the ESA to complete our critical habitat analysis. We also evaluated the cumulative effects of non-Federal activities (i.e., State and private) that are reasonably certain to occur within the action area. For all analyses, we used the best available scientific and commercial data. For this consultation, we relied on information submitted by the action agency, government reports, and the general scientific literature. To determine probable responses to the action, we used *Google Scholar* to search for all stressor-species combinations. When we discovered contradictory conclusions, we described all results, evaluated the merits or limitations of each study, and explained how each was similar or dissimilar to the proposed action to come to our own conclusion.

We used the above steps to help formulate our biological and conference opinion and conference. Coast Survey's action consists of many activities conducted over large geographic areas and long periods of time; such actions involve substantial uncertainty about the number, location, timing, frequency, and intensity of individual activities. Therefore, we conducted a programmatic consultation to determine whether Coast Survey has insured that its program is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. Specifically, we asked the following questions:

1. Has Coast Survey structured their program to minimize the adverse effects of their action on listed and proposed species and critical habitat?
2. Has Coast Survey structured their program to continuously monitor aspects of their action that are likely to adversely affect listed species and critical habitat? Has Coast Survey structured their program to encourage, monitor, and enforce the compliance of their surveyors and vessel operators?
3. Has Coast Survey structured their program to evaluate monitoring data in order to detect potentially adverse effects on listed species and critical habitat?
4. Has Coast Survey structured their program to allow it to change its action or requirements if deemed necessary to prevent jeopardizing listed species or to prevent the destruction or adverse modification of critical habitat?

We used the answers to these questions to determine whether and to what extent Coast Survey has designed their action to minimize the impact to listed resources, monitor the impact of the action on listed resources, and modify activities, if necessary, to avoid jeopardizing species and the destruction or adverse modification of critical habitat.

5.0 Status of the Species

Tables 1 and 2 describe the ESA-listed and proposed (respectively) species and critical habitat that occur in the action area and may be affected by the proposed action.

Table 1. Listed species and critical habitat (*) that may be affected by the proposed action.

Common Name (DPS), *Critical Habitat	***Scientific Name***	***Status***
Cetaceans		
Beluga whale (Cook Inlet)*	*Delphinapterus leucas*	Endangered
Killer Whale (Southern Resident)*	*Orcinus orca*	Endangered
Sperm whale	*Physeter macrocephalus*	Endangered

Common Name (DPS), *Critical Habitat	***Scientific Name***	***Status***
Blue whale	*Balaenoptera musculus*	Endangered
Bowhead whale	*Balaena mysticetes*	Endangered
Fin whale	*Balaenoptera physalus*	Endangered
Humpback whale	*Megaptera novaeangliae*	Endangered
North Atlantic right whale*	*Eubalaena glacialis*	Endangered
North Pacific right whale*	*Eubalaena japonica*	Endangered
Sei whale	*Balaenoptera borealis*	Endangered
Pinnipeds		
Bearded seal (Beringia)	*Erignathus barbatus*	Threatened
Ringed seal (Arctic)	*Phoca hispida hispida*	Threatened
Guadalupe fur seal	*Arctocephalus townsendi*	Threatened
Steller sea lion (Eastern)*	*Eumetopias jubatus*	Threatened
Steller sea lion (Western)*		Endangered
Marine Turtles		
Green sea turtle (Florida & Mexico's Pacific coast colonies)	*Chelonia mydas*	Endangered
Green sea turtle (All other areas)		Threatened
Hawksbill sea turtle	*Eretmochelys imbricate*	Endangered
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered
Leatherback sea turtle*	*Dermochelys coriacea*	Endangered
Loggerhead sea turtle (Northwest Atlantic)	*Caretta caretta*	Threatened
Loggerhead sea turtle (North Pacific)		Endangered
Olive ridley sea turtle (Mexico's Pacific coast breeding colonies)	*Lepidochelys olivacea*	Endangered
Olive ridley sea turtle (All other areas)		Threatened
Marine and Anadromous Fishes		
Atlantic salmon (Gulf of Maine)*	*Salmo salar*	Endangered
Atlantic sturgeon (Gulf of Maine)	*Acipenser oxyrinchus oxyrinchus*	Threatened
Atlantic sturgeon (New York Bight)		Endangered
Atlantic sturgeon (Chesapeake Bay)		Endangered
Atlantic sturgeon (Carolina)		Endangered
Atlantic sturgeon (South Atlantic)		Endangered
Chinook salmon (Central Valley Spring-run)*	*Oncorhynchus tschawytscha*	Threatened
Chinook salmon (Upper Columbia River)*		Endangered
Chinook salmon (Puget Sound)*		Threatened
Chinook salmon (Sacramento River Winter-run)*		Endangered
Chinook salmon (California coastal)*		Threatened
Chinook salmon (Lower Columbia River)*		Threatened
Chinook salmon (Upper Willamette)*		Threatened
Chinook salmon (Snake River fall run)*		Threatened
Chinook salmon (Snake River spring/summer run)*		Threatened
Chum salmon (Hood Canal Summer-run)*	*Oncorhynchus keta*	Threatened
Chum salmon (Columbia River)*		Threatened
Coho salmon (Central California Coast)*	*Oncorhynchus kisutch*	Endangered
Coho salmon (Oregon Coast)*		Threatened
Coho salmon (Lower Columbia River)		Threatened

Common Name (DPS), *Critical Habitat	***Scientific Name***	***Status***
Coho salmon (Southern Oregon and Northern California coasts)*		Threatened
Gulf sturgeon*	*Acipenser oxyrinchus desotoi*	Threatened
Green sturgeon (Southern)*	*Acipenser medirostris*	Threatened
Shortnose sturgeon*	*Acipenser brevirostrum*	Endangered
Smalltooth sawfish (U.S. portion of range)*	*Pristis pectinata*	Endangered
Largetooth sawfish	*Pristis perotteti*	Endangered
Bocaccio (Georgia Basin)	*Sebastes paucispinis*	Endangered
Yelloweye rockfish (Puget Sound/Georgia Basin)	*Sebastes pinniger*	Threatened
Canary rockfish (Puget Sound/Georgia Basin)	*Sebastes ruberrimus*	Threatened
Pacific eulachon (Southern)*	*Thaleichthys pacificus*	Threatened
Steelhead (Central California Coast)*	*Oncorhynchus mykiss*	Threatened
Steelhead (California Central Valley)*		Threatened
Steelhead (Puget Sound)		Threatened
Steelhead (Southern California)*		Endangered
Steelhead (Northern California)*		Threatened
Steelhead (South-central California coast)*		Threatened
Steelhead (Snake River Basin)*		Threatened
Steelhead (Upper Columbia River)*		Threatened
Steelhead (Middle Columbia River)*		Threatened
Steelhead (Lower Columbia River)*		Threatened
Steelhead (Upper Wilmette)*		Threatened
Sockeye salmon (Ozette Lake)*	*Oncorhynchus nerka*	Threatened
Sockeye salmon (Snake River)*		Endangered
Marine Invertebrates		
Elkhorn coral*	*Acropora palmata*	Threatened
Staghorn coral*	*Acropora cervicornis*	Threatened
White abalone	*Haliotis sorenseni*	Endangered
Black abalone*	*Haliotis cracherodii*	Endangered
Marine Plants		
Johnson's seagrass*	*Halophilia johnsonii*	

Table 2. Proposed species that may be affected by the proposed action.

Common Name (DPS)	***Scientific Name***	***Status***
Marine Invertebrates		
Elkhorn coral	*Acropora palmata*	Proposed Endangered
Staghorn coral	*Acropora cervicornis*	Proposed Endangered
Boulder star coral	*Montastraea annularis*	Proposed Endangered
Mountainous star coral	*Montastraea faveolata*	Proposed Endangered
Pillar coral	*Dendrogyra cylindrus*	Proposed Endangered
Rough Cactus Coral	*Mycetophyllia ferox*	Proposed Endangered
Star coral	*Montastraea franksi*	Proposed Endangered
Lamarck's Sheet Coral	*Agaricia lamarcki*	Proposed Threatened

Common Name (DPS)	***Scientific Name***	***Status***
Elliptical Star Coral	*Dichocoenia stokesii*	Proposed Threatened

5.1 Species and Critical Habitat Not Likely to be Adversely Affected by the Action

The proposed action may affect the above species and critical habitat; however, it is not likely to adversely affect some species and critical habitat. If an action's effects on listed species or critical habitat are insignificant, discountable, or completely beneficial, we conclude that the action is not likely to adversely affect those resources. Insignificant effects relate to the size of impact and do not result in take; discountable effects are unlikely to occur. Here we describe the species and critical habitat that are not likely to be adversely affected by the proposed action.

5.1.1 Baleen whales

Blue, bowhead, fin, humpback, sei, sperm, North Atlantic and North Pacific right whales occur in the action area. These large, highly mobile baleen whales would not be affected (i.e., no effect) by the following activities: anchoring, sound speed data collection, bottom sample collection, tide gauge procedures, ellipsoidally referenced surveys, or AUVs. They may be affected, however, by vessel activity, hydrographic surveys, and LIDAR surveys.

Vessel activity

Normal vessel activity may affect baleen whales via collision, noise, and discharges. Ship strikes pose a significant threat to critically low-abundance baleen whale populations (i.e., North Atlantic right whale; Clapham et al. 1999). The majority of ship strikes involve large, fast commercial vessels, such as container ships. Though Coast Survey employs smaller, slower vessels, one of its chartered vessels struck and killed a blue whale, while mapping the Californian coast in 2009. The vessel was traveling at a speed of 5.5 knots, well below the 10-knot speed limit recommended to minimize the likelihood of collision. The State of California determined that the collision was unavoidable: the whale suddenly and unexpectedly surfaced beneath the hull (http://archives.slc.ca.gov). An autopsy report indicated that the vessel's propeller severed the whale's vertebrae, resulting in instantaneous paralyzation (Jacobsen 2009). This unfortunate event constitutes Coast Survey's only ship strike in approximately 540,000 survey hours ($p = 1.9 \times 10^{-6}$; 95% CI = $0 - 5.5 \times 10^{-6}$). To avoid future collisions, Coast Survey vessels will operate at slow speeds (4 – 8 knots while mapping, <13 knots while transiting through critical habitat, and <13 knots while transiting within the range of ESA-listed cetaceans). Trained observers will keep watch for baleen whales, and the vessels will maintain a distance of 200 yards (500 yards for right whales). We conclude that the likelihood of another ship strike is extremely unlikely to occur and thus discountable.

Baleen whales are preyed upon by killer whales and sharks; they have also been hunted by humans. Therefore, the sight of a large, mobile object (i.e., a vessel) may elicit anti-predatory response, such as avoidance. This stressor, which we call visual disturbance, is inherent to the normal use of vessels. Baleen whales are often exposed to the presence of vessels because millions of recreational vessels (National Marine Manufacturers Association 2011) and hundreds of thousands of non-recreational vessels (http://cfpub.epa.gov/npdes/vessels/vgpermit.cfm) occur along U.S. coasts. An additional 30 Coast Survey vessels would not appreciably increase the likelihood of exposure, above background levels. Many individuals do not respond to the visual disturbance (Nowacek et al. 2004). Other individuals exhibit temporary changes in behavior, without apparent long-term consequences (Bauer et al. 1993). To minimize the effect on baleen whales, OCS vessels will maintain minimum distances of 200 yards (500 yards for right whales), following guidelines to avoid disturbance (http://www.nmfs.noaa.gov/pr/education/viewing.htm). At such distances, and given the minute increase in exposure (over background levels), OCS vessels are likely to have insignificant effects on baleen whales, as a result of visual disturbance.

Vessel noise is another potential stressor for baleen whales. Commercial shipping is the dominant source of low-frequency anthropogenic noise. Responses to this stressor include changes in behavior (such as decreased call rates at increased frequencies; Parks et al. 2007) and increased release of stress hormones (Rolland et al. 2012). To minimize their contribution to underwater noise, OCS vessels would maintain slow speeds. They would use trained observers to maintain minimum distances of 200 yards (500 yards for right whales) from baleen whales. The noise from OCS's slow, relatively small vessels would not appreciably increase noise over the present ambient background levels (the product of millions of vessels nationwide, as described above). We conclude that OCS vessel noise would have an insignificant effect on baleen whales.

Vessels have the potential to affect environmental water quality through discharges and the transport of aquatic nuisance species (ANS). The introduction of ANS has been cited as a major threat to biodiversity, second only to habitat loss (Wilcove et al. 1998); it has been implicated in the endangerment of 48 percent of the species listed under ESA (Czech and Krausman 1997). Coast Survey vessels do not leave the coastal waters of the continental United States and Alaska; therefore, they do not have the ability to introduce foreign ANS to U.S. waters. To further minimize the transfer of ANS, Coast Survey proposes to: rinse the anchor with a high-powered hose after retrieval; use anti-fouling coatings; regularly remove ANS from their hulls but avoid doing so in critical habitat; and avoid discharging ballast water in critical habitat. Coast Survey proposes to minimize the impact of their vessel discharges by meeting all EPA Vessel General Permit and Small Vessel General Permit requirements (http://cfpub.epa.gov/npdes/vessels/vgpermit.cfm). These permits authorize discharges from approximately 72,000 larger vessels and an additional approximately 138,000 small vessels. We consulted on these permits and concluded that EPA's action (the issuance and implementation of the permits) was not likely to jeopardize species and not likely to adversely modify or destroy critical habitat (http://www.nmfs.noaa.gov/pr/consultation/opinions/biop_epa_vessels.pdf). Compared to the VGPs, this action involves few vessels, and the small amount discharges from those vessels are likely to be unnoticeable. Given these protective measures and the small population of vessels (approximately 30 nationwide), we conclude that discharges from Coast Survey vessels would have insignificant effects on baleen whales.

Hydrographic surveys

Baleen whales use a wide range of vocalizations for navigation and communication (including mating calls). They are able to hear sounds within a frequency range of 7 Hz – 30 kHz (Ketten 1997, McDonald et al. 2005, Parks et al. 2007b) and have very sensitive hearing at lower end of that range. Coast Survey's high frequency multibeam systems (≥ 50 kHz) do not overlap with this range; therefore, baleen whales would not be exposed to the sound (i.e., no effect).

Coast Survey would use single beam systems with frequencies ≥ 30 kHz (K. Jamison pers. comm.), in uncharted waters ≤ 20 m in depth. Small vessels perform these initial reconnaissance missions when the depth of an area is unknown, to avoid potential grounding and resultant damage to expensive multibeam systems. Such surveys are short in duration and are rarely performed outside of Alaskan waters. The frequency of single beam systems ≥ 30 kHz slightly overlaps with the hearing range of baleen whales (7 Hz – 30 kHz); however, their hearing is less sensitive at this higher frequency. When using single beam sonar, OCS maintains a 12° beam angle. As single beam sonar is only used in depths of ≤ 20 m, the maximum resultant beam width would be 4.2 m. Therefore, a baleen whale would need to pass within 4.2 m of the small vessel to be exposed. Coast Survey would avoid approaching whales within at least 200 yards (182.9 m). If they suddenly became aware of a baleen whale within the 4.2 m beam width, they would suspend 30 kHz transmissions. Because exposure of ESA-listed baleen whales to single beam sonar is extremely unlikely to occur, the resultant effects are discountable.

LIDAR surveys
The LIDAR surveys would be flown at >1000 ft, in accordance with FAA regulations designed to minimize potential disturbance of whales. At such high altitudes, potential auditory or visual stressors would be minute. Therefore, the LIDAR surveys would have insignificant effects on baleen whales.

Summary
Coast Survey's action is not likely to adversely affect baleen whales (i.e., blue, bowhead, fin, humpback, sei, sperm, North Atlantic and North Pacific right whales).

5.1.2 North Atlantic right whale critical habitat

In 1994, NMFS designated critical habitat for the North Atlantic right whale, which includes the following three areas: (1) a spring/ early summer feeding and nursery area for a majority of the population in the Great South Channel; (2) a late winter/spring feeding and nursery area for a small portion of the population in Cape Cod Bay; and (3) a winter calving ground and nursery area in the coastal waters of the southeastern United States (59 FR 28805). Topographic and seasonal oceanographic characteristics of the foraging areas facilitate the growth of dense swarms of adult calanoid copepods and other zooplankton prey. Coastal waters of Georgia and Florida are conducive to calving because of their water depth, water temperature, and distance from shore to the 40 m isobath.

Coast Survey's action would not affect prey abundance in the foraging areas or oceanographic features in the calving area. Vessel traffic threatens the conservation value of the critical habitat in all three areas (59 FR 28805). Potential stressors include ship strike, visual disturbance, noise, and vessel discharges (including ANS). As described above for the species, the effects of ship strike are discountable, while the effects from visual disturbance, noise, and discharges are insignificant.
Though critical habitat is likely to be exposed to these stressors, the primary constituent elements that give the designated area value for the conservation are not likely to respond to that exposure. Therefore, Coast Survey's action is not likely to adversely affect North Atlantic right whale critical habitat.

5.1.3 North Pacific right whale critical habitat

In 2008, NMFS designated critical habitat for the North Pacific right whale, which includes an area in the Southeast Bering Sea and an area south of Kodiak Island in the Gulf of Alaska (73 FR 19000). These areas are influenced by large eddies, submarine canyons, or frontal zones which enhance nutrient exchange and act to concentrate prey. These areas are adjacent to major ocean currents and are characterized by relatively low circulation and water movement. Both critical habitat areas support feeding by North Pacific right whales because they contain the designated primary constituent elements, which include: nutrients, physical oceanographic processes, certain species of zooplankton, and a long photoperiod due to the high latitude (73 FR 19000). Consistent North Pacific right whale sights are a proxy for locating these elements.

Coast Survey's action would not affect these primary constituent elements in any manner. It would not diminish prey abundance or alter oceanographic features. Therefore, the action would not affect North Pacific right whale critical habitat.

5.1.4 Sperm whales

Sperm whales exhibit a strong preference for waters deeper than 1,000 m and are rarely found in depths < 300 m (Clarke 1956, Rice 1989). Coast Survey restricts their projects to coastal waters of depths fewer than 200 m. Therefore, sperm whales are not likely to be exposed to vessel activity, as described in detail for baleen whales, above.

Hydrographic surveys

Sperm whales do not occur in depths ≤ 20 m; therefore, they would not be exposed to single beam sonar. With a hearing range of 2.5-60 kHz, they are capable of hearing multibeam sonar systems (≥ 50 kHz). Their hearing is most sensitive at < 20 kHz, however, and they respond weakly to higher frequencies (Carder and Ridgway 1990). In a study by Watkins and Schevill (1975), sperm whales reacted to nearby 6 – 13 kHz pingers by temporarily suspending sound production; they did not otherwise alter their behavior. It is unlikely that higher frequency sound (≥ 50 kHz), from a distant source (at least 100 m and likely > 1 km), would have measurable effects on the behavior of sperm whales. We conclude that hydrographic surveys would have insignificant effects on the species.

LIDAR surveys

The LIDAR surveys would be flown at >1000 ft, in accordance with FAA regulations designed to minimize potential disturbance of whales. At such high altitudes, potential auditory or visual stressors would be minute. Therefore, the LIDAR surveys would have insignificant effects on sperm whales.

Summary

Coast Survey's action is not likely to adversely affect sperm whales.

5.1.5 Sea turtles

Sea turtles would not be affected (i.e., no effect) by the following activities: anchoring, sound speed data collection, bottom sample collection, tide gauge procedures, ellipsoidally referenced surveys, LIDAR surveys, and AUVs. Sea turtles hear at low frequencies (100 – 1000 Hz) (Bartol et al. 1999, Bartol and Ketten 2000, Ketten and Bartol 2006); therefore, they would not be exposed to single beam (≥ 30 kHZ) or multibeam (≥ 50 kHZ) systems.

Vessel activity
Ship strikes, visual disturbance, vessel noise, and discharges (including ANS) are stressors, inherent to the normal use of vessels, which may affect sea turtles. Ship strikes result in the deaths of several hundred sea turtles annually; however, reduced ship speeds, such as those used by Coast Survey, minimize the likelihood of collision (Hazel et al. 2007). In over 540,000 hours of surveying, OCS vessels have never struck a sea turtle ($p = 0.0$). This stressor is highly unlikely to occur and is therefore discountable.

Sea turtles are preyed upon by killer whales and sharks; they are also caught as bycatch in fisheries. Therefore, the sight of a large, mobile object (i.e., a vessel) may elicit anti-predatory response, such as avoidance. This stressor, which we call visual disturbance, is inherent to the normal use of vessels. Observers aboard OCS vessels will be on the look-out for turtles; they will help vessels maintain a distance of 50 yards from all sea turtles, consistent with NOAA sea turtle guidelines (http://www.nmfs.noaa.gov/pr/education/southeast/). Sea turtles often ignore vessels in close proximity, continuing to forage in their presence (Harvey et al 2006); therefore, we do not expect turtles to change their behavior in any manner in response to distant OCS vessels. Therefore, we expect visual disturbance to have insignificant effects on sea turtles.

Sea turtles may be affected by vessel noise; however, Samuel et al. (2005) observed juvenile sea turtles foraging near a loud, highly trafficked estuary system. Coast Survey would only operate one or a few vessels in the vicinity of an individual turtle. Noise from a single vessel is unlikely to elicit response; resting turtles often do not dive until a vessel approaches closely, indicating that the source of disturbance is likely the sight rather than the noise of a vessel (Pendoley 1997). Coast Survey vessels would travel at slow speeds, which reduces vessel noise. Because these vessels would add minimal noise to the ambient sound environment, we conclude that they would have an insignificant effect on listed sea turtle species.

Vessels have the potential to affect environmental water quality through discharges and the transport of ANS. Coast Survey proposes to minimize the impact of their vessel discharges by meeting all EPA Vessel General Permit and Small Vessel General Permit requirements (http://cfpub.epa.gov/npdes/vessels/vgpermit.cfm). To further minimize the transfer of ANS, Coast Survey proposes to: rinse the anchor with a high-powered hose after retrieval; use anti-fouling coatings; regularly remove ANS from their hulls but avoid doing so in critical habitat; and avoid discharging ballast water in critical habitat. As described above, Coast Survey vessels do not leave the coastal waters of the continental United States and Alaska; therefore, they do not have the ability to introduce foreign ANS to U.S. waters. Given these protective measures and the small population of vessels (approximately 30), we conclude that discharges from OCS vessels would have insignificant effects on sea turtles.

In summary, the action proposed by Coast Survey is not likely to adversely affect sea turtles.

5.1.6 Leatherback critical habitat
On January 20, 2012, NMFS issued a final rule to designate critical habitat for the leatherback sea turtle (77 FR 4170) within the action area. This designation includes two areas: one along the California coast from Point Arena to Point Arguello; and the other stretching from Cape Flattery, Washington to Cape Blanco, Oregon. The designated areas comprise approximately

108,558 km^2 with a maximum depth of 80 m. The primary constituent element essential for conservation of leatherback turtles is the occurrence of scyphomedusae prey species of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks.

The following actions would not affect leatherback critical habitat within the action area: anchoring, sound speed data collection, bottom sample collection, tide gauge procedures, ellipsoidally referenced surveys, LIDAR surveys, and AUVs. Scyphomedusae have rudimentary "hearing" organs that detect low frequency vibration. They would not be affected by hydrographic surveys, and the effects of vessel noise are likely to be insignificant. Their soft bodies are not likely to be injured by ship strike. Though medusae may get caught in and injured by the propellers, such events would not significantly reduce their abundance. Therefore, the action would not reduce the conservation value of the critical habitat. We conclude that the proposed action is not like to adversely affect designated critical habitat of the leatherback sea turtle.

5.1.7 Marine and anadromous fishes

Marine and anadromous fishes would not be affected by the following activities: anchoring, sound speed data collection, bottom sample collection, tide gauge procedures, ellipsoidally referenced surveys, LIDAR surveys, AUVs, ship strikes, and ship noise. Fish likely hear at low frequencies of <0.5-1 kHz (Wahlberg and Westerberg 2005); therefore, they would not be affected by OCS hydrographic surveys (≥ 30 kHZ).

Vessels have the potential to affect environmental water quality through discharges and the transport of ANS. Coast Survey proposes to minimize the impact of their vessel discharges by meeting all EPA Vessel General Permit and Small Vessel General Permit requirements (http://cfpub.epa.gov/npdes/vessels/vgpermit.cfm). To further minimize the transfer of ANS, Coast Survey proposes to: rinse the anchor with a high-powered hose after retrieval; use anti-fouling coatings; regularly remove ANS from their hulls but avoid doing so in critical habitat; and avoid discharging ballast water in critical habitat. As described above, Coast Survey vessels do not leave the coastal waters of the continental United States and Alaska; therefore, they do not have the ability to introduce foreign ANS to U.S. waters. Furthermore, they do not enter rivers and streams, where anadromous fish are most sensitive to the introduction of ANS. Given these protective measures and the small population of vessels (approximately 30), we conclude that discharges from OCS vessels would have insignificant effects on ESA-listed marine and anadromous fishes. In summary, the action proposed by Coast Survey is not likely to adversely affect ESA-listed marine and anadromous fish.

5.1.8 Marine and anadromous fishes critical habitat

Critical habitat has been designated for several marine and anadromous fish species. The primary constituent elements for these designations include aquatic environments free of obstruction and excessive predation, with optimal water quality and quantity conditions, and a healthy forage base, including aquatic invertebrates and fishes, to support growth and maturation. Vessel discharges and ANS may affect water quality or prey resources. As described above, however, Coast Survey proposes to minimize the impact of their vessel discharges by meeting all EPA Vessel General Permit and Small Vessel General Permit requirements (http://cfpub.epa.gov/npdes/vessels/vgpermit.cfm). To further minimize the transfer of ANS, Coast Survey proposes to: rinse the anchor with a high-powered hose after retrieval; use anti-fouling coatings; regularly remove ANS from their hulls but avoid doing so in critical habitat; and avoid discharging ballast water in critical habitat. More importantly, OCS vessels do not enter the rivers and streams that comprise critical habitat for most fishes. Therefore, discharges from OCS vessels are likely to have discountable effects on these fish critical habitat (i.e., those in rivers or streams). Discharges would insignificant effects on the critical habitat located within marine and estuarine waters, given the above-described protective measures and the small population of vessels (approximately 30 nationwide). In summary, the action proposed by Coast Survey is not likely to adversely affect the conservation value of ESA-listed marine and anadromous fish designated critical habitat.

5.1.9 Black and white abalone

Mollusks, such as abalone, would not be affected by the following activities: sound speed data collection, ellipsoidally referenced surveys, LIDAR surveys, AUVs, ship strikes, and ship noise. They merely detect low frequency sound (Mooney et al. 2010) and thus would not be affected by hydrographic surveys (≥ 30 kHz). Coast Survey would not anchor on the rocky reef habitat of abalone, as the only ship operating in California returns to port every night (K. Jamison, pers. comm.). They would not collect bottom samples or install tide gauges near abalone habitat. Therefore, abalone would not be affected by anchoring, bottom sample collection, or tide gauge procedures.

Abalone may be affected by vessels discharges, which have the potential to affect environmental water quality, and the introduction of ANS. Coast Survey proposes to minimize the impact of their vessel discharges by meeting all EPA Vessel General Permit and Small Vessel General Permit requirements (http://cfpub.epa.gov/npdes/vessels/vgpermit.cfm). To further minimize the transfer of ANS, Coast Survey proposes to: use anti-fouling coatings; regularly remove ANS from their hulls but avoid doing so in critical habitat; and avoid discharging ballast water in critical habitat. As described above, Coast Survey vessels do not leave the coastal waters of the continental United States and Alaska; therefore, they do not have the ability to introduce foreign ANS to U.S. waters. Furthermore, they rarely conduct surveys near abalone habitat. Given these protective measures and the small population of vessels (one that works within the range of abalone), we conclude that discharges from OCS vessels would have insignificant effects on ESA-listed abalone. In summary, the proposed action is not likely to adversely affect black or white abalone.

5.1.10 Black abalone critical habitat

On October 27, 2011, NMFS designated critical habitat for black abalone, which includes rocky areas from mean high water to six meters water depth in the Farallon, Channel, and Año Nuevo islands, as well as the California coastline from Del Mar Ecological Reserve south to Government Point. Black abalone critical habitat includes the following primary constituent elements: abundant food resources, rocky substrates, suitable water quality, and suitable nearshore circulation patterns (76 FR 66806).

Water quality may be affected by vessels discharges, and prey may be affected by the introduction of ANS. Coast Survey rarely conducts surveys in black abalone critical habitat. They propose to minimize the impact of their vessel discharges by meeting all EPA Vessel General Permit and Small Vessel General Permit requirements (http://cfpub.epa.gov/npdes/vessels/vgpermit.cfm). To further minimize the transfer of ANS, Coast Survey proposes to: use anti-fouling coatings; regularly remove ANS from their hulls but avoid doing so in critical habitat; and avoid discharging ballast water in critical habitat. As described above, Coast Survey vessels do not leave the coastal waters of the continental United States and Alaska; therefore, they do not have the ability to introduce foreign ANS to U.S. waters. Given these protective measures and the small population of vessels (one that works within the range of abalone), we conclude that discharges and potential ANS from this OCS vessel are not likely to adversely affect black abalone critical habitat.

5.1.11 Corals

Proposed and listed coral species would not be affected by the following activities: ship strikes, ship noise, sound speed data collection, hydrographic surveys, ellipsoidally referenced surveys, LIDAR surveys, and AUVs. Coast Survey would not anchor on the corals. They would use designated anchorage areas or anchor in sandy or muddy areas. In uncharted waters, they would perform substrate mapping before anchoring. Corals show up very well on their surveys, such that they can avoid anchor damage to corals. This procedure would also allow them to avoid collecting bottom samples or installing tide gauges where corals are present. Therefore, effects to corals as a result of anchoring, bottom sample collection, or tide gauge procedures would be extremely unlikely, i.e., discountable.

Corals may be affected by vessels discharges, which have the potential to affect environmental water quality, and the introduction of ANS. Coast Survey proposes to minimize the impact of their vessel discharges by meeting all EPA Vessel General Permit and Small Vessel General Permit requirements (http://cfpub.epa.gov/npdes/vessels/vgpermit.cfm). To further minimize the transfer of ANS, Coast Survey proposes to: rinse the anchor with a high-powered hose after retrieval; use anti-fouling coatings; regularly remove ANS from their hulls but avoid doing so in critical habitat; and avoid discharging ballast water in critical habitat. As described above, Coast Survey vessels do not leave the coastal waters of the continental United States and Alaska; therefore, they do not have the ability to introduce foreign ANS to U.S. waters. Given these protective measures and the small population of vessels (approximately 30 nationwide), we conclude that discharges from OCS vessels would have insignificant effects on corals. In summary, the proposed action is not likely to adversely affect ESA-listed and proposed coral species.

5.1.12 Coral critical habitat

NMFS published a final rule to designate critical habitat for elkhorn and staghorn corals on November 26, 2008 (73 FR 72210). This habitat serves as substrate of suitable quality and availability (i.e., natural consolidated hard substrate or dead coral skeleton that is free from fleshy or turf macroalgae cover and sediment cover), in water depths from the mean high water line to 98 feet (except along some areas of Florida, where 6 foot contour is the shoreward limit), to support successful larval settlement, recruitment, and reattachment of fragments. Four specific areas were designated, but only one (the Florida unit, which comprises approximately 1,329 square miles of marine habitat) occurs within the action area.

Coast Survey's proposed action is not likely to destroy hard substrate or dead coral skeleton because they will avoid anchoring, collecting bottom samples, or installing tide gauges on these substrates. Coast Survey proposes to minimize the transfer of macroalgae by: rinsing the anchor with a high-powered hose after retrieval; using anti-fouling coatings; regularly removing fouling organisms from their hulls (but avoid doing so in critical habitat); and avoiding discharging ballast water in critical habitat. Given these protective measures and the small population of vessels (approximately 30 nationwide), we conclude that OCS vessels are not likely to adversely affect designated critical habitat for corals.

5.1.13 Summary

We conclude that the following ESA-listed species and their designated critical habitat are not likely to be adversely affected by the action: all baleen whales (blue, bowhead, fin, humpback, North Atlantic right, North Pacific right, sei), sperm whales, all sea turtles, all fishes, both abalone species, and all coral species. In addition, the action is not likely to adversely affect the critical habitats of the Southern Resident killer whale, Steller sea lion or Johnson's seagrass; however, we will discuss these critical habitat designations as we consider the effects of the action on the species, in a later section.

5.2 Species an Critical Habitat Likely t Be Adversely Affected b th Action

5.2.1 Cook Inlet beluga whale

Species description

The beluga whale (*Delphinapterus leucas*) is a small, toothed, white whale. The DPS resides year-round within Cook Inlet, in the Gulf of Alaska. It was listed as endangered under the ESA, effective December 22, 2008 (73 FR 62919). We used information available in the final rule, the 2008 Status Review (Hobbs et al. 2008), and recent stock assessment reports (Allen and Angliss 2011) to summarize the status of this species, as follows.

Life history

The Cook Inlet DPS is reproductively, genetically, and physically discrete from the four other known beluga populations in Alaska (i.e., those north of the Alaska Peninsula). Its unique habitat experiences large tidal exchanges, with salinities varying from freshwater to marine at either end of the estuary. Belugas occur in mid-Inlet waters in the winter. During spring, summer, and fall, they concentrate in the upper Inlet (a contraction of its range), which offers the most abundant prey, most favorable feeding topography, best calving areas, and best protection from predation. Cook Inlet belugas feed on a wide variety of prey species, focusing on specific species when they are seasonally abundant. During the spring, they focus on eulachon; in the summer, as the eulachon runs diminish, their focus shifts to salmon species. These fatty, energy-rich prey are critical to pregnant and lactating belugas. Calves are born in the summer and remain with their mothers for about 24 months. The calving interval ranges from 2-4 years. Females reach sexual maturity at 4 to 10 years, and males mature at 8 to 15 years. Life expectancy exceeds 60 years.

Acoustics

Beluga whales have a well-developed sense of hearing and echolocation. They hear over a large range of frequencies, from about 40 Hz to 100 kHz, although their hearing is most acute from 10 – 75 kHz (Richardson et al. 1995). They call at frequencies of 0.26- 20 kHz and echolocate at frequencies of 40-60 kHz and 100-120 kHz (Blackwell and Greene 2002). Their diverse vocal repertoire has earned them the nickname of "sea canaries."

Population dynamics
The most recent abundance estimate for the Cook Inlet DPS is 345 (CV = 0.13) belugas, based on an average of population estimates from 2008 to 2010 (Allen and Angliss 2011). There were an estimated 1,300 whales in 1979. Subsistence removals led to a 47 percent decline from 1994 to 1998 (from 653 to 347 whales). From 1999 to 2008, the population has declined an average of 1.5 percent per year, despite restriction on subsistence harvest since 1999 (0-2 whales harvested annually; 5 total).

Population viability
The Cook Inlet beluga whale DPS is endangered as a result of over-exploitation. A brief commercial whaling operation in the 1920s harvested 151 Cook Inlet belugas in 5 years. Cook Inlet belugas were harvested by Alaska Natives and for sport prior to the enactment of the Marine Mammal Protection Act (MMPA) in 1972. Annual subsistence take by Alaska Natives during 1995–1998 averaged 77 whales, with 20 percent of the population harvested in 1996. Though subsistence removals through the 1990s are sufficient to account for the declines in abundance, other factors now threaten the DPS. Since the early 1990s, over 200 belugas have stranded along the mudflats in upper Cook Inlet, often resulting in death; the cause is uncertain but may be linked with the extreme tidal fluctuations, predator avoidance, or pursuit of prey. Additional threats include: coastal development, oil and gas development, seismic exploration, point and non- point source discharge of contaminants, contaminated waste disposal, water quality standards, activities that involve the release of chemical contaminant and/or noise, vessel operations, and research (73 FR 62919).

Status summary
In summary, the Cook Inlet beluga whale DPS is an endangered species that continues to decline in abundance despite removal of the primary cause of endangerment (i.e., over-exploitation). Its resilience to future perturbation is low because of the following factors: the population has not grown as expected with the cessation of harvest; as a result of the range contraction, the population range is more vulnerable to catastrophic events; and if the current DPS is extirpated, it is unlikely other belugas would repopulate Cook Inlet (Hobbs et al. 2008).

5.2.2 Cook Inlet beluga whale critical habitat
On April 11, 2011, NMFS designated critical habitat for the Cook Inlet beluga whale. This critical habitat is divided between two areas. Area 1 encompasses the upper Inlet, a 1,909 km^2 area bounded by the Municipality of Anchorage, the Matanuska-Susitna Borough, and the Kenai Peninsula borough. This area hosts a high concentration of belugas from spring through fall. It provides shallow tidal flats and river mouths or estuarine areas, important to foraging and calving. Mudflats and shallow areas adjacent may allow for molting and escape from predators. Area 2 consists of 5,891 km^2 south of Area 1 including: Tuxedni, Chinitna, and Kamishak Bays on the west coast, a portion of Kachemak Bay on the east coast, and south of Kalgin Island. During the fall and winter, Belugas typically occur in smaller densities or deeper waters of this feeding and transit area. Areas 1 and 2 contain the following physical or biological features essential to the conservation of this DPS (76 FR 20180):

(1) Intertidal and subtidal waters of Cook Inlet with depths less than 30 feet (9.1 m) and within 5 miles (8 km) of high and medium flow anadromous fish streams.
(2) Primary prey species consisting of four species of Pacific salmon (Chinook, sockeye,

chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole.
(3) Waters free of toxins or other agents of a type and amount harmful to Cook Inlet beluga whales.
(4) Unrestricted passage within or between the critical habitat areas.
(5) Waters with in-water noise below levels resulting in the abandonment of critical habitat areas by Cook Inlet beluga whales.

5.2.3 Southern Resident killer whale

Species description
Killer whales (or orcas) are distributed worldwide. These top predators are isolated by region and ecotype (i.e., different morphology, ecology, and behavior). Southern Resident killer whales occur in the inland waterways of Puget Sound, Strait of Juan de Fuca, and Southern Georgia Strait during the spring, summer and fall. During the winter, they move to coastal waters primarily off Oregon, Washington, California, and British Columbia. The DPS was listed as endangered under the ESA on November 18, 2005 (70 FR 69903). We used information available in the final rule, the 2011 Status Review (NMFS 2011), and the 2011 Stock Assessment Report (http://www.nmfs.noaa.gov/pr/pdfs/sars/po2011whki-pensr.pdf) to summarize the status of this species, as follows.

Life history
Southern Resident killer whales are geographically, matrilineally, and behaviorally distinct from other killer whale populations (70 FR 69903). The DPS includes three large, stable pods (J, K, and L), which occasionally interact (Parsons et al. 2009). Most mating occurs outside natal pods, during temporary associations of pods, or as a result of the temporary dispersal of males (Pilot et al. 2010). Males become sexually mature at 10 – 17 years of age. Females reach maturity at 12 – 16 years of age and produce an average of 5.4 surviving calves during a reproductive life span of approximately 25 years. Mothers and offspring maintain highly stable, life-long social bonds, and this natal relationship is the basis for a matrilineal social structure. During peak periods, Fraser River Chinook make up nearly 80 percent of the whales' diet, with the DPS consuming 13-25 percent of returning Fraser River Chinook (Hanson et al. 2010; http://www.nmfs.noaa.gov/stories/2013/01/1_22_13killer_whale_chinook.html).

Acoustics
Killer whales have a hearing range of 0.5 to 120 kHz. Their hearing is most sensitive in the 18 – 42 kHz range (which overlaps with their echolocation clicks) and is less sensitive at higher frequencies (Szymanski et al. 1999).

Population dynamics
The most recent abundance estimate for the Southern Resident DPS is 86 whales in 2010. This represents an average increase of 0.4 percent annually since 1982 when there were 78 whales. Population abundance has fluctuated during this time with a maximum of approximately 100 whales in 1995 (http://www.nmfs.noaa.gov/pr/pdfs/sars/po2011whki-pensr.pdf). As compared to stable or growing populations, the DPS reflects a smaller percentage of juveniles and lower fecundity (NMFS 2011).

Population viability
The Southern Resident killer whale was listed as endangered in 2005, in response to the population decline from 1996–2001, small population size, and reproductive limitations (i.e., few reproductive males and delayed calving). Threats to its survival and recovery include: contaminants, vessel traffic, and changes in prey availability. Chinook salmon populations have declined due to degradation of habitat, hydrology issues, harvest, and hatchery introgression; such reductions may require an increase in foraging effort. In addition, these prey contain environmental pollutants (e.g., flame retardants; PCBs; and DDT). These contaminants become concentrated at higher trophic levels and may lead to immune suppression or reproductive impairment (70 FR 69903). The inland waters of Washington and British Columbia support a large whale watch industry, commercial shipping, and recreational boating; these activities generate underwater noise, which may mask whales' communication or interrupt foraging.

Status summary
In summary, the Southern Resident killer whale DPS is an endangered species that has demonstrated weak growth in recent decades. The factors that originally endangered the species persist throughout its habitat: contaminants, vessel traffic, and reduced prey. Its resilience to future perturbation is reduced as a result of its small population size; however, it has demonstrated the ability to recover from smaller population sizes in the past and has shown an increasing trend over the last several years. NOAA Fisheries is currently conducting a status review prompted by a petition to delist the DPS based on new information, which indicates that there may be more paternal gene flow among populations than originally detected (Pilot et al. 2010).

5.2.4 Southern resident killer whale critical habitat
On November 29, 2006, NMFS designated critical habitat for the Southern Resident killer whale (71 FR 69054). The critical habitat consists of approximately 6,630 km^2 in three areas: the Summer Core Area in Haro Strait and waters around the San Juan Islands; Puget Sound; and the Strait of Juan de Fuca. It provides the following physical and biological features: water quality to support growth and development; prey species of sufficient quantity, quality and availability to support individual growth, reproduction and development, as well as overall population growth; and inter-area passage conditions to allow for migration, resting, and foraging.

5.2.5 Steller sea lion (Eastern DPS)
Species description
The Steller sea lion ranges from Japan, through the Okhotsk and Bering Seas, to central California. It consists of two morphologically, ecologically, and behaviorally distinct DPSs: the eastern DPS, which includes sea lions in Southeast Alaska, British Columbia, Washington, Oregon and California; and the western DPS, which includes sea lions in all other regions of Alaska, as well as Russia and Japan. On November 26, 1990, NMFS issued a final determination to list the species as threatened under the ESA (55 FR 49204). We used information available in the final listing (55 FR 49205) and the draft status review (NMFS 2012) to summarize the status of the eastern DPS, as follows.

Life history
Within the eastern DPS, pupping and breeding occurs at 15 major rookeries from late May to early July. Male Steller sea lions become sexually mature at 3 – 7 years of age. They are

polygynous, competing for territories and females by age 10 or 11. Female Steller sea lion become sexually mature at 3 – 6 years of age and reproduce into their early 20s. Most females breed annually, giving birth to a single pup, but nutritional stress may result in reproductive failure. About 90% of pups within a given rookery are born within a 25-day period, as such they are highly vulnerable to fluctuations in prey availability. Most pups are weaned in 1 – 2 years.

Females and their pups disperse from rookeries by August – October. Juveniles and adults disperse widely, especially males. Their large aquatic ranges are used for foraging, resting, and traveling. Steller sea lions forage on a wide variety of demersal, semi-demersal, and pelagic prey, including fish and cephalopods. Some prey species form large seasonal aggregations, including endangered salmon and eulachon species. Others are available year round.

Acoustics
Steller sea lions hear within the range of 0.5 – 32 kHz (Kastelein et al. 2005).

Population dynamics
The eastern DPS has increased from an estimated 18,040 animals in 1979 to an estimated 63,488 animals in 2009, an average growth rate of 4.3% per year for 30 years. Pup production has also increased significantly, especially since the mid-1990s.

Population viability
The species was listed as threatened in 1990 because of significant declines in population sizes (55 FR 49204). At the time, the major threat to the species was thought to be reduction in prey availability. To protect and recovery the species, NMFS established the following measures: prohibition of shooting at or near sea lions; prohibition of vessel approach to within 3 nautical miles of specific rookeries, within 0.5 miles on land, and within sight of other listed rookeries; and restriction of incidental fisheries take to 675 sea lions annually in Alaskan waters. Since that time, the population size of eastern DPS has increased considerably, becoming more important to the long-term viability of the species. The biological and ESA listing criteria have been met; the initial threats have been minimized; and other regulations (e.g., MMPA) ensure the continued survival and recovery of the DPS. As a result, NMFS has proposed this DPS for delisting (i.e., removal from the ESA; 77 FR 23209).

Status summary
The Steller sea lion eastern DPS is currently listed as threatened under the ESA; however, NMFS has proposed delisting. The DPS has grown at an average rate of 4.3% per year for the past 30 years. Threats at the time of listing have been removed and protective measures are in place. As a result, the DPS is highly resilient to further disturbances.

5.2.6 Steller sea lion (Western DPS)

Species description
The Stel1er sea lion ranges from Japan, through the Okhotsk and Bering Seas, to central California. It consists of two morphologically, ecologically, and behaviorally distinct DPSs: the Eastern DPS, which includes sea lions in Southeast Alaska, British Columbia, Washington, Oregon and California; and the Western DPS, which includes sea lions in all other regions of Alaska, as well as Russia and Japan. On May 5, 1997, NMFS issued a final determination to list the western DPS as endangered under the ESA (62 FR 24345). We used information available in

the final listing (62 FR 24345) and the 2010 stock assessment report (http://www.nmfs.noaa.gov/pr/pdfs/sars/ak2011slst-w.pdf) to summarize the status of the western DPS, as follows.

Life history
Within the western DPS, pupping and breeding occurs at numerous major rookeries from late May to early July. Reproductive, movement, and dietary characteristics are likely similar to those described for the eastern DPS (see above).

Acoustics
Steller sea lions hear within the range of 0.5 – 32 kHz (Kastelein et al. 2005).

Population dynamics
As of 2010, the best estimate of abundance of the western Steller sea lion DPS in Alaska was 50,035 (N_{min} = 42, 366). This represents a large decline since counts in the 1950s (N = 140,000) and 1970s (N = 110,000). Trend site counts have decreased 40 percent from 1991 to 2000, an average annual decline of 5.4 percent. Trends since 2000 are difficult to characterize as a result of the increasing presence of eastern DPS seal lions at the trend sites. In 2007 and 2008, over 19,000 Steller sea lions were counted in Russia (http://www.nmfs.noaa.gov/pr/pdfs/sars/ak2011slst-w.pdf).

Population viability
The species was listed as threatened in 1990 because of significant declines in population sizes (55 FR 49204). At the time, the major threat to the species was thought to be reduction in prey availability. To protect and recovery the species, NMFS established the following measures: prohibition of shooting at or near sea lions; prohibition of vessel approach to within 3 nautical miles of specific rookeries, within 0.5 miles on land, and within sight of other listed rookeries; and restriction of incidental fisheries take to 675 sea lions annually in Alaskan waters.

In 1997, the western DPS was reclassified as endangered because it had continued to decline since its initial listing in 1990 (62 FR 24345). Despite the added protection (and an annual incidental fisheries take of approximately 26 individuals), the DPS is likely still in decline (though the decline has slowed or stopped in some portions of the range). The reasons for the continued decline are unknown but may be associated with nutritional stress as a result of environmental change and competition with commercial fisheries.

Status summary
The Steller sea lion western DPS is listed as endangered under the ESA. Despite protections, it continues to decline in abundance. Though the total population size is still relatively large (N > 70,000), the causes for the decline remain unknown. The resilience of the DPS appears to be low to additional perturbations.

5.2.7 Steller sea lion critical habitat

In 1997, NMFS designated critical habitat for the Steller sea lion (58 FR 45269). The critical habitat includes specific rookeries, haulouts, and associated areas, as well as three foraging areas that are considered to be essential for the health, continued survival, and recovery of the species.

In Alaska, areas include major Steller sea lion rookeries, haulouts and associated terrestrial, air, and aquatic zones. Critical habitat includes a terrestrial zone extending 3,000 feet (0.9 km) landward from each major rookery and haulout; it also includes air zones extending 3,000 feet (0.9 kin) above these terrestrial zones and aquatic zones. Aquatic zones extend 3,000 feet (0.9 km) seaward from the major rookeries and haulouts east of 144°W. In California and Oregon, major Steller sea lion rookeries and associated air and aquatic zones are designated as critical habitat. Critical habitat includes an air zone extending 3,000 feet (0.9 km) above rookery areas historically occupied by sea lions. Critical habitat also includes an aquatic zone extending 3,000 feet (0.9 kin) seaward.

In addition, NMFS designated special aquatic foraging areas as critical habitat for the Steller sea lion. These areas include the Shelikof Strait (in the Gulf of Alaska), Bogoslof Island, and Seguam Pass (the latter two are in the Aleutians). These sites are located near Steller sea lion abundance centers and include important foraging areas, large concentrations of prey, and host large commercial fisheries that often interact with the species.

5.2.8 Guadalupe fur seal

Species description

Guadalupe fur seals (*Arctocephalus townsendi*) occur primarily in the waters surrounding Guadalupe Island, Mexico, though individuals have been observed in the Channel Islands in recent years. The species was listed as threatened under the ESA in 1985 (50 FR 51252). We used information available in the final listing, the 2000 stock assessment report, and the IUCN Red List (http://www.iucnredlist.org/details/2061/0) to summarize the status of the species, as follows.

Life history

Guadalupe fur seal rookeries are located on Guadalupe Island and San Benitos Islands in Mexico. Polygynous males establish territories occupied by an average of six females, which give birth to a single pup during the summer and nurse for 9 – 11 months (http://www.iucnredlist.org/details/2061/0).

Acoustics

Though there has been no auditory assessment of the Guadalupe fur seal, its hearing likely falls within a similar range as that of the Northern fur seal, 2-40 kHz (Moore & Schusterman 1987).

Population dynamics

Prior to commercial harvest, the population was estimated at 20,000 to 100,000 individuals. The species was hunted to near extinction in the 19th century. Since commercial exploitation has ended, the species has since made a partial recovery, from an estimated 200 – 500 individuals in 1954, to 15,000 – 17, 000 individuals in 2008. The population is increasing at a rate of 13.7 percent annually. A small rookery at San Benitos was discovered in 1997; 1,566 animals were recorded in a 2007 census. A single pup was born on San Miguel Island, Channel Islands, California, in 1997 (SAR 2008; http://www.iucnredlist.org/details/2061/0).

Population viability

In 1985, the species was listed as threatened (i.e., likely to become endangered in the foreseeable future). This listing reflected the species' extreme reduction as a result of 19th century commercial harvest and its small population size at the time of listing (approximately 1,600). Specific recovery criteria include: population size of 30,000 animals; establishment of at least one rookery (in addition to the Guadalupe rookery); and growth to maximum net productivity. Critical habitat has not been designated.

Status summary
In summary, the Guadalupe fur seal continues to show a steady increase in abundance. At least one new rookery has been established (San Benitos) since listing. The species appears to be on the path of recovery and is likely resilient to further perturbation.

5.2.9 Ringed seal (Arctic DPS)

Species description
The ringed seal (*Phoca hispida*) is a small, Northern Hemisphere ice seal. It is divided into five subspecies, including the Arctic subspecies (*Phoca hispida hispida*). On December 20, 2012, NMFS issued a final determination to list the Arctic DPS as threatened under the ESA. We used information available in the final listing (as filed), the proposed listing (75 FR 77476), and the status review report (Kelly et al. 2010) to summarize the status of the species, as follows.

Life history
Ringed seals are uniquely adapted to living on the ice. They use stout claws to maintain breathing holes in heavy ice. They excavate lairs in the snow cover above these holes to provide warmth and protection from predators while they rest, pup, and molt. Females give birth in March – April to a single pup annually; they nurse for 5 – 9 weeks. During this time, pups spend an equal amount of time in the water and in the lair. Females attain sexual maturity at 4 – 8 years of age, males at 5 – 7 years. The average lifespan of a ringed seal is 15 – 28 years. They are trophic generalists, but prefer small, schooling prey that form dense aggregations (Kelly et al. 2010).

Acoustics
Ringed seals can hear frequencies of 1 – 40 kHz (Richardson et al. 1995, Blackwell et al. 2004). Though they may be able to hear frequencies above this limit (Terhune and Ronald 1976); their sensitivity to such sounds diminishes greatly above 45 kHz (Terhune and Ronald 1975).

Population dynamics
The best estimated population size of the Arctic DPS is low millions; there are likely 1 million ringed seals in the Chukchi and Beaufort Seas (Kelly et al. 2010). The DPS's broad distribution, seasonal movements, subsurface behavior, and remote, varying habitat prevent reliable estimates of population size or trends.

Population viability
The Arctic ringed seal DPS was listed as threatened, i.e., likely to become endangered in the foreseeable future. Warming climate trends are likely to result in the loss of essential sea ice and snow cover, and ocean acidification may alter prey populations (Kelly et al. 2010). The reduced snow cover throughout portions of its range would prevent the excavation of lairs, essential to resting, molting, and pupping. Earlier warming and break-up of ice in the spring would shorten the length of time pups have to grow and mature in a protected setting, which has been shown to reduce overall fitness. The large range and population size of the Arctic DPS, however, make it

less vulnerable to other perturbations (75 FR 77476). Therefore, ESA section 4(d) protective regulations and section 9 prohibitions were deemed unnecessary for the conservation of the species (http://www.nmfs.noaa.gov/pr/pdfs/species/ringedseal_frn_filed.pdf). Critical habitat has not been designated.

Status summary
In summary, the Arctic ringed seal DPS has a large population size and is likely resilient to immediate perturbations. It is, however, threatened by future climate change, specifically the loss of essential sea ice and snow cover, and as a result, is likely to become endangered in the future.

5.2.10 Bearded seal (Beringia DPS)

Species description
The bearded seal (*Erignathus barbatus*) is a large, Northern Hemisphere ice seal. It is divided into two subspecies. The Pacific subspecies (*E. b. nauticus*) is further divided into two geographically and ecologically discrete DPSs. The Beringia DPS inhabits the continental shelf waters of the Bering, Chukchi, Beaufort, and East Siberian Seas. On December 20, 2012, NMFS issued a final determination to list the Beringia DPS as threatened under the ESA (as filed). We used information available in the final listing, the proposed listing (75 FR 77496), and the status review report (Cameron et al. 2010) to summarize the status of the species, as follows.

Life history
In the spring and early summer, bearded seals rely on sea ice to rest, molt, and pup. Females mature at 5 – 6 years of age, they give birth to a single pup annually. The pups enter the water within hours of birth and begin to forage while still nursing, which lasts approximately 3 weeks. Males reach sexual maturity at 6 – 7 years of age. Bearded seals have a lifespan of 20 – 30 years. They feed primarily on benthic organisms, but they are also able to forage on schooling pelagic fishes (Cameron et al. 2010).

Acoustics
Male bearded seals vocalize during the breeding season (March – July), with a peak in calling during and after pup rearing. Their complex vocalizations range from 0.02 to 11 kHz in frequency. These calls are likely used to attract females and defend their territories to other males (Cameron et al. 2010).

Population dynamics
The estimated population size of the Beringia bearded seal DPS is 155,000 individuals (75 FR 77496). There is substantial uncertainty around this estimate, however, and population trends for the DPS are unknown. An estimate of bearded seals in the western Bering Sea (63,200 95% CI 38,400 – 138,600) from 2003 – 2008 appears to be similar in magnitude to an estimate from 1974 – 1987 (57,000 – 87,000; Cameron 2010).

Population viability
The Beringia bearded seal DPS was listed as threatened, i.e., likely to become endangered in the foreseeable future. Warming climate trends are likely to result in the loss of essential sea ice habitat, and ocean acidification may alter prey populations (75 FR 77496). To adapt, bearded seals would likely shift their nursing, rearing, and molting areas to ice covered seas, potentially

increasing the risks of disturbance, predation, and competition. The large range and population size of the Beringia DPS make it less vulnerable to other perturbations. Therefore, ESA section 4(d) protective regulations and section 9 prohibitions were deemed unnecessary for the conservation of the species (http://www.nmfs.noaa.gov/pr/pdfs/species/beardedseal_frn_filed.pdf). Critical habitat has not been designated.

Status summary
In summary, the Beringia bearded seal DPS has a large, apparently stable population size, which makes it resilient to immediate perturbations. It is, however, threatened by future climate change, specifically the loss of essential sea ice and change in prey availability, and as a result, is likely to become endangered in the future.

5.2.11 Johnson's seagrass

Species description
Johnson's seagrass is a rare species with an extremely limited distribution. It is found on the east coast of Florida from Sebastian Inlet to central Biscayne Bay. On September 14, 1998, NMFS issued a final rule to list the species as threatened pursuant to the ESA (69 FR 49035). We used information available in the final rule and the 5-year review (NOAA 2007) to summarize the status of the species, as follows.

Life history
The life history and maintenance of populations is exclusively dependent on asexual reproduction and clonal growth dynamics. No male flowers have ever been reported, and there is no evidence of sexual reproduction. Female flowers, however, are common; they are morphologically and physiologically capable of being fertilized if male pollen was available. Growth and the occupation of space, as well as the dispersal of the species, depend on the division of apical meristems. Populations disappear and reappear on both short- (months) and long-term (years) time scales (http://www.nmfs.noaa.gov/pr/pdfs/species/johnsonsseagrass_5yearreview.pdf). Johnson's seagrass is able to colonize and thrive in environments where other seagrasses cannot, as a result of its potential for vegetative expansion, a perennial and intertidal growth habit, and a relatively high tolerance for fluctuating salinity and temperature (Kenworthy and Virnstein 1997).

Population dynamics
The species distribution is characterized as patchy, disjunct, and temporally fluctuating. Surveys indicate, however, that the present geographic ranges of the southern and northern limits of the species have been stable for at least 10 years. It appears that the populations in the northern range of the species (Sebastian Inlet to Jupiter Inlet) are stable and capable of sustaining themselves despite stochastic events related to severe storms and fluctuating climatology. Although it is disjunctly distributed and patchy, there is some continuity in the southern distribution, at least during periods of relatively good environmental conditions, and no significant large-scale disturbances (NOAA 2007).

Population viability
Johnson's seagrass was listed as a threatened species in 1998 because of its limited reproductive potential and energy storage capacity restrict its ability to repopulate an area after anthropogenic

or natural disturbances (69 FR 49035). At the time of listing, five threats were identified: dredging, prop scoring, storm surge, altered water quality, and siltation. Given its limited distribution and inability to quickly repopulation, the species' is expected to have little resilience to these perturbations. Despite the continuation, or increase, of these threats, however, abundance and distribution have remained constant over the past decade.

Status summary
Johnson's seagrass is a threatened species that remains vulnerable to most threats identified in the original listing, including: dredging and filling, shoreline construction and modification, prop scarring, altered water quality, siltation, and storm events. Its abundance, distribution, and extinction risk have remained stable in the past ten years.

5.2.12 Johnson's seagrass critical habitat

Critical habitat for Johnson's seagrass was designated on April 5, 2000 (65 FR 17786). Ten areas were designated: a portion of the Indian River Lagoon, north of the Sebastian Inlet Channel; a portion of the Indian River Lagoon, south of the Sebastian Inlet Channel; a portion of the Indian River Lagoon near the Fort Pierce Inlet; a portion of the Indian River Lagoon, north of the St. Lucie Inlet; a portion of Hobe Sound; a site on the south side of Jupiter Inlet; a site in central Lake Worth Lagoon; a site in Lake Worth Lagoon, Boynton Beach; a site in Lake Wyman, Boca Raton; and a portion of Biscayne Bay. These areas are characterized by one or more of the following criteria: (1) locations with populations that have persisted for 10 years; (2) locations with persistent flowering populations; (3) locations at the northern and southern range limits of the species; (4) locations with unique genetic diversity; and (5) locations with a documented high abundance of Johnson's seagrass compared to other areas in the species' range. Important physical and biological features of the critical habitat areas include adequate water quality, salinity levels, water transparency, and stable, unconsolidated sediments that are free from physical disturbance.

6.0 Environmental Baseline

The environmental baseline includes the past and present impacts of all Federal, State, 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, which are contemporaneous with the consultation in process (50 CFR 402.02). For this Opinion, the action area is coastal waters nationwide. Because it would be difficult to list all such past and present impacts, we summarize the factors that have led to the current status of the species, as described above.

6.1 Whaling

Prior to 1900, aboriginal hunting and early commercial whaling on the high seas, using hand harpoons, took an unknown number of whales (Johnson and Wolman 1984). Modern commercial whaling removed approximately 50,000 whales annually. In 1965, the IWC banned the commercial hunting of whales. Although commercial harvesting no longer targets whales in the proposed action area, prior exploitation may have altered the population structure and social cohesion of species, such that effects on abundance and recruitment continued for years after harvesting has ceased.

6.2 Shipping

Ships have the potential to affect marine mammals through strikes, noise (discussed below), and disturbance by their physical presence. Ship strikes are considered a serious and widespread threat to marine mammals. This threat is increasing as commercial shipping lanes cross important breeding and feeding habitats and as whale populations recover and populate new areas or areas where they were previously extirpated (Swingle et al. 1993, Wiley et al. 1995). As ships continue to become faster and more widespread, an increase in ship interactions with marine mammals is to be expected. For whales, studies show that the probability of fatal injuries from ship strikes increases as vessels operate at speeds above 14 knots (Laist et al. 2001).

Responses to vessel interactions include interruption of vital behaviors and social groups, separation of mothers and young, and abandonment of resting areas (Kovacs and Innes. 1990, Kruse 1991, Wells and Scott 1997, Samuels and Gifford. 1998, Bejder et al. 1999, Colburn 1999, Cope et al. 1999, Mann et al. 2000, Samuels et al. 2000, Boren et al. 2001, Constantine 2001, Nowacek et al. 2001). Whale watching, a profitable and rapidly growing business with more than 9 million participants in 80 countries and territories, may increase these types of disturbance and negatively affect the species (Hoyt 2001).

6.3 Noise

Noise generated by human activity adversely affects marine mammals in the action area. Noise is generated by commercial and recreational vessels, aircraft, commercial sonar, military activities, seismic exploration, in-water construction activities, and other human activities. These activities occur within the action area to varying degrees throughout the year. Whales generate and rely on sound to navigate, hunt, and communicate with other individuals. Anthropogenic noise can interfere with these important activities. The effects of noise on marine mammals can range from behavioral disturbance to physical damage (Richardson et al. 1995).

Commercial shipping traffic is a major source of low frequency anthropogenic noise in the oceans (NRC 2003). Although large vessels emit predominantly low frequency sound, studies report broadband noise from large cargo ships above 2 kHz, which may interfere with important biological functions of cetaceans (Holt 2008). Commercial sonar systems are used on recreational and commercial vessels and may affect marine mammals (NRC 2003). Although little information is available on potential effects of multiple commercial sonars to marine mammals, the distribution of these sounds would be small because of their short durations and the fact that the high frequencies of the signals attenuate quickly in seawater (Richardson et al. 1995).

Seismic surveys using towed airguns also occur within the action area and are the primary exploration technique to locate oil and gas deposits, fault structure, and other geological hazards. Airguns generate intense low-frequency sound pressure waves capable of penetrating the seafloor and are fired repetitively at intervals of 10-20 seconds for extended periods (NRC 2003). Most of the energy from the guns is directed vertically downward, but significant sound emission also extends horizontally. Peak sound pressure levels from airguns usually reach 235-240 dB at dominant frequencies of 5-300 Hz (NRC 2003). Most of the sound energy is at frequencies below 500 Hz.

6.4 Navy Activities

The Navy conducts military readiness activities, which can be categorized as either training or testing exercises, throughout the action area. During training, existing and established weapon systems and tactics are used in realistic situations to simulate and prepare for combat. Activities include: routine gunnery, missile, surface fire support, amphibious assault and landing, bombing, sinking, torpedo, tracking, and mine exercises. Testing activities are conducted for different purposes and include at-sea research, development, evaluation, and experimentation. The Navy performs testing activities to ensure that its military forces have the latest technologies and techniques available to them. Navy activities are likely to produce noise and visual disturbance to marine mammals throughout the action area.

6.5 Fisheries

Marine mammals probably consume at least as many fish as are harvested by humans (Kenney et al. 1985). Whales and pinnipeds are known to feed on several species of fish that are harvested by humans (Waring et al. 2008). Therefore, competition with humans for prey is a potential concern. Reductions in fish populations, whether natural or human-caused, may affect the survival and recovery of several populations.

Entrapment and entanglement in fishing gear is a frequently documented source of human-caused mortality in marine mammals (see Dietrich et al. 2007). These entanglements also make animals more vulnerable to additional dangers (e.g., predation and ship strikes) by restricting their agility and swimming speed. Marine mammals that die from entanglement in commercial fishing gear often sink rather than strand ashore thus making it difficult to accurately determine the extent of such mortalities.

6.6 Pollution

Contaminants cause adverse health effects in marine species. Contaminants may be introduced by rivers, coastal runoff, wind, ocean dumping, dumping of raw sewage by boats and various industrial activities, including offshore oil and gas or mineral exploitation (Grant and Ross 2002, Garrett 2004, Hartwell 2004). The accumulation of persistent pollutants through trophic transfer may cause mortality and sub-lethal effects in long-lived higher trophic level animals (Waring et al. 2008), including immune system abnormalities, endocrine disruption, and reproductive effects (Krahn et al. 2007). Recent efforts have led to improvements in regional water quality and monitored pesticide levels have declined, although the more persistent chemicals are still detected and are expected to endure for years (Mearns 2001, Grant and Ross 2002).

Exposure to hydrocarbons released into the environment via oil spills and other discharges pose risks to marine species. Marine mammals are generally able to metabolize and excrete limited amounts of hydrocarbons, but exposure to large amounts of hydrocarbons and chronic exposure over time pose greater risks (Grant and Ross 2002). Cetaceans have a thickened epidermis that greatly reduces the likelihood of petroleum toxicity from skin contact with oils (Geraci 1990), but they may inhale these compounds at the water's surface and ingest them while feeding (Matkin and Saulitis 1997). Hydrocarbons also have the potential to impact prey populations, and therefore may affect listed species indirectly by reducing food availability.

Marine organisms are also impacted by marine debris, which includes: plastics, glass, metal, polystyrene foam, rubber, and derelict fishing gear. Marine debris is introduced into the marine environment through ocean dumping, littering, or hydrologic transport of these materials from land-based sources. Even natural phenomena, such as tsunamis and continental flooding, can cause large amounts of debris to enter the ocean environment. Marine mammals often become entangled in marine debris. They may also ingest it while feeding, potentially leading to digestive problems, injury, or death.

Aquatic nuisance species (ANS) are aquatic and terrestrial organisms, introduced into new habitats throughout the United States and other areas of the world, that produce harmful impacts on aquatic ecosystems and native species (http://www.anstaskforce.gov). They are also referred to as invasive, alien, or nonindigenous species. Introduction of these species is cited as a major threat to biodiversity, second only to habitat loss (Wilcove et al. 1998). They have been implicated in the endangerment of 48% of the species listed under ESA (Czech and Krausman 1997). Over 250 nonindigenous species of invertebrates, algae, and microorganisms have established themselves in the coastal marine ecosystems of California, whose waters have been the subject of most in-depth analyses of aquatic invasions in the U.S.

6.7 Scientific research

Scientific research permits, issued by NMFS, authorize the study of listed resources in the action area. The primary objective of these studies is generally to monitor populations or gather data for behavioral and ecological studies. Activities authorized include: aerial and vessel surveys, photo-identification, biopsy sampling, and attachment of scientific instruments. These activities may result in harassment, stress, and injury.

6.8 Marine mammal viewing

Although considered by many to be a non-consumptive use of marine mammals with economic, recreational, educational and scientific benefits, marine mammal watching is not without negative impacts. Whale watching has the potential to harass whales by altering feeding, breeding, and social behavior or even injury if the vessel gets too close. Another concern is that preferred habitats may be abandoned if disturbance levels are too high. Several studies have specifically examined the effects of whale watching on marine mammals, and investigators have observed a variety of short-term responses from animals, including: no apparent response; changes in vocalizations; duration of time spent at the surface; swimming speed, angle, or direction; respiration rate; dive time; feeding behavior; and social behavior (NMFS 2006). Responses appear to be dependent on factors such as vessel proximity, speed, and direction, as well as the number of vessels in the vicinity (Watkins 1986, Corkeron 1995, Au and Green. 2000, Erbe 2002, Magalhaes et al. 2002, Williams et al. 2002a, Williams et al. 2002b, Richter et al. 2003, Scheidat et al. 2004). Foote et al. (2004) reported that Southern Resident killer whale call duration in the presence of whale watching boats increased by 10-15 percent between 1989-1992 and 2001-2003, indicating compensation for a noisier environment. Disturbance by whale watch vessels has also been noted to cause newborn calves to separate briefly from their mothers' sides, which leads to greater energy expenditures by the calves (NMFS 2006). Although numerous short-term behavioral responses to whale watching vessels are documented, little information is available on whether long-term negative effects result from whale watching (NMFS 2006).

6.9 Climate change

Climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the structure and function of marine ecosystems in the near future (IPCC 2002). From 1906-2006, global surface temperatures have risen 0.74º C and continue to rise at an accelerating pace; 11 of the 12 warmest years on record since 1850 have occurred since 1995 (Poloczanska et al. 2009). The direct effects of climate change include increases in atmospheric temperatures, decreases in sea ice, and changes in sea surface temperatures, patterns of precipitation, and sea level.

Indirect effects of climate change include altered reproductive seasons/locations, shifts in migration patterns, reduced distribution and abundance of prey, and changes in the abundance of competitors and/or predators. Climate change is most likely to have its most pronounced effects on species whose populations are already in tenuous positions (Isaac 2008). As such, we expect the extinction risk of listed species to rise with global warming. Marine mammals with restricted distributions linked to water temperature may be particularly exposed to range restriction (Learmonth et al. 2006, Issac 2009). MacLeod (2009) estimated that, based upon expected shifts in water temperature, 88 percent of cetaceans would be affected by climate change, 47 percent would be negatively affected, and 21 percent would be put at risk of extinction. Of greatest concern are cetaceans with ranges limited to non-tropical waters and preferences for shelf habitats (Macleod 2009).

The potential for invasive species to spread under the influence of climactic change is also a concern. If water temperatures warm in marine ecosystems, native species may shift poleward to cooler habitats, opening ecological niches that can be occupied by invasive species introduced via ships' ballast water or other sources (Ruiz et al. 1999, Philippart et al. 2011). Invasive species that are better adapted to warmer water temperatures would outcompete native species that are physiologically geared towards lower water temperatures; such a situation currently occurs along central and northern California (Lockwood and Somero 2011).

6.10 Impact of the Baseline on Listed Resources

Because the action area is so broad (coastal waters of the continental United States and Alaska), most of the species' ranges are contained within the action area. Therefore, we used the Environmental Baseline section to summarize the factors that have led to the current status of the species, as described in the Status of the Species section. These factors include: whaling, shipping, noise, Navy activities, fisheries, pollution, scientific research, marine mammal viewing, and climate change. Though the threat of whaling has declined dramatically over time, the other threats remain. We considered these threats when we described the population viability, resilience, and overall status of the species, as described in the previous section.

7.0 Effects of the Action

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. Using the best available scientific and commercial information, 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; and the probable responses of those individuals (given exposure). If responses are likely to reduce an individual's fitness (i.e., growth, survival, annual reproductive success, and lifetime reproductive success), we evaluate the risk posed to the viability of the listed population. The ultimate purpose of this assessment is to determine whether the proposed action is expected to reduce the species' likelihood of surviving and recovering in the wild.

Our "destruction or adverse modification" determinations must be based on an action's effects on the conservation value of habitat that has been designated as critical to threatened or endangered species. If an area encompassed in a critical habitat designation is likely to be exposed to the direct or indirect consequences of the proposed action on the natural environment, we ask if primary constituent elements included in the designation (if there are any) or physical, chemical or biotic phenomena that give the designated area value for the conservation are likely to respond to that exposure.

For this consultation, we are particularly concerned about responses that are likely to result in a reduction of fitness of an individual. This includes behavioral disruptions that may result in an individual's failure to feed, grow, or breed successfully. Take, incidental to the action, requires authorization under 50 CFR 402.14(i) and, in the case of marine mammals, under the MMPA Section 101(a)(5). Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (16 U.S.C. 1532(19)). The U.S. Fish and Wildlife Service further defines harm as an act which actually kills or injures wildlife, which may include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. They define harass as actions that create the likelihood of injury to listed species by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering (USFWS and NMFS 1998). For this Opinion, we define take, harm, and harassment as described above.

7.1 Stressors

During the course of this consultation, we identified the following potential stressors:

- Vessel activity
    - Vessel strike (marine mammals and Johnson's seagrass)
    - Vessel noise (marine mammals only)
    - Visual disturbance (marine mammals only)
    - Vessel discharges (marine mammals and Johnson's seagrass)
    - Introduction of aquatic nuisance species (marine mammals and Johnson's seagrass)

- Injury due to anchoring, bottom sampling, or buoy installation (Johnson's seagrass only)

- Noise disturbance due to tide gauge installation (marine mammals only)

- Sonar noise (marine mammals only)

We do not expect the other proposed activities to cause physical, chemical, or biological stressors. The collection of sound speed data involves the raising and lowering of a CTD or the towing of a MVP. These instruments are designed to fall through and remain in the water column; they are small in size (< 2 m^2) and are unlikely to strike mobile marine organisms (such as marine mammals). The surveyors avoid letting these expensive instruments hit the substrate; therefore, it is unlikely that these instruments would damage seagrass. Similarly, AUVs would be programmed to avoid known obstructions, avoid striking the sea floor, and to pause and reverse or surface in the event of a collision. Coast Survey would only conduct LIDAR surveys in the Gulf of Mexico and Caribbean. Therefore, these activities are unlikely to affect Johnson's seagrass or the marine mammals listed above.

7.2 Exposure

Our exposure analyses identify the co-occurrence of ESA-listed species and critical habitat with the action's effects in space and time, and identify the nature of that co-occurrence. When possible, we identify 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. To streamline this Opinion, we describe species-specific exposure below, in the section entitled *Response*.

Here, we describe the general probability of exposure to the action, i.e., the probability that Coast Survey will conduct its surveys within the range of an endangered or threatened species or designated critical habitat. Because this is a programmatic consultation on a nationwide action, we are not able to describe the exact location and timing of individual events. Instead, we consider the general area and timing of potential activities.

Coast Survey classifies their project areas by region: Alaska, Pacific Coast, Atlantic Coast, and Gulf of Mexico. They also conduct hydrographic surveys in the Great Lakes, but we do not consider these because ESA-listed species and critical habitat under NMFS' jurisdiction do not occur in this area. Coast Survey conducts hydrographic surveys year-round in some areas and seasonally in others. They operate in the Arctic or Bering Sea between June and September to avoid dangerous, icy conditions. They conduct surveys in Southeast, Central, and Southwest Alaska between March and November. West Coast, Northeast, and Mid-Atlantic surveys are also conducted between March and November. They conduct surveys in the Southeast and Gulf of Mexico year round.

To estimate exposure to ESA-listed species and critical habitat as a result of the proposed action, we look to past hydrographic survey activities. Coast Survey has conducted similar activities for the past 40 years. Though project locations change over the years, the area surveyed remains generally constant. To estimate future effort, we look at survey data from 2012, a typical year for Coast Survey.

In 2012, Coast Survey planned to survey approximately 4,500 square nautical miles (SNM). They surveyed approximately 3,000 SNM (57,984 linear nautical miles). They were on survey for 13,217 hours (this does not include transit time, anchorage, or time in port). For the purposes of our analyses, we must acknowledge the potential for an increase in surveys (though it is more likely that future budget cuts may result in fewer surveys). Table 3 provides an indication of how much total time may be spent in each large geographic area annually. Though project plans change annually, it is unlikely that 13,000 hours would be spent mapping the Pacific Coast and 0 hours on the Atlantic Coast, for example. Therefore, we use the data from 2012 as a guideline of how future survey projects may be divided throughout the nation.

Table 3. Coast Survey total projects by area in 2012.

Area	No. Projects (Planned/Surveyed)	Planned Area (SNM)	Surveyed Area (SNM)	Hours on Survey
Alaska	13/8	2816	1734	3897
Pacific Coast	6/3	157	74	942
Atlantic Coast	16/13	1015	655	5323
Gulf of Mexico	6/5	466	376	3055

A single project is conducted aboard a NOAA or contracted vessel. Projects last from a few days to several months. Areas survey in 2012 ranged from 0 to 463 SNM and required up to 2,417 hours per project; however, there is great variance among projects, as shown in Table 4. We use these ranges to estimate exposure, as described for each species, below.

Table 4. Coast Survey per project surveyed by area in 2012.

Area	Range of Areas Surveyed (SNM)	Area Surveyed, Ave. (SD) (SNM)	Hours on Survey, Range	Hours on Survey, Ave. (SD)	Water Depth, Range (m)
Alaska	61 – 463	217 (148)	150 - 1027	487 (261)	4 – 300
Pacific Coast	0 – 68	25 (38)	0 – 640	314 (320)	4 – 204
Atlantic Coast	1 – 208	50 (77)	10 – 2417	409 (647)	4 – 95
Gulf of Mexico	5 – 170	75 (69)	384 – 768	611 (144)	4 – 58

7.3 Response

In this section, we evaluate likely responses of ESA-listed resources to the action. For each species, we review potential stressors and estimate the extent of exposure. We describe likely responses of an individual. Specifically, we determine whether an individual's fitness is likely to be reduced as a result of the action. If so, we determine whether fitness reductions are likely to diminish population viability. If so, we determine whether diminished population viability is likely to jeopardize the species. We also determine whether the action will adversely affect critical habitat. If so, we determine whether the adverse effects are likely to reduce the conservation value of critical habitat, resulting in its adverse modification or destruction.

7.3.1 Johnson's seagrass

Exposure

Johnson's seagrass is rare. Its distribution is limited to the east coast of Florida from Sebastian Inlet to central Biscayne Bay. Within this small area, its occurrence is patchy and disjunct. The ten areas with the highest documented abundance and longest persistence have been designated as critical habitat (65 FR 17786).

In 2012, OCS surveyed an area of 655 SNM in 5,323 hours along the Atlantic Coast, spread across 13 projects. As described in Coast Survey's PEA, there are critical areas for mapping within the range of the species and within its designated critical habitat (NOAA 2012). There are also Priority 2 and 3 areas. Therefore, it is likely that one or more survey project would overlap with Johnson's seagrass and its critical habitat. Using data from 2012, these projects would likely have an average duration of 409 hours and cover an average area of 50 SNM. We conclude that the entire species is likely to be exposed to one or more activities of the action.

Johnson's seagrass would not be affected by visual disturbance or noise from the vessels, aircraft or sonar systems. The installation and maintenance of tertiary tide gauges are also unlikely to cause stressors because Coast Survey would not install these pressure gauges in seagrass habitat. The species may be affected by anchoring, bottom sampling, or buoy installation. It may also be affected by vessel strike (specifically prop scarring) and vessel discharges, including the introduction of ANS.

Anchoring, bottom sampling, or buoy installation

To minimize exposure, Coast Survey would avoid anchoring, bottom sampling, and buoy installation in Johnson's seagrass critical habitat. They would use designated anchorage areas, where available. They would only collect bottom samples in muddy and sandy areas and avoid taking samples where seagrass is present. Given these precautions and the species' rarity outside of designated critical habitat, it is extremely unlikely that anchoring, bottom sampling, and buoy installation would result in injury or damage. Therefore, such effects would be discountable.

Vessel activity

Vessel discharges likely contribute to altered water quality, one of the five threats to Johnson's seagrass. One or a few OCS vessels are likely to transit through or survey within the range of Johnson's seagrass and its critical habitat. They would release discharges incidental to the normal operation of the vessel, which are authorized under EPA's Vessel General Permit and Small Vessel General Permit. These permits authorize discharges from approximately 72,000 larger vessels and an additional approximately 138,000 small vessels. The requirements in these permits minimize the impact of such discharges on listed species. We consulted on these permits and concluded that EPA's action (the issuance and implementation of the permits) was not likely to jeopardize species and not likely to adversely modify or destroy critical habitat (http://www.nmfs.noaa.gov/pr/consultation/opinions/biop_epa_vessels.pdf). The discharges from this large universe of vessels have not reduced the likelihood of survival or recovery of Johnson's seagrass. The discharges of one or a few OCS vessels, compliant with the permits, are not likely to have a noticeable or measurable impact on water quality. Therefore, effects on Johnson's seagrass would be insignificant.

The introduction of ANS, though not identified as one of the five major threats, has the potential to adversely affect Johnson's seagrass through competition or disease tranmission (Minchin 2007, Williams 2007). To minimize the risk of ANS introduction, OCS vessels would perform the following protective measures: avoid discharge of ballast water in designated critical habitat; use anti-fouling coatings; clean the hull regularly to remove ANS (but avoid doing so in critical habitat), and rinse the anchor with a high-powered hose after retrieval. These protective measures go beyond the requirements of the Vessel and Small Vessel General Permits, as described above. Furthermore, the OCS vessels do not transit outside of the United States; therefore, they would not introduce foreign ANS. Given the protective measures, it is highly unlikely that one or a few of OCS vessels would transfer existing ANS to Johnson's seagrass critical habitat. Given the species rarity outside these areas, we expect the effect to be discountable.

Prop scarring is one of the greatest threats to Johnson's seagrass. Prop scarring breaches root systems and severs rhizomes. One or a few OCS vessels are likely to transit through or survey within the range of Johnson's seagrass and its critical habitat. Four meters is the minimum depth surveyed by OCS vessels. In such shallow waters, Coast Survey would use smaller survey boats. These small boats may spend considerable time in one area (range 10 – 2417 hours), providing opportunity for prop scarring. To minimize the risk, the surveyors would avoid Johnson's seagrass critical habitat, when possible. Trained crew would operate the vessels to avoid grounding. They would operate these vessels at slow speeds (<13 knots while transiting; 4 – 8 knots while surveying). An observer would be aboard to avoid seagrasses. Even with these protective measures, there is a small likelihood of prop scarring (estimated ≤ 1 occurrence annually) to a small amount of seagrass (estimated ≤ 1 m^2). Ramets are semi-independent units that act together as a single clonal organism, i.e., the genet (Dean and Durako 2007). We expect that one incidence of prop scarring is likely to adversely affect a small portion of one genet.

Prop scarring and propeller dredging are one of the most severe injuries seagrasses experience because they disturb the sediments and uproot seagrasses, damaging the leaves and the root/rhizome systems, as well as the apical meristems which are responsible for the growth and maintenance of a seagrass meadow (Kenworthy 1997). Johnson's seagrass is especially vulnerable to these disturbances because it is so shallow rooted. While stressed ramets are often supported by unstressed ramets, the severing of rhizomes reduces the shared benefits. Because prop scarring may sever the rhizomes, it is likely to reduce the growth of the genet (Dean and Durako 2007). This loss in growth is likely to reduce the fitness of the genet.

Because we expect a reduction in fitness for one "individual," we next consider whether this reduction is likely to diminish population viability. In 2000, there were 131,759 vessels registered within the species' range; in 2006, the DMV registered 200,187 vessels, an increase of 52% in 6 years. These vessels include recreational and commercial vessels whose operators are likely to be less conscientious than the OCS vessels and less likely to follow the protective measures outlined above. Therefore, we would expect that many non-OCS vessels have been involved in prop scarring. Despite this increase in vessel traffic, the abundance and distribution of Johnson's seagrass has remained constant over the past decade. There even appears to be some range expansion in the more heavily trafficked southern regions (http://www.nmfs.noaa.gov/pr/pdfs/species/johnsonsseagrass_5yearreview.pdf). Therefore, the populations appear to be relatively resistant to many prop scarring events. One or a few additional OCS vessels and the unlikely occurrence of prop scarring from these vessels is not likely to appreciably change current trends. We conclude that one minor incidence of prop scaring annually by an OCS vessel is not likely to reduce the viability of any Johnson's seagrass population.

Summary

In summary, Johnson's seagrass would not be affected by visual disturbance or noise from vessels, aircraft or sonar systems. It would not be adversely affected by anchoring, bottom sampling, buoy installation, or tide gauge installation because Coast Survey will not conduct these activities in the critical habitat of Johnson's seagrass (i.e., exposure is highly unlikely and thus discountable). The species is also not likely to be adversely affected by discharges, including potential of ANS introduction, from one or a few OCS vessels. Johnson's seagrass is likely to be adversely affected by propeller scarring, as a result of the Coast Survey action. There is a small likelihood that propeller scarring would reduce the fitness of a genet by damaging ≤ 1 m^2 of seagrass, annually. This magnitude of damage, however, is not likely to reduce the viability of any population.

7.3.2 Johnson's seagrass critical habitat

Exposure

Ten areas with the highest documented abundance and longest persistence comprise Johnson's seagrass critical habitat (65 FR 17786). These areas are characterized by one or more of the following criteria: (1) locations with populations that have persisted for 10 years; (2) locations with persistent flowering populations; (3) locations at the northern and southern range limits of the species; (4) locations with unique genetic diversity; and (5) locations with a documented high abundance of Johnson's seagrass compared to other areas in the species' range. Important physical and biological features of the critical habitat areas include adequate water quality, salinity levels, water transparency, and stable, unconsolidated sediments that are free from physical disturbance.

Vessel activity

Coast Survey's action is not likely to affect salinity levels, water transparency, and the stability of unconsolidated sediments. The action may affect water quality (through its vessel discharges).

As described above, one or a few OCS vessels are likely to transit through or survey within Johnson's seagrass critical habitat. They would release discharges incidental to the normal operation of the vessel, which are authorized under EPA's Vessel General Permit and Small Vessel General Permit. We consulted on these permits and concluded that EPA's action (the issuance and implementation of the permits) was not likely to jeopardize species and not likely to adversely modify or destroy critical habitat (http://www.nmfs.noaa.gov/pr/consultation/opinions/biop_epa_vessels.pdf). The discharges of one or a few OCS vessels, compliant with the permits, are not likely to have a noticeable or measurable impact on water quality. Therefore, we do not expect Coast Survey's action to adversely affect water quality of the critical habitat.

Summary

In summary, Johnson's seagrass critical habitat would not be affected by visual disturbance or noise from vessels, aircraft or sonar systems. It would not be affected by anchoring, bottom sampling, buoy installation, or tide gauge installation, which would not be conducted within critical habitat. Water quality is not likely to be adversely affected by the discharges of one or a few OCS vessels.

7.3.3 Cook Inlet beluga whale

Exposure

Coast Survey may conduct coastal surveys in Cook Inlet. Though there are no "critical areas," "emerging critical areas," or "Priority 1" areas for mapping in Cook Inlet, there is one "Priority 2" and two small "Priority 3" areas in Cook Inlet. These areas fall within designated critical habitat for the Cook Inlet beluga whale. The rest of Cook Inlet is considered "Priority 4" for mapping. Because there is a small possibility that OCS will conduct surveys in Cook Inlet, we analyze the effects of this action on the Cook Inlet beluga whale and its critical habitat.

We would expect a single NOAA vessel to survey areas within Cook Inlet for a few days to three months in Cook Inlet, in one or more years. Similar projects in Alaska have surveyed an average of 217 SNM (maximum 463 SNM) and have required an average of 487 hours (maximum 1027 hours). This action is likely to produce stressors that have been shown to adversely affect Cook Inlet beluga whales, as reviewed by Norman (2011). Because they are large, highly mobile marine organisms, we do not expect belugas to be exposed to injury as a result of anchoring, bottom sampling, or buoy installation. Belugas may be affected by the presence of the vessel, through visual disturbance, ship strike potential, and vessel discharges. They may also be affected by the noise resulting from operation of the vessel, tide gauge installation, and the hydrographic surveys (i.e., sonar system noise).

Vessel activity

The physical presence of the vessel is likely to result in visual disturbance. Coast Survey reduces the likelihood of visual disturbance by requiring 100% observer coverage and maintaining a distance of 200 yards from all whales. During the course of the survey, it is possible that the vessel may be observed by nearly every individual within Cook Inlet (N~345), including adults, juveniles, and calves of both sexes. The exposure is expected to be short-lived (< 1 hour). Though individuals may be exposed on more than one occasion, we do not expect a single individual to be exposed numerous times. Belugas are likely to respond to visual disturbance by avoidance. Stewart (2010) observed evasive swimming behavior and more time spent underwater, in the presence of vessels. Such responses are likely to adversely affect individuals if foraging, nursing, or mating behaviors are interrupted. We expect exposure to be temporary and isolated, however, limiting the interruption of vital behaviors in duration and frequency. Therefore, reductions in fitness, as a result of visual disturbance, are unlikely for all individuals.

Although ship strikes have not been definitively documented in Cook Inlet, photo-identification studies have documented presumed boat strike and propeller marks on individual whales (McGuire et al. 2011). As previously described, OCS vessels have struck only one whale in approximately 540,000 hours of mapping over the past 40 years ($p = 1.9 \times 10^{-6}$; 95% CI = $0 - 5.5 \times 10^{-6}$). Therefore, we do not expect any ship strikes during the survey, which averages 487 hours (with a maximum of 1,027 hours) in Alaska. To further reduce the potential for ship strike, the NOAA vessel would maintain speeds of 4 – 8 knots while surveying and < 13 knots while transiting throughout the range of the beluga whale. Coast Survey requires 100% observer coverage and a distance of 200 yards from all whales. Given their previous record and the additional protective measures included in the action, it is highly unlikely that any beluga will be exposed to vessel strike during the survey of Cook Inlet. Therefore, the effects of ship strike on Cook Inlet belugas are discountable.

Vessel noise is a concern for the highly vocal beluga whale. By reducing its speed, as described above, the OCS vessel would also reduce its noise. Still, Cook Inlet belugas are likely to be exposed to noise from this vessel. During the course of the survey, it is possible that the vessel may be heard by nearly every individual within Cook Inlet (N~345), including adults, juveniles, and calves of both sexes. The exposure is expected to be short-lived (< 1 hour). Though individuals may be exposed on more than one occasion, we do not expect a single individual to be exposed numerous times. Native Alaskan whalers report that Cook Inlet belugas are very sensitive to boat noise and will leave areas subjected to high use; however, they may habituate to vessel noise in more heavily trafficked areas (Norman 2011). Belugas are known to increase their levels of vocalization as a function of background noise by increasing call repetition and amplitude, shifting to higher frequencies, and changing structure of call content (Lesage et al. 1999; Scheifele et al. 2005). It is unlikely that the reduced noise (as a result of its slower speeds) from one OCS vessel (in the context of the ambient vessel noise within Cook Inlet) would interrupt feeding, nursing, or mating for a prolonged period of time. We could not find any such examples in the literature. Therefore, while vessel noise is likely to adversely affect individuals, it is not likely to result in reduced fitness for any individual due to limited exposure (i.e., short duration and frequency) and magnitude (i.e., one vessel moving at slow speeds).

Vessel pollution is another potential stressor. The OCS vessel would minimize the discharge of pollutants by meeting all EPA Vessel General Permit requirements. The authorized vessel discharges from an OCS vessel would be insignificant against the background of discharges from hundreds to thousands of vessels in Cook Inlet. They are unlikely to result in adverse effects to beluga whales.

Belugas are also sensitive to changes in prey abundance and availability, which could be reduced by the introduction of ANS. OCS vessels do not enter the rivers and streams where anadromous fish species are most vulnerable to ANS. To further minimize the transfer of ANS, Coast Survey proposes to: rinse the anchor with a high-powered hose after retrieval; use anti-fouling coatings; regularly remove ANS from their hulls but avoid doing so in critical habitat; and avoid discharging ballast water in critical habitat. Given these protective measures, the discharges and potential for ANS transfer from a single OCS vessel would have discountable effects on beluga whales and are not likely to adversely affect the species.

Tide gauge installation

The installation of tide gauges in remote areas may require the short-term use of a hand-held electric drill. This activity may result in temporary noise disturbance (<1 hour). Because noise travels long distances in water, many individuals (N~345) of all ages and both sexes may be exposed to this noise. Belugas exhibit a wide range of responses to louder noises, such as oil and gas drilling. They have been regularly seen near drill sites in Cook Inlet (Richardson et al. 1995); other individuals did not react strongly to playbacks of oil industry-related noise at levels up to 60 dB above ambient (Stewart et al. 1983). When Romano et al. (2004) exposed a captive beluga whale to sounds from a seismic water gun, blood cortisol levels (associated with stress) increased significantly with elevated sound levels. Thomas et al. (1990), however, did not find elevated stress hormone levels in the blood after playbacks of oil drilling platform noise to captive belugas, though their measures were less sensitive than those used in Romano et al. (2004). The noise created by a small, hand-held drill to install tide gauges is more comparable to the noise of a single vessel's propeller. It is shorter in duration and much quieter than the extremely loud seismic water guns described in the studies above. We could not find any data on how belugas would respond to such a minor noise disturbance. Given the studies above, however, we expect that belugas would not respond behaviorally or physiologically. Therefore, beluga whales are not likely to be adversely affected by the relatively benign and short-lived drilling used to install tide gauges.

Hydrographic surveys

Noise as a result of the hydrographic surveys is a concern for the highly vocal beluga whale. Belugas are able to hear at frequencies of 40 Hz to 100 kHz, although their hearing is most acute from 10 – 75 kHz (Richardson et al. 1995). Therefore, they are able to hear both single beam (≥ 30 kHz) and multibeam systems (≥ 50 kHz) used during OCS projects.

Single beam sonar systems emit a single beam of sound. Coast Survey uses these systems while performing exploratory missions aboard small vessels and surveying shallow water of 20 m or less. The beam angle remains at a constant 12° such that the maximum beam width is 4.2 m. A whale would need to swim under the vessel, within 4.2 m of the sound source, to be exposed to the noise. This is unlikely to occur because OCS surveyors would avoid beluga whale critical habitat when possible, and they would avoid approaching within 200 yards (183 m) of all whales. A trained observer would watch for belugas; they would suspend sound transmission if an individual were observed within hearing range (i.e., 4.2 m of the sound source). While exposure to single beam sonar noise is unlikely, one or a few occurrences are possible. An exposed individual of any age or either sex would likely respond by avoidance. These fast, highly agile small whales (4 – 5 m) could quickly and easily move out of range of the beam width (4.2 m). They would not be forced to dive. They would likely resume their previous behavior immediately after avoidance. This minor and temporary behavioral alteration is not likely to reduce fitness, i.e., the interruption of feeding, nursing, or mating behavior would be infrequent and transitory. We conclude that exposure of beluga whales to single beam sonar noise is unlikely. If exposure occurred, it is likely to adversely affect one or a few individuals but not likely to result in the reduced fitness of any individual.

Coast Survey would rely primarily on its multibeam sonar systems for surveying Cook Inlet. To minimize beluga exposure to multibeam sound, OCS surveyors would use trained observers to maintain a distance of 200 yards (183 m) from belugas. They would avoid critical habitat when possible, and they would suspend transmission if an individual were observed. Unlike single beam sonars, which have a beam width of ≤ 4.2 m, multibeam systems have a swath width of up to 1 km. Multibeam systems, however, are operated at much higher frequencies, generally ≥ 200 kHz, which is outside the hearing range of beluga whales. Coast Survey would avoid using sonar frequencies of < 180 kHz, whenever possible; however, they use lower frequencies in water depth of > 100 m, to achieve high-resolution mapping. Cook Inlet is a relatively shallow estuary. We were only able to find two, small areas where water depths exceeded 100 m (http://www.charts.noaa.gov/OnLineViewer/16660.shtml). Furthermore, sound dissipates rapidly in the shallow waters and over the sandy/muddy substrates that characterize Cook Inlet, making it a poor environment for propagating acoustics (Blackwell and Greene 2002). Therefore, belugas whales would only be exposed to multibeam sonar noise of < 180 kHz while in the close proximity of two, small areas within Cook Inlet.

The two areas, which are located in critical habitat Area 2, are low priority (Priority 3 and 4) for hydrographic surveys; therefore, there is only a small likelihood that Coast Survey would use frequencies of <180 kHz in Cook Inlet. If these two areas were surveyed, however, the activity would likely expose individuals to several hours or days of 50 – 100 kHz multibeam sonar sound, which would be heard by every individual within a 1 km radius of the ship (maximum N = 345 including adults, juveniles, and calves, of both sexes). Individuals may be exposed repetitively over several days.

Coast Survey's multibeam sonar systems use high output power to provide clear returns and precise water depths. The noise is loudest at the transducer face (i.e., sound source), which is located on the vessel hull. It dissipates rapidly as a result of spreading loss and absorption, i.e., as sound is converted to heat through attenuation (Urick and Urick 1983, Au and Hastings 2008). The sound from the Coast Survey's high frequency echosounders attenuates much more quickly than the lower frequency sound of seismic surveys or Naval operations; it quickly decreases in intensity as it moves away from the sound source.

As described in the PEA (NOAA 2012), one method of assessing potential marine mammal response to this sound is to calculate threshold radii; however, NMFS is currently revising its acoustic criteria and thresholds. Therefore, we include these radii for information purposes. There are only two multibeam systems used in Alaskan surveys that operate at frequencies within the range of beluga hearing: the Kongsberg Simrad EM170 (70 – 100 kHz) and the Reson Seabat 8160 (50 kHz). Following methods described in Southall et al. (2007) and Richardson et al. (1995) for the Kongsberg system (peak source = 231 dB re: 1 μPa), the maximum radii for the 190 dB, 180 dB, and 160 dB isopleths are 90 m, 212 m, and 630 m. For the Reson system (peak source = 228 dB re: 1 μPa), the radii for the 190 dB, 180 dB, and 160 dB isopleths are 72 m, 190 m, and 790 m (NOAA 2012). These radii are based on the assumption of spherical spreading from an acoustic source. In practice, the acoustic energy of hydrographic echosounders is limited by the downward-facing orientation of the transmit beam (Weber 2008) and occurs in water depths shallower than most of the 190, 180, and 160 dB radii. Therefore, the majority of energy is lost at the substrate before reaching its maximum range possible in the water column. Furthermore, Coast Survey always sets the power 15 – 25 dB lower than maximum, such that the range used in surveys is 190 –210 dB re: 1 μPa. Using these guidelines, belugas would need to be located within << 1 km of the vessel to be adversely affected by multibeam sonar noise.

In this Opinion, we instead base our analyses on the likelihood of exposure, coupled with information available on individual responses to similar sound levels and frequencies. As described above, the likelihood of exposure to noise from multibeam systems is extremely low because Coast Survey would use frequencies outside of the hearing range of beluga whales. There are many addition reasons why exposure to hydrographic survey noise is unlikely. First, there are no high priority survey areas in Cook Inlet (such that surveys are not likely to occur within the range of the DPS). Second, there are only two small, deep areas that would require the use of echosounder frequencies audible by beluga whales. Third, Coast Survey would employ several protective measures to avoid exposing belugas to sonar sound (e.g., avoiding

whales, ceasing transmission upon the sight of whales, etc.). Fourth, the sound levels are likely to dissipate quickly, further reducing exposure.
Though highly unlikely, there is a very small possibility of exposure as a result of multibeam surveys; a maximum of 345 belugas (and likely much less) would be exposed to the pings for several hours to several days. While multibeam echosounders transmit at high sound pressure levels, the very short duration of their pulses and their high spatial selectivity make them unlikely to cause damage to marine mammal auditory systems (Lurton and DeRuiter 2011). We were unable to find any information regarding the behavioral response of beluga whales to multibeam sonar systems. While the immediate and cumulative effects of sound from high frequency echosounders on marine mammal behavior are uncertain, belugas are likely to respond to this high frequency underwater noise with avoidance behavior (Wartzok and Ketten 1999), i.e., leaving or avoiding the two small areas of Cook Inlet. Such behavior is likely to temporarily interrupt feeding, nursing, migration, or mating behavior; however, cetaceans that are actively engaged in feeding or socializing often seem to tolerate considerable disturbance before reacting (Richardson et al. 1995). Furthermore, the duration of the disturbance is short (from several hours to several days), and the area in which the stressor would occur is small (<< 1 km in two small areas of Cook Inlet); therefore any interruption of vital behaviors is expected to be temporary and easily avoidable. Given the small likelihood of exposure, the protective measures (i.e., avoiding whales, ceasing transmission, etc.), and the small magnitude of potential responses, we do not expect any beluga to experience reduced fitness as a result of multibeam surveys in Cook Inlet.

Summary
In summary, Cook Inlet beluga whales would not be affected by anchoring, bottom sampling, or buoy installation. They are not likely to be adversely affected by ship strikes, vessel pollution, and tide gauge installation. Belugas are likely to be adversely affected by visual disturbance and the noise from the vessel and sonar systems (single beam and multibeam). These activities, alone or in concert, are not likely to reduce the fitness of any individual.

7.3.4 Cook Inlet beluga whale critical habitat

Exposure
It is unlikely that Coast Survey would conduct a survey of Cook Inlet because there are no "critical areas," "emerging critical areas," or "Priority 1" areas for mapping in Cook Inlet. However, if OCS did survey Cook Inlet, they would likely work within beluga critical habitat, which contains physical and biological features that are essential to the conservation of the species. These features include: intertidal and subtidal waters of Cook Inlet; primary prey species; waters free of toxins; unrestricted passage between two areas; and low in-water noise levels. The Coast Survey action would not restrict passage between the two areas of critical habitat. It may affect water quality, primary prey species, and in-water noise levels.

Vessel activity
Discharges incidental to the normal use of a vessel may affect water quality. Discharges from vessels (such as oil and metals) are potentially harmful to belugas and their prey; however, the pollutants discharged from a single vessel are small in magnitude. To further reduce their impact, the OCS vessel would meet all EPA Vessel General Permit requirements, as described above. It is unlikely that those discharges would increase background pollutant levels by a measurable amount. Therefore, Coast Survey's action is not likely to adversely affect critical

habitat in this manner.

Aquatic nuisance species carried in ballast water or on the hull of a vessel have the potential to reduce the abundance of prey fish species. To reduce this risk, the OCS vessel would meet all EPA Vessel General Permit requirements, rinse the anchor with a high powered hose, avoid ballast water discharge within critical habitat, use anti-fouling coatings, and regularly remove aquatic nuisance species from the hull (but avoid performing such cleaning in critical habitat). They would not enter the important stream habitat areas, where anadromous fish species are most vulnerable to ANS introductions. With these precautions, it is unlikely that the OCS action would adversely affect Cook Inlet beluga whale critical habitat by reducing the abundance of prey species.

The noise of a small to medium sized, slow-moving vessel would not appreciably increase ambient noise levels within Cook Inlet critical habitat areas 1 and 2, which support a large vessel population. To protect endangered species, Coast Survey would avoid mapping in critical habitat, when possible; however, there are Priority 2 survey areas within Cook Inlet beluga critical habitat. Therefore, at some point, hydrographic surveys and tide gauge installation may occur within critical habitat. Both are likely to add to in-water noise. The drilling for tide gauge installation would be of small magnitude and duration; it would not reduce the conservation value of critical habitat. To minimize noise exposure as a result of hydrographic surveys, Coast Survey will use the highest frequency possible, outside of the hearing range of beluga whales. In most cases, this would involve multibeam sonar systems, described above. The Priority 2 mapping areas occur in relatively shallow waters; therefore OCS vessels will use ≥ 200 kHz frequencies. Belugas would not be exposed because they appear to hear best in the 10-100 kHz range (Blackwell and Greene 2002). There are two small areas in Area 2, which are deeper than 100 m; however, these areas are low priority (Priority 3 and 4). If surveys were conducted in these areas, OCS vessels may use 50 – 100 kHz frequencies, which overlap with beluga hearing. Such hydrographic surveys would temporarily increase in-water noise in these small areas, adversely affecting critical habitat. The increase in noise level would be relatively small in magnitude and duration, as described above, and is not likely to appreciably increase noise levels in critical habitat. Therefore, we conclude that the unlikely occurrence of noise produced as a result of the action in Cook Inlet is not likely to appreciably diminish the conservation value of beluga whale critical habitat.

Summary

In summary, the action is not likely to adversely affect the critical habitat of beluga whales by altering water quality or prey abundance. The action is likely to adversely affect noise levels in Cook Inlet, however, such effects would be of small magnitude and duration. Therefore, the action is not likely to reduce the conservation value of Cook Inlet beluga whale critical habitat.

7.3.5 Southern Resident killer whale

Exposure

Coast Survey is likely to work with the range of the Southern Resident killer whale. There are two "critical areas" for mapping in Washington, Oregon, and California; there are several "Priority 2" and "Priority 3" areas. Because Coast Survey is likely to map at least one of these areas, we analyze the effects of this action on the Southern Resident killer whale and its critical habitat.

Based on previous surveys in the Pacific, we would expect one to three OCS vessels to survey coastal areas in Washington, Oregon, or Northern California for a few days to three months, in one or more years. Similar projects in the Pacific have surveyed an average of 25 SNM (maximum 68 SNM) and have required an average of 314 hours (maximum 640 hours). This action is likely to produce stressors that are likely to adversely affect Southern Resident killer whales. Because they are large, high mobile marine organisms, we do not expect killer whales to be exposed to injury as a result of anchoring, bottom sampling, or buoy installation. They may be affected by the presence of the vessel, through visual disturbance, ship strike potential, and vessel discharges. They may also be affected by the noise resulting from operation of the vessel, tide gauge installation, and the hydrographic surveys (i.e., sonar system noise).

Vessel activity

The physical presence of the vessel is likely to result in visual disturbance. Coast Survey reduces the likelihood of visual disturbance by requiring 100% observer coverage and maintaining a distance of 200 yards from all whales. During the course of the survey, it is possible that the vessel may be observed by nearly every individual in the DPS (N~86), including adults, juveniles, and calves of both sexes. The exposure is expected to be short-lived (< 1 hour). Individuals may be exposed on more than one occasion. Visual disturbance is likely to adversely affect Southern Resident killer whales, which would likely respond with avoidance. Individuals spend significantly less time foraging and more time travelling in the presence of vessels (Lusseau et al. 2009, Williams et al. 2009). Prolonged exposure would result in reduced growth and development; however, we expect exposure to be temporary and isolated, limiting the interruption of foraging in duration and frequency. Therefore, reductions in fitness, as a result of visual disturbance, are unlikely for all individuals.

Killer whales often exhibit propeller wounds and have died as a result of collision (Williams and O'Hara 2009). As previously described, OCS vessels have struck only one whale in approximately 540,000 hours of mapping over the past 40 years ($p = 1.9 \times 10^{-6}$; 95% CI = 0 – 5.5×10^{-6}). Therefore, we do not expect any ship strikes during the projects, which average 314 hours (with a maximum of 640 hours) in the Pacific. To further reduce the potential for ship strike, the NOAA vessel would maintain speeds of 4 – 8 knots while surveying and < 13 knots while transiting throughout the range of the Southern Resident killer whale. Coast Survey requires 100% observer coverage and maintaining a distance of 200 yards from all whales. Therefore, it is highly unlikely (i.e., discountable) that any Southern resident killer whale will be exposed to vessel strike during the survey.

Vessel noise is a concern for the Southern Resident killer whale. By reducing speed, as described above, the OCS vessels also reduce noise. Still, Southern Residents are likely to be exposed to small amounts of noise from this vessel. During the course of the survey, it is possible that the vessel may be heard by nearly every individual (N~86), including adults, juveniles, and calves of both sexes. The exposure is expected to be short-lived (< 1 hour). Individuals are likely to be exposed on more than one occasion. Whales are expected to respond with increased call durations or amplitude (Foote et al. 2004, Holt 2008, Holt et al. 2009). They are also likely to avoid areas of high vessel traffic (Erbe 2002). Therefore, it is likely that noise from OCS vessels would adversely affect Southern Resident killer whales. Because of the protective measures incorporated into the action (i.e., reduced speed, avoidance of whales) and limited exposure (i.e., one or a few vessels transiting through the range), we do not expect this noise to interrupt or interfere with feeding, mating, or reproduction (Richardson et al. 1995). We conclude that noise from OCS vessels is likely to adversely affect Southern Resident killer whales, but it is not likely to reduce the fitness for any individual.

Vessel pollution is another potential stressor. The OCS vessels would minimize the discharge of pollutants by meeting all EPA Vessel General Permit requirements. The authorized vessel discharges from OCS vessels would be insignificant against the background of discharges from thousands of vessels in the area. It is unlikely that Southern Resident killer whales would be adversely affected by discharges from these vessels.

Southern Resident killer whales are also sensitive to changes in prey abundance and availability, which could be reduced by the introduction of ANS. OCS vessels do not enter the rivers and streams where fish species are most vulnerable to ANS. To further minimize the transfer of ANS, Coast Survey proposes to: rinse the anchor with a high-powered hose after retrieval; use anti-fouling coatings; regularly remove ANS from their hulls but avoid doing so in critical habitat; and avoid discharging ballast water in critical habitat. Given these protective measures, the discharges and potential for ANS transfer from OCS vessels would have discountable effects on Southern Resident killer whales and are not likely to adversely affect the species.

Tide gauge installation

The installation of tide gauges in remote areas may require underwater or near-shore drilling. This activity may result in noise disturbance. Because noise travels long distances under water, many individuals (of all ages and both sexes) are likely to be exposed to the resulting noise for less than one hour. We were unable to find information on Southern Resident responses to small-scale drilling. The recovery plan states that potential impacts from larger scale drilling (i.e., oil and gas) are poorly understood (Holt 2008). The noise created by a small, hand-held drill is shorter in duration and much quieter than oil and gas drilling. We could not find any data on how killer whales would respond to such a minor noise disturbance, but we do not expect for them to respond behaviorally or physiologically. We conclude that Southern Resident killer whales are not likely to be adversely affected by the relatively benign drilling used to install tide gauges.

Hydrographic surveys

Noise as a result of the hydrographic surveys is a concern for the Southern Resident killer whales, which hear at frequencies of 0.5 – 120 kHz. Their hearing is most sensitive at frequencies of 18 – 42 kHz, which overlap with their echolocation clicks (Szymanski et al. 1999). Therefore, they are able to hear both single beam (≥ 30 kHz) and multibeam systems (≥ 50 kHz) used during OCS projects.

As described above under the section on Cook Inlet beluga whales, Coast Survey uses single beam systems while performing exploratory missions aboard small vessels and surveying shallow water of 20 m or less; these missions are relatively uncommon within the range of the Southern Resident killer whale. In addition, it is highly unlikely that an individual would be exposed to single beam transmissions because it would need to swim under the vessel, within 4.2

m of the sound source. This is unlikely to occur because OCS surveyors would avoid Southern Resident killer whale critical habitat when possible. They would avoid approaching within 200 yards (183 m) of all whales. A trained observer would watch for whales; they would suspend sound transmission if an individual were observed within hearing range. While exposure to single beam sonar noise is unlikely, one or a few occurrences are possible. An exposed individual of any age or either sex would likely respond by avoidance. These fast, highly agile small whales (4 – 5 m) could quickly and easily move out of range of the beam width (4.2 m). They would not be forced to dive. They would likely resume their previous behavior immediately after avoidance. This minor and temporary behavioral alteration is not likely to reduce fitness, i.e., the interruption of feeding, nursing, or mating behavior would be infrequent and transitory. We conclude that exposure of Southern Resident killer whales to single beam sonar noise is unlikely but may adversely affect one or a few individuals. It is not likely to result in the reduced fitness of any individual.

Coast Survey would rely primarily on its multibeam sonar systems for surveying areas within the range of the Southern Resident killer whale. To minimize exposure to multibeam sound, OCS surveyors would use trained observers to maintain a distance of 200 yards (183 m) from all whales. They would avoid critical habitat when possible, and they would suspend transmission if an individual were observed within hearing range. As described above, multibeam systems have a swath width of up to 1 km. Multibeam systems, however, are operated at much higher frequencies, generally ≥ 200 kHz. Coast Survey would avoid using sonar frequencies of < 180 kHz, whenever possible; however, they use lower frequencies in water depth of > 100 m, to achieve high-resolution mapping. There are several such areas within the range of the Southern Resident killer whale (e.g., http://www.charts.noaa.gov/OnLineViewer/18400.shtml). Therefore, the species is likely to be exposed to multibeam sonar noise of ≥ 50 kHz.

In our discussion of Cook Inlet beluga whales, we described the characteristics of multibeam sonar system and how sound dissipates quickly over time and distance. There is only one multibeam system used in Pacific surveys that operates at frequencies within the range of Southern Resident killer whale hearing: the Reson Seabat 8160 (50 kHz). Following methods described in Southall et al. (2007) and Richardson et al. (1995), the maximum radii for the 190 dB, 180 dB, and 160 dB isopleths are 72 m, 190 m, and 790 m for the Reson system (peak source = 228 dB re: 1 µPa). As described above, the majority of sound energy would be lost at the substrate before reaching its maximum range possible in the water column. Furthermore, Coast Survey always sets the power 15 – 25 dB lower than maximum, such that the range used in surveys is 190 –210 dB re: 1 µPa. Using these guidelines, Southern Resident killer whales would need to be located within << 1 km of the vessel to be exposed to noise, which occurs at the higher end of their hearing range (i.e., where their hearing is much less sensitive).

As discussed above, NOAA acoustic criteria and thresholds are being revised; therefore, we base our analyses on the likelihood of exposure, coupled with information available on individual responses to similar sound levels and frequencies. Coast Survey would employ several protective measures to avoid exposing whales to multibeam sonar sound. As previously described, the sound levels are likely to dissipate quickly, such that individuals would need to be within << 1 km of the sound source to be exposed. Given the high mobility of the species and the likelihood for surveys in the area, it is likely that Southern Resident killer whales will be exposed to multibeam noise. All individuals (N = 86) of both sexes and all age groups may be exposed.

While multibeam echosounders transmit at high sound pressure levels, the very short duration of their pulses and their high spatial selectivity make them unlikely to cause damage to marine mammal auditory systems (Lurton and DeRuiter 2011). We were unable to find specific information on how killer whales respond to multibeam noise. Several studies, however, use both "splitbeam" echosounder and multibeam systems to study foraging behavior of killer whales. One of these studies was performed on Southern Resident killer whales (Horne and Gauthier 2004). Horne and Gauthier (2004) collected combined echosounder and multibeam sonar data for five whale "encounters." They observed individuals and groups in close proximity to their boat (and sound source). The whales continued to forage and dive throughout the duration of the study, as indicated by single killer whales, groups of killer whales, and fish aggregations present in the multibeam images. The study is somewhat comparable to Coast Survey's proposed surveys. Horne and Gauthier (2004) operated their splitbeam system (38 and 120 kHz; peak source = 230 dB re: 1 μPa) and multibeam system (200 kHz) in the immediate vicinity of the whales and their prey. Coast Survey would suspend their multibeam systems (≥ 50 kHz; peak source = 228 dB re: 1 μPa) in the immediate vicinity of the whales. Therefore, we expect Coast Survey's hydrographic surveys to be even less intrusive to the whales and not likely to interrupt important activities, such as foraging. Given the small sample size of the above study, we must acknowledge that adverse effects, such as avoidance, are possible and even likely. Still, the data indicate that noise from the hydrographic surveys is not likely to reduce the fitness of any individual.

Summary
In summary, Southern Resident killer whales would not be affected by anchoring, bottom sampling, or buoy installation. They are not likely to be adversely affected by ship strikes, vessel pollution, and tide gauge installation. If exposed to visual disturbance and the noise from the vessels and sonar systems (which is unlikely), beluga whales are likely to be adversely affected. These activities, alone or in concert however, are not likely to reduce the fitness of any individual.

7.3.6 Southern Resident killer whale critical habitat

Exposure
It is possible that OCS will conduct coastal surveys within Southern Resident killer whale critical habitat in the next five years. There are two "critical areas" and several "Priority 2" and "Priority 3" mapping areas within designated critical habitat. Southern Resident killer whale critical habitat consists of approximately 6,630 km^2 in three areas: the Summer Core Area in Haro Strait and waters around the San Juan Islands; Puget Sound; and the Strait of Juan de Fuca. It supports the following physical and biological features: water quality, sufficient prey abundance, and inter-area passage.

Vessel activity
Coast Survey's action would not restrict passage between the areas of critical habitat. Discharges incidental to the normal use of a vessel, however, may affect water quality. Discharges from vessels (such as oil and metals) are potentially harmful to killer whales or their prey; however, the pollutants discharged from one to three OCS vessels are small in magnitude.

To further reduce their impact, the OCS vessels would meet all EPA Vessel General Permit requirements. Therefore, it is unlikely that those discharges would reduce water quality of Southern Resident killer whale critical habitat.

Aquatic nuisance species carried in ballast water or on the hull of a vessel have the potential to reduce the abundance of prey fish species. To reduce this risk, the NOAA vessel would meet all EPA Vessel General Permit requirements, rinse the anchor with a high powered hose, avoid ballast water discharge within critical habitat, use anti-fouling coatings, and regularly remove aquatic nuisance species from the hull (but avoid performing such cleaning in critical habitat). With these precautions, it is unlikely that the NOAA vessel would introduce aquatic nuisance species that would reduce the abundance of killer whale prey species.

Summary
In summary, the action would not affect the critical habitat of Southern Resident killer whales by restricting inter-area passage. The action is not likely to adversely affect critical habitat by reducing water quality or prey abundance.

7.3.7 Steller sea lion (Eastern and western DPSs) and critical habitat

Exposure
It is possible that OCS will conduct coastal surveys within the large range of the Steller sea lion DPSs. There are several "critical areas," "emerging critical areas," and Priority 1 areas along the coasts of California, Oregon, Washington, and southeastern Alaska. The vessels that would conduct projects throughout the range of the DPSs may include "Pacific" vessels or "Alaskan" vessels. Therefore, we include information about exposure to both.

We would expect 1 – 3 OCS vessels to survey coastal areas in Washington, Oregon, or Northern California for a few days to three months, in one or more years. Similar projects in the Pacific have surveyed an average of 25 SNM (maximum 68 SNM) and have required an average of 314 hours (maximum 640 hours). We would expect 1 – 4 OCS vessels to survey coastal areas in Alaska. Individual projects would require a few days to three months, in one or more years. Eight similar projects were completed in Alaska in 2012; they surveyed an average of 217 SNM (maximum 463 SNM), requiring an average of 487 hours (maximum 1027 hours). It is likely that several projects will occur through the range of the DPSs. This action is likely to produce stressors that have been shown to adversely affect Steller sea lions. Because they are large, high mobile marine organisms, we do not expect individuals to be exposed to injury as a result of anchoring, bottom sampling, or buoy installation. These foraging generalists are not likely to be affected by vessel discharges or the introduction of ANS. They may be affected by visual disturbance or noise from vessels, tide gauge installation, and hydrographic surveys. Steller sea lion critical habitat includes specific rookeries, haulouts, and associated areas, as well as three foraging areas that are considered to be essential for the health, continued survival, and recovery of the species. It is not likely to be affected by the action.

Coast Survey would take special precautions while conducting its action around Steller sea lion rookeries. They would avoid conducting surveys in these areas, which are not heavily trafficked as a result of the listing and critical habitat requirements (i.e., vessels must maintain a distance of 3 nm from listed rookeries). Coast Survey prioritizes its projects based on need, and minimally trafficked areas are not high on the list for surveys. As a result, OCS vessels would not approach most Steller sea lion rookeries to within 3 nm.

Coast Survey may be required to map some areas near rookeries. In these instances, they will use binoculars ("big eyes") to observe rookeries from a distance. If they observe sea lions on land, they would remain far offshore, and no near-shore surveys would be conducted on that day. If they do not observe sea lions, they would conduct near-shore surveys. During such surveys, they would avoid approaching sea lions at sea (maintaining a 100 yard distance). If a sea lion approached the vessel during single beam sonar operations, the surveyors would cease transmission. Though these precautions would reduce the chance of exposure, we still consider the effects of visual disturbance and noise from vessels, tide gauge installation, and hydrographic surveys.

Vessel activity
The physical presence of OCS vessels may result in visual disturbance to Steller sea lions. As described above, OCS vessels would avoid approaching sea lions in rookeries (i.e., they would avoid near shore surveys if sea lions were observed on land). They require 100% observer coverage to a distance of 100 yards from all sea lions at sea. Still, over the course of all surveys, at least some Stellar sea lions (N = 10s to 100s) are likely to be exposed to the visual disturbance of OCS vessels. Sea lions in water tolerate close and frequent approaches by vessels and sometimes congregate around fishing vessels. Those hauled out on land are more responsive but rarely react unless the vessel approaches within 100 – 200 m (Richardson et al. 1995). We expect sea lions on shore to respond to visual disturbance by entering the water. We expect sea lions at sea to respond to visual disturbance by diving or swimming away. Such behaviors would temporarily interrupt resting, nursing, and foraging behavior; however the interruption would be isolated and short-lived. We do not expect either scenario to reduce the fitness of any individual. Visual disturbance of sea lions on land may result in a stampede, killing pups; however, we do not expect this to occur because OCS vessels would not conduct near-shore surveys in the presence of sea lions. Therefore, visual disturbance is likely to adversely affect Steller sea lions, by altering their behavior, but it is not likely to reduce the fitness of any individuals.

To reduce the potential for ship strike, the OCS vessels would maintain speeds of 4 – 8 knots while surveying and < 13 knots while transiting throughout the range of the Steller sea lion DPSs. Coast Survey vessels have struck only one marine mammal (a cetacean) in approximately 540,000 hours of mapping over the past 40 years. Using 2012 statistics as a guide, Coast Survey spends an average of 487 hours mapping (maximum 1,027 hours) in Alaska and 314 hours (maximum 640 hours) in the Pacific. Stellar sea lions are relatively small and highly mobile; they would easily avoid collision with any vessel. Therefore, it is highly unlikely that any Stellar sea lion would be exposed to vessel strike during the action.

By reducing its speed, as described above, the OCS vessels also reduce their noise. We could not find information on how Steller sea lions respond to vessel noise. It is difficult to untangle the responses to visual disturbance (described above) from the noise of the vessels. Sea lions on shore are more likely to respond to the sight of a vessel approaching, rather than its noise. Underwater vessel noise, however, may reach an in-water sea lion before it is visually observed.

Regardless, we expect the responses to be similar to those described for visual disturbance. Similarly, we conclude that vessel noise is likely to adversely affect Steller sea lions, by altering their behavior, but it is not likely to reduce the fitness of any individuals.

Tide gauge installation
The installation of tide gauges in remote areas may require underwater or near-shore drilling. This activity may result in noise disturbance. Because noise travels quickly in water, Steller sea lions (N = 10s or 100s) may be exposed to the resulting noise for less than one hour. We were unable to find information on Steller sea lion responses to drilling; however, non-breeding northern fur seals do not appear to avoid prolonged, airborne construction sounds or vibrations from heavy equipment within 100 m (Gentry et al. 1990). Steller sea lions are likely to respond similarly or to avoid noise from small-scale, underwater drilling, which could possibly interfere with foraging or resting. Due to its small magnitude and limited exposure (i.e., short duration and frequency), however, we do not expect the installation of tide gauges to reduce the fitness of any Steller sea lion.

Hydrographic surveys
Stellar sea lions would not be affected by multibeam surveys (≥ 50 kHz). They may be affected by the noise from single beam sonars (≥ 30 kHz), which overlap their hearing range frequency (1 – 32 kHz). As described in previous sections, single beam sonar is only used in water depths < 20 m for exploratory purposes. It is highly unlikely that relatively small, highly mobile sea lion would be within 4.2 m of sound source. The surveyors would avoid sea lions and cease transmission within this distance. If sea lions were exposed, they would likely respond by diving or swimming away from the source. The avoidance of such a small area (4.2 m) is not likely to disrupt their normal behavior in any way. Therefore, Steller sea lions are not likely to be adversely affected by hydrographic surveys.

Summary
In summary, Steller sea lions would not be affected by anchoring, bottom sampling, buoy installation, LIDAR surveys, or vessel pollution. They are not likely to be adversely affected by ship strikes or hydrographic surveys. They are likely to be adversely affected by visual disturbance and noise from vessels and tide gauge installation; however, these activities, alone or in concert, are not likely to reduce the fitness of any individual. Steller sea lion critical habitat includes specific rookeries, haulouts, and associated areas, as well as three foraging areas that are considered to be essential for the health, continued survival, and recovery of the species. The action would not affect critical habitat.

7.3.8 Guadalupe fur seal

Exposure
It is possible that OCS will conduct coastal surveys within the range of the Guadalupe fur seal. There are no "critical areas" or "emerging critical areas" for mapping within their range; however, there are several "Priority 2" areas around the Channel Islands. Coast Survey currently operates one navigation response team vessel in California, stationed out of San Francisco (K. Jamison pers. comm.); it is unlikely that they will survey the Channel Islands. In the event that

they do, we analyze the effects of this action on the Guadalupe fur seal, which has been observed in the Channel Islands in recent years.

We would expect a single vessel to survey coastal areas around the Channel Islands for a few days to three months, in one or more years. Similar projects in the Pacific have surveyed an average of 25 SNM (maximum 68 SNM) and have required an average of 314 hours (maximum 640 hours). Because they are large, high mobile marine organisms, we do not expect Guadalupe fur seals to be exposed to injury as a result of anchoring, bottom sampling, or buoy installation. Coast Survey does not conduct LIDAR studies along the Pacific coast. Guadalupe fur seals may be affected by visual disturbance or noise from vessels, tide gauge installation, or hydrographic surveys.

Vessel activity
The physical presence of the vessel may result in visual disturbance. Coast Survey reduces the likelihood of visual disturbance by requiring 100% observer coverage and maintaining a distance of 100 yards from all pinnipeds. During the course of the survey, it is possible that the vessel may be observed by one or two adults of either sex (the low number reflects the rarity of Guadalupe fur seals outside of Mexican waters). The exposure is expected to be short-lived (< 1 hour). Though individuals may be exposed on more than one occasion, we do not expect a single individual to be exposed repetitively. Guadalupe fur seals are likely to respond to such exposure by avoidance, either entering the water (if on land), diving underwater, or swimming in the opposite direction. Individuals around the Channel Islands are likely foraging or hauling out. Prolonged exposure would be reason for concern; however, we expect exposure to be temporary and isolated, limiting the interruption of foraging or rest in duration and frequency. Therefore, reductions in fitness, as a result of visual disturbance, are unlikely for all individuals.

Because Guadalupe fur seals are so rare in U.S. waters, vessel collision is unlikely. To further reduce the potential for ship strike, the vessel would maintain speeds of 4 – 8 knots while surveying. Coast Survey vessels have struck only one whale in approximately 540,000 hours of mapping over the past 40 years. Using 2012 statistics as a guide, Coast Survey spends an average of 314 hours mapping Pacific projects (with a maximum of 640 hours). Therefore, it is highly unlikely that any Guadalupe fur seal will be exposed to vessel strike during the survey.

By reducing its speed, as described above, the vessel also reduces its noise. During the course of the survey, one or two adults of either sex may be exposed to vessel noise (the low number reflects the rarity of Guadalupe fur seals outside of Mexican waters). The exposure is expected to be short-lived (< 1 hour). Though individuals may be exposed on more than one occasion, we do not expect a single individual to be exposed repetitively. The potential for fur seal disturbance as a result of vessel noise appears to be low (Johnson 1989). We are not aware of any other behavior changes (e.g., reduced foraging or resting), as a result of noise from a single vessel. Therefore, noise from the contracted vessel is not likely to adversely affect Guadalupe fur seals.

Tide gauge installation
The installation of tide gauges in remote areas may require underwater or near-shore drilling. This activity may result in noise disturbance. Because noise travels quickly in water, two adults

(of either sex) may be exposed to the resulting noise for less than one hour. Non-breeding northern fur seals do not appear to avoid prolonged, airborne construction sounds or vibrations from heavy equipment within 100 m (Gentry et al. 1990); therefore, we do not expect other fur seals to avoid noise from small-scale, underwater drilling. Installation of tide gauges is not likely to adversely affect Guadalupe fur seals due to its small magnitude and limited exposure (i.e., short duration and frequency).

Hydrographic surveys
Though there has been no auditory assessment of the Guadalupe fur seal, it is likely that their hearing falls within a similar underwater range as that of the Northern fur seal, 2-40 kHz (Moore and Schusterman 1987). As such, we do not expect them to be exposed to multibeam sonar noise. Given the rarity of the species in the action area, and the small footprint of a single beam system (approximately 4.2 m, see above sections), we do not expect Guadalupe fur seals to be exposed to hydrographic survey noise.

Summary
In summary, Guadalupe fur seals would not be affected by anchoring, bottom sampling, buoy installation, or sonar systems. They are not likely to be adversely affected by ship strikes and tide gauge installation. They are likely to be adversely affected by visual disturbance; however, vessel activity, along with all other OCS activities, is not likely to reduce the fitness of any individual.

7.3.9 Arctic ringed seal

Exposure
Coast Survey will likely conduct hydrographic surveys within the range of Arctic ringed seals. There are two "critical areas," several "Priority 2," and several "Priority 3" mapping areas within the range of the species. Due to this likelihood, we analyze the effects of OCS's action on the DPS.

We would expect 1 – 4 NOAA vessels to survey coastal areas in Alaska. Individual projects would require a few days to three months, in one or more years; it is likely that several projects will occur through the range of the DPS. Eight similar projects were completed in Alaska in 2012; they surveyed an average of 217 SNM (maximum 463 SNM), requiring an average of 487 hours (maximum 1027 hours). This action is likely to produce stressors that have been shown to adversely affect Arctic ringed seals, as reviewed by Kelly et al. (2010). Because they are small, high mobile marine organisms, we do not expect ringed seals to be exposed to injury as a result of anchoring, bottom sampling, or buoy installation. These foraging generalists are not likely to be affected by vessel discharges or the introduction of ANS. They may be affected by visual disturbance or noise from vessels, tide gauge installation, and hydrographic surveys.

Vessel activity
The physical presence of the vessel may result in visual disturbance; however, only icebreakers and certain polar-class vessels are able to transit the heavy ice habitat of ringed seals. Seals whelp, nurse, and molt on ice between March and June; OCS would conduct surveys between June and September to avoid icy conditions in the Arctic and Bering Sea. Therefore, seals are not likely to be exposed to the OCS vessels while on pack ice. Individual seals may encounter OCS vessels while at sea or while resting on ice floes. Coast Survey reduces the likelihood of

visual disturbance by requiring 100% observer coverage and maintaining a distance of 100 yards from all seals. Still, over the course of a survey, we expect many ringed seals (N = 10s to 100s) of all ages and both sexes to be exposed to the visual disturbance of OCS vessels. Though data is limited, seals exhibit considerable tolerance to vessels (Richardson et al. 1995). Upon exposure, we expect seals to either ignore vessels or respond with avoidance behavior. Ringed seals are preyed upon by polar bears, walruses, and killer whales; they are also hunted by humans. They are likely to react to the sight of a vessel as they would react to the sight of a predator, i.e., by diving into the water. Prolonged or repetitive exposure may interrupt resting or foraging (the main behaviors of ringed seals, between June and September); however, we do not expect prolonged or repetitive exposure. We expect the interruption of such behaviors to be temporary and isolated. We do not expect reductions in fitness to any individuals as a result of exposure to OCS vessels.

To reduce the potential for ship strike, the OCS vessels would maintain speeds of 4 – 8 knots while surveying and < 13 knots while transiting throughout the range of the Arctic ringed seal. Coast Survey vessels have struck only one marine mammal in approximately 540,000 hours of mapping over the past 40 years. Using 2012 statistics as a guide, Coast Survey spends an average of 487 hours mapping (with a maximum of 1,027 hours). Ringed seals are small and highly mobile; they would easily avoid collision with any vessel. Therefore, it is highly unlikely that any Arctic ringed seal will be exposed to vessel strike during the action.

By reducing its speed, as described above, the OCS vessels also reduce their noise. We could not find information on how ringed seals respond to vessel noise. Ringed seals rely on thick ice, especially during parturition and nursing (March – June). Coast Survey vessels would avoid this thick ice to prevent damage to their ships and because they are unable to perform their hydrographic surveys in such an environment. Therefore, ringed seals are unlikely to be exposed to vessel noise during this time. Seals may be exposed to vessel noise while they are resting on ice floes or foraging in the water. Seals often retreat into the water in response to anthropogenic noise, although some seals remain on ice during extremely loud seismic surveys (Kelly et al. 1988). We expect seals to temporarily retreat into the water or to remain on ice in response to vessel noise. For seals already in water, we expect them to dive or to swim away from vessel noise. Though the disturbance is likely to adversely affect the seals, the temporary and relatively benign noise (as compared to seismic surveys) is not likely to significantly interrupt vital behaviors. Therefore, we conclude that vessel noise is not likely to reduce the fitness of any ringed seal.

Tide gauge installation

Tertiary tide gauge installation requires drilling into the substrate. This noise may affect ringed seals in the immediate area (N = 10s to 100s). We were unable to find any information regarding ringed seal response to hand-held drill noise. We were able to find information on louder, more invasive techniques such as pipe-driving and other construction activities. Of 23 ringed seals, none reacted strongly to noise from construction: 39 percent did not respond and another 48% appeared indifferent or curious; those that did respond either looked in the direction of the noise or entered the water (Blackwell et al. 2004). Similarly, most seals (85%) did not respond to pipe-driving (Blackwell et al. 2004). Those that responded were curious, with one seal approaching to within 46 m of the activity. Such activities would be louder and more invasive than the temporary use of a single hand-held drill. Therefore, we conclude while ringed seals may be adversely affected by the noise of drilling, they will not experience reductions in fitness as a result of tide gauge installation.

Hydrographic surveys
Ringed seals would not be affected by multibeam surveys (≥ 50 kHz). They may be affected by the noise from single beam sonars (≥ 30 kHz), which overlap their hearing range frequency (1 – 40 kHz). As described in previous sections, single beam sonar is only used in water depths < 20 m for exploratory purposes. It is highly unlikely that small, highly mobile ringed seals would swim within 4.2 m of sound source. The surveyors would avoid seals and cease transmission within this distance. If seals were exposed, they would likely move away from the source. The avoidance of such a small area (4.2 m) is not likely to disrupt their normal behavior in any way. Therefore, ringed seals are not likely to be adversely affected by hydrographic surveys.

Summary
In summary, Arctic ringed seals would not be affected by anchoring, bottom sampling, or buoy installation. They are not likely to be adversely affected by ship strikes, tide gauge installation, or hydrographic surveys. They are likely to be adversely affected by visual disturbance. This activity is not likely to reduce the fitness of any individual.

7.3.10 Beringia bearded seal

Exposure
Coast Survey will likely conduct hydrographic surveys within the range of Beringia bearded seals. There are two "critical areas," several "Priority 2," and several "Priority 3" mapping areas within the range of the species. Due to this likelihood, we analyze the effects of Coast Survey's action on the Beringia bearded seal DPS.

We would expect 1 – 4 NOAA vessels to survey coastal areas in Alaska. Individual projects would require a few days to three months, in one or more years; it is likely that several projects will occur throughout the range of the DPS. Eight similar projects were completed in Alaska in 2012; they surveyed an average of 217 SNM (maximum 463 SNM), requiring an average of 487 hours (maximum 1027 hours). This action is likely to produce stressors that have been shown to adversely affect bearded seals, as reviewed by Cameron et al. (2010). Where we could not find response data on Beringia bearded seals, we used information on the ringed seal (an ice seal with an overlapping range). Because they are relatively small, high mobile marine organisms, we do not expect bearded seals to be exposed to injury as a result of anchoring, bottom sampling, or buoy installation. These foraging generalists are not likely to be affected by vessel discharges or the introduction of ANS. They may be affected by visual disturbance or noise from vessels, tide gauge installation, and hydrographic surveys.

Vessel activity
The physical presence of the vessel may result in visual disturbance; however, only icebreakers and certain polar-class vessels are able to transit the typical pack-ice habitat of bearded seals. Seals whelp, nurse, and molt on ice between April and June; OCS would conduct surveys between June and September to avoid icy conditions in the Arctic and Bering Sea. Therefore, seals are not likely to be exposed to the OCS vessels during the most sensitive times that they are on ice. Individual seals may encounter OCS vessels while at sea or while resting on ice floes.

Coast Survey reduces the likelihood of visual disturbance by requiring 100% observer coverage and maintaining a distance of 100 yards from all seals. Still, over the course of a survey, we expect many bearded seals (N = 10s to 100s) of all ages and both sexes to be exposed to the visual disturbance of OCS vessels. Upon exposure, we expect seals to respond with avoidance behavior. Bearded seals are preyed upon by polar bears, walruses, and sharks; they are also hunted by humans. They are likely to react to the sight of a vessel as they would react to the sight of a predator, i.e., by diving underwater. Prolonged or repetitive exposure may interrupt foraging and resting (the main behaviors of bearded seals, during the summer, at sea); however, we do not expect prolonged or repetitive exposure. We expect the interruption of such behaviors to be temporary and isolated. We do not expect reductions in fitness to any individuals as a result of exposure to OCS vessels.

To reduce the potential for ship strike, the OCS vessels would maintain speeds of 4 – 8 knots while surveying and < 13 knots while transiting throughout the range of the Beringia bearded seal. Coast Survey vessels have struck only one marine mammal in approximately 540,000 hours of mapping over the past 40 years. Using 2012 statistics as a guide, Coast Survey spends an average of 487 hours mapping (with a maximum of 1,027 hours). Bearded seals are relatively small and highly mobile; they would easily avoid collision with any vessel. Therefore, it is highly unlikely that any Beringia bearded seal will be exposed to vessel strike during the OCS action.

By reducing its speed, as described above, the OCS vessels also reduce their noise. The noise of one relatively slow vessel is not likely to interrupt or mask male vocalizations during the breeding season (March – July). Furthermore, there would only be one month of overlap between these vocalizations and OCS surveys (June). We were unable to find any information on the response of bearded seals to vessel noise. We did, however, find information on the responses of 24 bearded seals to full array, single gun, and no gun (i.e., control) seismic arrays (Harris et al. 2001). Seals approached to within 2 m of the vessel. The most common responses to the vessel during no gun and single gun treatments were to dive or swim away (followed by to look at or approach the vessel). Overall, seals did not react dramatically to the seismic operations and remained in the general area (< 150 m). The noise of a vessel is much quieter than a single gun or seismic array; it is equivalent to the noise of no guns. Therefore, we expect seals to respond to vessel noise by diving or swimming away, which are normal behaviors of bearded seals at sea. While this may result in the interruption of resting, we expect such interruptions to be infrequent and of short duration. Therefore, we do not expect vessel noise to reduce the fitness of any Beringia bearded seal.

Tide gauge installation

Tertiary tide gauge installation requires drilling into the substrate. This noise may affect bearded seals in the immediate area (N = 10s to 100s). We were unable to find any information regarding bearded seal response to hand-held drill noise. This noise, however, is much quieter and more infrequent than the noise of seismic surveys, as discussed above. Seals responded to single gun and gun arrays by diving or swimming away (Harris et al. 2001). Such activities would be louder and more invasive than the temporary use of a single hand-held drill. Though seals may dive or swim away from the noise of the drill, there are not likely to be any fitness costs because of the short duration and small magnitude of the noise.

Hydrographic surveys
The hydrographic surveys produce noise (≥ 30 kHz), which may affect bearded seals. As described above, male bearded seals are highly vocal during the mating season. Coast Survey's mapping season overlaps with the mating season by one month (June). The males' complex vocalizations range from 0.02 to 11 kHz in frequency (Cameron et al. 2010). Therefore, their calls would not be masked by hydrographic survey noise. We could not find information on the hearing range of bearded seals. We expect it to be similar to that of ringed seals (1 – 40 kHz). Therefore, bearded seals are not likely to be affected by multibeam surveys (≥ 50 kHz) but may be affected by the noise from single beam sonars (≥ 30 kHz). As described in previous sections, it is highly unlikely that bearded seals would be exposed to single beam sonar. The surveyors would avoid seals and cease transmission within this distance. If exposed, the seals would likely move away from the sound source. This short distance movement (4.2 m) is unlikey to disrupt essential behaviors. Therefore, this unlikely and minor inconvenience is not likely to adversely affect bearded seals.

Summary
In summary, Beringia bearded seals would not be affected by anchoring, bottom sampling, buoy installation, or vessel pollution. They are not likely to be adversely affected by ship strike or hydrographic surveys. They are likely to be adversely affected by visual disturbance and the noise from the vessels, and tide gauge installation. These activities, alone or in concert, are not likely to reduce the fitness of any individual.

7.4 Programmatic Analysis
Because Coast Survey's action occurs throughout the nation at unspecified times and locations, we conducted a programmatic consultation. Here, we evaluate whether and how Coast Survey has insured that its programmatic action is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat.

1. *Has Coast Survey structured their program to minimize the adverse effects of their action on listed and proposed species and critical habitat?*

Coast Survey has incorporated the following measures into its proposed action to minimize adverse effects on listed species and critical habitat:

1. Minimize vessel disturbance and ship strike potential

- Slow speeds (4 – 8 knots), when mapping
- Reduced speeds (<13 knots) when transiting through ranges of ESA-listed cetaceans (unless otherwise required, e.g., NOAA Sanctuaries)
- Reduced speeds (<13 knots) while transiting through designated critical habitat (unless slower speeds are required, e.g., < 10 knots in right whale critical habitat and management areas)
- Trained observers aboard all vessels; 100% observer coverage
- Species identification keys (for marine mammals, sea turtles, corals, abalone, and seagrasses) available on all vessels

2. Minimize noise

- Reduced speed (see above)
- Multibeam surveys using ≥ 50 kHz frequencies, lowest possible power and ping-rate
- Single beam surveys using ≥ 30 kHz frequencies, lowest possible power and ping-rate, and 12° beam angle.

3. Minimize vessel discharges (including aquatic nuisance species)
- Meet all EPA Vessel General Permits and Coast Guard requirements
- Avoid discharge of ballast water in designated critical habitat
- Use anti-fouling coatings
- Clean hull regularly to remove aquatic nuisance species
- Avoid cleaning of hull in critical habitat
- Avoid cleaners with nonylphenols
- Rinse anchor with high-powered hose after retrieval

4. Minimize anchor impact to corals, abalone, and seagrass
- Use designated anchorage area when available
- Use mapping data to anchor in mud or sand, to avoid anchoring on corals
- Avoid anchoring in abalone habitat (California vessels return to port, rather than anchor)
- Avoid anchoring in critical habitat
- Minimize anchor drag

5. Avoid collecting bottom samples in seagrass critical habitat

6. Avoid using tide gauges throughout the ranges of ESA listed and proposed coral, abalone and seagrass species

7. Cetaceans
- Avoid approaching within 200 yards (182.9 m), 500 yards for right whales
- Avoid critical habitat, when possible
- Avoid using sonar frequencies < 180 kHz, when possible
- Suspend multibeam sonar transmissions of < 125 kHz, when susceptible ESA-listed species (i.e., Southern Resident killer whale and Cook Inlet beluga whale) are within hearing range
- Suspend single beam sonar transmissions of 30 kHz when ESA-listed species are within hearing range

8. Pinnipeds
- Avoid approaching in-water pinnipeds within 100 yards (182.9 m)
- When possible, Maintain a vessel distance of at least 3 nautical miles (5.5 km) and a land-based distance of 0.5 miles (0.8 km) of Steller sea lion rookeries listed in 50 CFR 223.202 or Marmot Island
- When possible, suspend sonar transmissions when ESA-listed species are within hearing range

9. Sea turtles
- Avoid approaching within 50 yards

As a result, the proposed action is not likely to adversely affect a majority of ESA-listed species and critical habitat in the action area, including: all baleen whales, sperm whales, sea turtles, marine and anadromous fishes, both abalone, and all coral species. Cook Inlet beluga whales (and critical habitat), Southern Resident killer whales, Steller sea lions, ice seals, Guadalupe fur seals, and Johnson's sea grass are likely to be adversely affected; however, these measures minimize the likelihood and magnitude of effects, as described in the Effects of the Action. Therefore, we conclude that Coast Survey has structured their nationwide hydrographic survey program to minimize the adverse effects of their action on listed species and critical habitat.

2. *Has Coast Survey structured their program to continuously monitor aspects of their action that are likely to adversely affect listed species and critical habitat? For contracted work, has Coast Survey structured their program to encourage, monitor, and enforce the compliance of surveyors and vessel operators?*

Coast Survey would require a trained observer to be aboard all survey vessels at all times (during transits and surveys). They would require that species keys be aboard all survey vessels at all times. They would require monitoring for all endangered species. Observations of marine mammals and sea turtles (the only ESA-listed species likely to be observed) would be recorded in their Observation Log (NOAA 2012). Surveyors would record the date, time, location, species, number of individuals, and response behavior (if any). They would also take a digital photograph.

Coast Survey is responsible for environmental compliance during all survey operational activities that occur while aboard NOAA ships; therefore, they are able to ensure compliance while on survey. NOAA's Office of Marine and Aviation Operations is responsible for transit operations to, from and between survey areas, unless the ship is acquiring data with its survey systems during the transit. Coast Survey would provide the list of protective measures to the NOAA captains and crews. The NOAA captains and crew are sensitive to environmental requirements and make every effort to comply (K. Jamison, pers. comm.). Any instances in which they are unable to comply (e.g., due to rough seas) will be recorded in detail. This information would be compiled, summarized, and provided to us at the end of each year.

Coast Survey contracts privately owned vessels to perform its surveys. These contracts are lucrative for the vessel owners, and therefore, the vessel owners are strongly motivated to comply with OCS requirements. Coast Survey will provide the list of protective measures to all survey vessels. They will incorporate this list of requirements into the contracts, to be issued in 2013. They will require reporting and compliance as required above. If the contractor does not comply, Coast Survey will cancel their contract (K. Jamison, pers. comm.).

Coast Survey will require their surveyors to collect monitoring data on marine mammal and sea turtle observations, during all projects. In this manner, OCS has structured their program to continuously monitor the effects of their action. Coast Survey will provide the list of protective measures to all vessel captains and crew. They will explain that these measures are required to fulfill their ESA section 7 requirements, i.e., to insure that their action does not jeopardize endangered or threatened species and does not adversely modify or destroy critical habitat. They will ensure compliance during surveys conducted aboard NOAA ships. They will strongly encourage compliance during transits aboard NOAA ships and record any instances of non-compliance. They will require compliance as a condition of their contracts for private vessels. In this manner, they have structured their program to encourage, monitor, and enforce compliance.

3. *Has Coast Survey structured their program to evaluate monitoring data in order to detect potentially adverse effects on listed species and critical habitat?*

Coast Survey would require surveyors to record the date, time, location, species, number of individuals, and response behavior (if any). They would also take a digital photograph. The information from the Observation Logs would be compiled, summarized, and provided to us at the end of each year. We will work with OCS to identify any issues, e.g., if response behavior provides new information that indicates a species is likely to be adversely affected by their action. Therefore, Coast Survey has structured their program to evaluate monitoring data to detect potentially adverse affects on listed species and critical habitat.

4. *Has Coast Survey structured their program to allow it to change its action or requirements if deemed necessary to prevent jeopardizing listed species or to prevent the destruction or adverse modification of critical habitat?*

As described above, Coast Survey will work with us to analyze their observation data. If we identify unanticipated adverse effects, OCS would request reinitiation. They would change their action or modify the protective measures to remove the stressor. Such changes would be forwarded to all surveyors to be implemented immediately. We would review the changes under informal or formal consultation and issue a letter of concurrence or an amended biological opinion. The data evaluation described above provides an annual review and opportunity to modify the action, if necessary. In addition, as described in the Incidental Take Statement, below, surveyors will immediately notify Cost Survey if unauthorized take occurs. This includes the unauthorized take of any baleen whale, sperm whale, sea turtle, fish, abalone, seagrass or coral species. It also includes unauthorized take of other marine mammals (e.g., harm or accidental mortality under the MMPA. If such an event would occur, the surveyors would notify OCS immediately. Coast Survey would respond by suspending all activities that may have contributed to that event. They would contact us to request reinitiation and to discuss modifying their action. In this manner, Coast Survey has structured their program to change its action or requirements if necessary to avoid jeopardizing listed species and to avoid the destruction or adverse modification of critical habitat.

8.0 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.

During this consultation, NMFS searched for information on future state, tribal, local, or private actions reasonable certain to occur in the action area. We did not find any information other than what has already been described in the *Environmental Baseline,* which we expect will continue into the future. Anthropogenic effects include commercial fishing, vessel traffic, ocean noise, and those from habitat degradation due to pollution, discharged contaminants, and coastal development. An increase in these activities could result in an increased effect on ESA-listed species; however, the magnitude and significance of any anticipated effects remain unknown at this time.

9.0 Integration and Synthesis of Effects

The Office of Coast Survey (OCS) proposes to provide reliable nautical charts and other navigation products through its nationwide hydrographic survey program. Specific activities, as described in the PEA (NOAA 2012) include: vessel transits, anchoring, hydrographic surveys, sound speed data collection, bottom sampling, tide gauge operations, testing of new survey products, and LIDAR surveys. In addition, Coast Survey has incorporated the following protective measures into its action: minimize vessel disturbance, discharges, noise and ship strike potential; minimize impact to corals, abalone, and Johnson's seagrass by avoiding anchoring, bottom sampling, and installing tide gauges; minimize impact to marine mammals; and minimize impact to sea turtles. Coast Survey also proposes to gather, analyze, report, and review monitoring data. In the event of unanticipated adverse effects or incidental take, they would modify their action and request reinitiation.

Coast Survey's action is not likely to adversely affect all ESA listed baleen whales (blue, bowhead, fin, humpback, North Atlantic right, North Pacific right, sei), sperm whales, sea turtles, anadromous fishes, abalone species, coral species, and all designated critical habitat. It is likely to adversely affect the following species: Cook Inlet beluga whale (and its designated critical habitat), Southern Resident killer whale, Steller sea lion (Eastern and Western DPSs), Guadalupe fur seal, ringed seal (Arctic DPS), bearded seal (Beringia DPS), and Johnson's seagrass. We analyzed the expected exposure and response of each of these species to the proposed action.

During the course of our consultation, we identified the following stressors: vessel activity including: vessel strike, noise, visual disturbance, discharges, and introduction of aquatic nuisance species; injury due to anchoring, bottom sampling, or buoy installation; noise disturbance due to tide gauge installation; and sonar noise (summarized in Table 5 and described below).

Table 5. Summary of effect determinations of all adversely affected species and critical habitat. Determinations include no effect (NE), not likely to adversely affect (NLAA), and likely to adversely affect (LAA).

	Anchoring, bottom sampling, or buoy installation	Vessel activity	Tide gauge installation	Hydrographic surveys	Overall
Johnson's seagrass	NLAA	LAA**	NE	NE	LAA**
Johnson's seagrass critical habitat	NE	NLAA	NE	NE	NLAA
Cook Inlet beluga whale	NE	LAA*	NLAA	LAA*	LAA*
Cook Inlet beluga whale critical habitat	NE	NLAA	LAA***	LAA***	LAA***
Southern Resident killer whale	NE	LAA*	NLAA	LAA*	LAA*
Southern Resident killer whale critical habitat	NE	NLAA	NE	NE	NLAA
Steller sea lion (eastern and western DPS)	NE	LAA*	LAA*	NLAA	LAA*
Steller sea lion critical habitat	NE	NE	NE	NE	NE
Guadalupe fur seal	NE	LAA*	NLAA	NE	LAA*
Arctic ringed seal	NE	LAA*	LAA*	NLAA	LAA*
Beringia bearded seal	NE	LAA*	LAA*	NLAA	LAA*

*Not likely to reduce the fitness of any individual
**Likely to reduce fitness of individuals; not likely to reduce viability of any population
***Not likely to diminish the conservation value of critical habitat

Johnson's seagrass is a threatened species that remains vulnerable to most threats identified in the original listing, including: dredging and filling, shoreline construction and modification, prop scarring, altered water quality, siltation, and storm events. Its abundance, distribution, and extinction risk have remained stable in the past ten years. The species would not be affected by visual disturbance or noise from vessels, aircraft or sonar systems. It would not be adversely affected by anchoring, bottom sampling, buoy installation, or tide gauge installation because Coast Survey will not conduct these activities in the critical habitat of Johnson's seagrass (i.e., exposure is highly unlikely and thus discountable). The species is also not likely to be adversely affected by discharges, including potential of ANS introduction, from one or a few Coast Survey vessels. Johnson's seagrass is likely to be adversely affected by propeller scarring, as a result of the Coast Survey action. There is a small likelihood that propeller scarring would reduce the fitness of a genet by damaging $\leq 1\ m^2$ of seagrass. This magnitude of damage, however, is not likely to reduce the viability of any population.

Johnson's seagrass critical habitat includes ten areas characterized by: 10 years of existence, persistent flowering populations, range limits of the species, genetic diversity, and high abundance. Important physical and biological features include: adequate water quality, salinity levels, water transparency, and stable, unconsolidated sediments that are free from physical disturbance. Johnson's seagrass critical habitat would not be affected by visual disturbance or noise from vessels, aircraft or sonar systems. It would not be affected by anchoring, bottom sampling, buoy installation, or tide gauge installation, which would not be conducted within critical habitat. Water quality is not likely to be adversely affected by the discharges of one or a few Coast Survey vessels.

The Cook Inlet beluga whale DPS is an endangered species that continues to decline in abundance despite removal of the primary cause of endangerment (i.e., over-exploitation). Its resilience to future perturbation is low because of its small population size, range contraction, and isolation from other beluga populations. The DPS would not be affected by anchoring, bottom sampling, or buoy installation. It is not likely to be adversely affected by ship strikes, vessel pollution, and tide gauge installation. If exposed to the action (which is unlikely), belugas are likely to be adversely affected by visual disturbance and the noise from the vessel and sonar systems (single beam and multibeam); however, these activities, alone or in concert, are not likely to reduce the fitness of any individual.

Cook Inlet beluga whale critical habitat includes two areas that contain the following physical or biological features essential to the conservation of this DPS: shallow waters near fish streams, primary prey species, toxin-free waters, unrestricted passage between areas, and low in-water noise levels. The action is not likely to alter water quality, prey abundance, or passage between areas. It is likely to adversely affect noise levels in Cook Inlet, however, such effects would be of small magnitude and duration. Therefore, the action is not likely to reduce the conservation value of Cook Inlet beluga whale critical habitat.

The Southern Resident killer whale DPS is an endangered species that has demonstrated weak growth in recent decades. The factors that originally endangered the species persist throughout its habitat: contaminants, vessel traffic, and reduced prey. Its resilience to future perturbation is reduced as a result of its small population size; however, it has demonstrated the ability to recover from smaller population sizes in the past and has shown an increasing trend over the last several years. Southern Resident killer whales would not be affected by anchoring, bottom sampling, or buoy installation. They are not likely to be adversely affected by ship strikes, vessel pollution, and tide gauge installation. They are likely to be adversely affected by visual disturbance and the noise from the vessels and sonar systems (single beam and multibeam). These activities, alone or in concert, are not likely to reduce the fitness of any individual.

Southern Resident killer whale critical habitat includes three areas that provide the following physical and biological features: water quality, prey species, and inter-area passage. The action would not affect the critical habitat of Southern Resident killer whales by restricting inter-area passage. It is not likely to adversely affect critical habitat by reducing water quality or prey abundance.

The Steller sea lion eastern DPS is currently listed as threatened under the ESA; however, NMFS has proposed delisting. The DPS has grown at an average rate of 4.3% per year for the past 30 years. Threats at the time of listing have been removed and protective measures are in place. As a result, the eastern DPS is highly resilient to further disturbances. The Steller sea lion western DPS is listed as endangered under the ESA. Despite protections, it continues to decline in abundance. Though the total population size is still relatively large (N > 70,000), the causes for the decline remain unknown. The resilience of the western DPS appears to be low to additional perturbations. Steller sea lions of both DPSs would not be affected by anchoring, bottom sampling, buoy installation, LIDAR surveys, or vessel pollution. They are not likely to be adversely affected by ship strikes or hydrographic surveys. They are likely to be adversely affected by visual disturbance and noise from vessels and tide gauge installation; however, these activities, alone or in concert, are not likely to reduce the fitness of any individual from either DPS.

Steller sea lion critical habitat includes specific rookeries, haulouts, and associated areas, as well as three foraging areas that are considered to be essential for the health, continued survival, and recovery of the species. The action would not affect critical habitat.

The Guadalupe fur seal is a threatened species that continues to show a steady increase in abundance. At least one new rookery has been established (San Benitos) since listing. The species appears to be on the path of recovery and is likely resilient to further perturbation. Guadalupe fur seals would not be affected by anchoring, bottom sampling, buoy installation, or sonar systems. They are not likely to be adversely affected by ship strikes and tide gauge installation. They are likely to be adversely affected by visual disturbance; however, vessel activity, along with all other Coast Survey activities, is not likely to reduce the fitness of any individual.

The threatened Arctic ringed seal DPS has a large population size and is likely resilient to immediate perturbations. It is, however, threatened by future climate change, specifically the loss of essential sea ice and snow cover, and as a result, is likely to become endangered in the future. Arctic ringed seals would not be affected by anchoring, bottom sampling, or buoy installation. They are not likely to be adversely affected by ship strikes, tide gauge installation, or hydrographic surveys. They are likely to be adversely affected by visual disturbance. This activity is not likely to reduce the fitness of any individual.

The threatened Beringia bearded seal DPS has a large, apparently stable population size, which makes it resilient to immediate perturbations. It is, however, threatened by future climate change, specifically the loss of essential sea ice and change in prey availability, and as a result, is likely to become endangered in the future. Beringia bearded seals would not be affected by anchoring, bottom sampling, buoy installation, or vessel pollution. They are not likely to be adversely affected by ship strike or hydrographic surveys. They are likely to be adversely affected by visual disturbance and the noise from the vessels, and tide gauge installation. These activities, alone or in concert, are not likely to reduce the fitness of any individual.

Coast Survey's action occurs throughout the nation at unspecified times and locations. Therefore, we conducted a programmatic consultation to determine whether OCS has insured that its action is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. Coast Survey has structured their nationwide hydrographic survey program to minimize the adverse effects of their action on listed species and critical habitat. They have structured their program to continuously monitor the effects of their action. They have also structured their program to encourage, monitor, and enforce compliance. Coast Survey has structured their program to evaluate monitoring data to detect potentially adverse effects on listed species and critical habitat. If necessary, they would change their action or requirements to avoid jeopardizing listed species and to avoid the destruction or adverse modification of critical habitat.

10.0 Conclusion

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that Coast Survey has insured that their action, as proposed, is not likely to jeopardize the continued existence of the following species: beluga whale (Cook Inlet), killer whale (Southern Resident), sperm whale, blue whale, bowhead whale, fin whale, humpback whale, North Atlantic right whale, North Pacific right whale, sei whale , bearded seal (Beringia), ringed seal (Arctic), Guadalupe fur seal, Steller sea lion (Eastern), Steller sea lion (Western), green sea turtle (Florida & Mexico's Pacific coast colonies), green sea turtle (all other areas), hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead sea turtle (Northwest Atlantic), loggerhead sea turtle (North Pacific), olive ridley sea turtle (Mexico's Pacific coast breeding colonies), olive ridley sea turtle (all other areas), Atlantic salmon (Gulf of Maine), Atlantic sturgeon (Gulf of Maine), Atlantic sturgeon (New York Bight), Atlantic sturgeon (Chesapeake Bay), Atlantic sturgeon (Carolina), Atlantic sturgeon (South Atlantic), Chinook salmon (Central Valley Spring-run), Chinook salmon (Upper Columbia River), Chinook salmon (Puget Sound), Chinook salmon (Sacramento River Winter-run), Chinook salmon (California coastal), Chinook salmon (Lower Columbia River), Chinook salmon (Upper Willamette), Chinook salmon (Snake River fall run), Chinook salmon (Snake River spring/summer run), chum salmon (Hood Canal Summer-run), chum salmon (Columbia River), coho salmon (Central California Coast), coho salmon (Oregon Coast), coho salmon (Lower Columbia River), coho salmon (Southern Oregon and Northern California coasts), Gulf sturgeon, green sturgeon (Southern), shortnose sturgeon, smalltooth sawfish (U.S. portion of range), largetooth sawfish, bocaccio (Georgia Basin), yelloweye rockfish (Puget Sound/Georgia Basin), canary rockfish (Puget Sound/Georgia Basin), Pacific eulachon (Southern), steelhead (Central California Coast), steelhead (California Central Valley), steelhead (Puget Sound), steelhead (Southern California), steelhead (Northern California), steelhead (South-central California coast), steelhead (Snake River Basin), steelhead (Upper Columbia River), steelhead (Middle Columbia River), steelhead (Lower Columbia River), steelhead (Upper Wilmette), sockeye salmon (Ozette Lake), sockeye salmon (Snake River), elkhorn coral, staghorn coral, white abalone, black abalone, and Johnson's seagrass.

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that Coast Survey has insured that their action, as proposed, is not likely to destroy or adversely modify designated critical habitat of the following species: beluga whale (Cook Inlet), killer whale (Southern Resident), North Atlantic right whale, North Pacific right whale, Steller sea lion (Eastern), Steller sea lion (Western), leatherback sea turtle, Atlantic salmon (Gulf of Maine), Chinook salmon (Central Valley Spring-run), Chinook salmon (Upper Columbia River), Chinook salmon (Puget Sound), Chinook salmon (Sacramento River Winter-run), Chinook salmon (California coastal), Chinook salmon (Lower Columbia River), Chinook salmon (Upper Willamette), Chinook salmon (Snake River fall run), Chinook salmon (Snake River spring/summer run), chum salmon (Hood Canal Summer-run), chum salmon (Columbia River), coho salmon (Central California Coast), coho salmon (Oregon Coast), coho salmon (Southern Oregon and Northern California coasts), Gulf sturgeon, green sturgeon (Southern), shortnose sturgeon, smalltooth sawfish (U.S. portion of range), Pacific eulachon (Southern), steelhead (Central California Coast), steelhead (California Central Valley), steelhead (Southern California), steelhead (Northern California), steelhead (South-central California coast), steelhead (Snake River Basin), steelhead (Upper Columbia River), steelhead (Middle Columbia River), steelhead (Lower Columbia River), steelhead (Upper Wilmette), sockeye salmon (Ozette Lake), sockeye salmon (Snake River), elkhorn coral, staghorn coral, black abalone, and Johnson's seagrass.

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our conference opinion that Coast Survey has insured that their action, as proposed, is not likely to jeopardize the continued existence of the following species: elkhorn coral, staghorn coral, boulder star coral, mountainous star coral, pillar coral, rough cactus coral, star coral, Lamarck's sheet coral, and elliptical star coral.

11.0 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 U.S. Fish and Wildlife Service as an act which actually kills or injures wildlife, which may 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. Harass is defined by the U.S. Fish and Wildlife Service as actions that create the likelihood of injury to listed species by annoying them to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, 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. Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plant species. Section 9 and 4(d) prohibitions were not extended to the threatened Johnson's seagrass (65 FR 49035); therefore, this authorization of take for the species is not required.

We do not anticipate that the proposed action will incidentally take any ESA-listed sea turtles, fishes, abalone, or corals. We are not including incidental take authorization for marine mammals at this time because the incidental take of marine mammals has not been authorized under section 101(a)(5) of the Marine Mammal Protection Act and/or its 1994 Amendments. Following issuance of such regulations or authorizations, we may amend this biological opinion (or reinitiate consultation) to include an incidental take statement for marine mammals, as appropriate. If, during the course of the action, incidental take occurs, Coast Survey must request reinitiation of consultation. They must contact us immediately to provide an explanation of the cause(s) of the taking and to discuss whether and/or how to modify their action to avoid future take.

12.0 Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act 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.

Coast Survey conducts hydrographic surveys to map coastal areas nationwide. These surveys are used to create detailed charts, establish designated anchorage areas, and provide information to the maritime community. Such information has the potential to assist species conservation. In furtherance of their responsibilities under section 7(a)(1), we recommend that Coast Survey provide us with the results of their mapping surveys conducted in critical habitat of endangered species (e.g., Cook Inlet beluga whale, Southern Resident killer whale, etc.). We will work with Coast Survey to identify whether and which critical habitat areas have been surveyed during the previous year. We request that OCS provide this information annually, when they submit their Observer Log summaries. We will use the information to improve our understanding of the physical and oceanographic features that provide conservation value to critical habitat.

13.0 Reintiation Notice

This concludes formal consultation on the action. As described 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 (i.e., if incidental take occurs during the course of this action); (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 (e.g., when the Permits and Conservation Division proposes to authorize take of marine mammals under the MMPA section 101(a)(5)); or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where incidental take occurs, any operations causing such take must cease pending reinitiation.

14.0 Literature Cited

Acevedo-Whitehouse, K. and A. L. J. Duffus. 2009. Effects of environmental change on wildlife health. Philosophical Transactions of the Royal Society of London B Biological Sciences **364**:3429-3438.

Allen, B. and R. Angliss. 2011. Alaska marine mammal stock assessments, 2010.

Arndt, D. S., M. O. Baringer, M. R. Johnson, L. V. Alexander, H. J. Diamond, R. L. Fogt, J. M. Levy, J. Richter-Menge, P. W. Thorne, L. A. Vincent, A. B. Watkins, and K. M. Willett. 2010. State of the climate in 2009. Bulletin of the American Meteorological Society **91**:S1-S224.

Atkinson, A., V. Siegel, E. Pakhomov, and P. Rothery. 2004. Long-term decline in krill stock and increase in salps within the Southern Ocean. Nature **432**:100-103.

Au, W. W. and M. C. Hastings. 2008. Principles of marine bioacoustics. Springer.

Au, W. W. L. and M. Green. 2000. Acoustic interaction of humpback whales and whale-watching boats. Marine Environmental Research **49**:469-481.

Bailey, K. M., J. F. Piatt, T. C. Royer, S. A. Macklin, R. K. Reed, M. Shima, R. C. Francis, A. B. Hollowed, D. A. Somerton, R. D. Brodeur, W. J. Ingraham, P. J. Anderson, and W. S. Wooster. 1995. ENSO events in the northern Gulf of Alaska, and effects on selected marine fisheries. CalCOFI Reports **36**:78-96.

Bartol, S. M. and D. R. Ketten. 2000. Turtle and tuna hearing. Pages 98-103 *in* Y. Swimmer and R. Brill, editors. NOAA Technical Memorandum. U.S. Department of Commerce.

Bartol, S. M., J. A. Musick, and M. L. Lenhardt. 1999. Evoked potentials of the loggerhead sea turtle (*Caretta caretta*). Copeia **1999**:836-840.

Bauer, G. B., J. R. Mobley, and L. M. Herman. 1993. Responses of wintering humpback whales to vessel traffic. Journal of the Acoustical Society of America **94**:1848.

Bejder, L., S. M. Dawson, and J. A. Harraway. 1999. Responses by Hector's dolphins to boats and swimmers in Porpoise Bay, New Zealand. Marine Mammal Science **15**:738-750.

Benson, S. R., D. A. Croll, B. B. Marinovic, F. P. Chavez, and J. T. Harvey. 2002. Changes in the cetacean assemblage of a coastal upwelling ecosystem during El Niño 1997-98 and La Niña 1999. Progress in Oceanography **54**:279-291.

Blackwell, S. B. and C. R. Greene. 2002. Acoustic measurements in Cook Inlet, Alaska, during August 2001.*in* N. M. Fisheries, editor. NOAA Anchorage, Alaska.

Blackwell, S. B., J. W. Lawson, and M. T. Williams. 2004. Tolerance by ringed seals (Phoca hispida) to impact pipe-driving and construction sounds at an oil production island. J Acoust Soc Am **115**:2346.

Boren, L. J., N. J. Gemmell, and K. J. Barton. 2001. Controlled approaches as an indicator of

tourist disturbance on New Zealand fur seals (Arctocephalus forsteri). Fourteen Biennial Conference on the Biology of Marine Mammals, 28 November-3 December Vancouver Canada. p.30.
Born, E., F. F. Riget, R. Dietz, and D. Andriashek. 1999. Escape responses of hauled out ringed seals (Phoca hispida) to aircraft disturbance. Polar Biology **21**:171-178.
Boyd, I. L. 2002. Antarctic marine mammals. Encyclopedia of Marine Mammals. W. F. Perrin, B. Wursig AND J. G. M. Thewissen (eds.). p.30-36. Academic Press, San Diego, CA. 1414pgs.
Brashares, J. S. 2003. Ecological, behavioral, and life-history correlates of mammal extinctions in West Africa. Conservation Biology **17**:733-743.
Brodeur, R. D., B. W. Frost, S. R. Hare, R. C. Francis, and W. J. I. Jr. 1996a. Interannual variations in zooplankton biomass in the Gulf of Alaska, and covariation with California Current zooplankton biomass. CalCOFI Reports **37**:80-99.
Brodeur, R. D., B. W. Frost, S. R. Hare, R. C. Francis, and J. W.J. Ingraham. 1996b. Interannual variations in zooplankton biomass in the Gulf of Alaska, and covariation with California Current zooplankton biomass. CalCOFI Reports **37**:80-99.
Brodeur, R. D. and D. M. Ware. 1992. Long-term variability in zooplankton biomass in the subarctic Pacific Ocean. Fisheries Oceanography **1**:32-38.
Brown, C. J., E. A. Fulton, A. J. Hobday, R. J. Matear, H. P. Possingham, C. Bulman, V. Christensen, R. E. Forrest, P. C. Gehrke, N. A. Gribble, S. P. Griffiths, H. Lozano-Montes, J. M. Martin, S. Metcalf, T. A. Okey, R. Watson, and A. J. Richardson. 2009. Effects of climate-driven primary production change on marine food webs: implications for fisheries and conservation. Global Change Biology **16**:1194-1212.
Cameron, M., J. Bengtson, P. Boveng, J. Jansen, B. P. Kelly, S. Dahle, E. Logerwell, J. Overland, C. Sabine, G. Waring, and J. Wilder. 2010. Status review of the bearded seal (*Erignathus barbatus*). U.S. Dep. Commer.
Canning-Clode, J. o., A. E. Fowler, J. E. Byers, J. T. Carlton, and G. M. Ruiz. 2011. 'Caribbean creep' chills out: Climate change and marine invasive species. PLoS ONE **6**:e29657.
Carder, D. A. and S. Ridgway. 1990. Auditory brainstem response in a neonatal sperm whale. Journal of the Acoustic Society of America **88**:S4.
Cardillo, M. 2003. Biological determinants of extinction risk: Why are smaller species less vulnerable? Animal Conservation **6**:63-69.
Cardillo, M., G. M. Mace, K. E. Jones, and J. Bielby. 2005. Multiple causes of high extinction risk in large mammal species. Science **309**:1239-1241.
Caut, S., E. Guirlet, and M. Girondot. 2009. Effect of tidal overwash on the embryonic development of leatherback turtles in French Guiana. Marine Environmental Research **69**:254-261.
Cerchio, S., J. K. Jacobsen, D. M. Cholewiak, and E. A. Falcone. 2005. Reproduction of female humpback whales off the Revillagigedo Archipelago during a severe El Niño event. Page 55 Sixteenth Biennial Conference on the Biology of Marine Mammals, San Diego, California.
Cheung, W. W. L., V. W. Y. Lam, J. L. Sarmiento, K. Kearney, R. Watson, D. Zeller, and D. Pauly. 2010. Large-scale redistribution of maximum fisheries catch potential in the global ocean under climate change. Global Change Biology **16**:24-35.
Childers, A. R., T. E. Whitledge, and D. A. Stockwell. 2005. Seasonal and interannual variability in the distribution of nutrients and chlorophyll a across the Gulf of Alaska shelf: 1998-

2000. Deep-Sea Research II **52**:193-216.
Clapham, P., S. Young, and R. Brownell. 1999a. Baleen whales: conservation issues and the status of the most endangered populations. Mammal Review **29**:35-60.
Clapham, P. J., S. B. Young, and R. L. Brownell Jr. 1999b. Baleen whales: conservation issues and the status of the most endangered populations. Mammal Review **29**:35-60.
Clarke, R. 1956. Sperm whales of the Azores. Discovery Reports **28**:237-298.
Colburn, K. 1999. Interactions between humans and bottlenose dolphin, Tursiops truncatus, near Panama City, Florida. Duke University, Durham North Carolina.
Constantine, R. 2001. Increased avoidance of swimmers by wild bottlenose dolphins (Tursiops truncatus) due to long-term exposure to swim-with-dolphin tourism. Marine Mammal Science **17**:689-702.
Cope, M., D. S. Aubin, and J. Thomas. 1999. The effect of boat activity on the behavior of bottlenose dolphins (Tursiops truncatus) in the nearshore waters of Hilton Head, South Carolina. Thirteen Biennial Conference on the Biology of Marine Mammals, 28 November - 3 December Wailea Maui HI. p.37-38.
Corkeron, P. J. 1995. Humpback whales (*Megaptera novaeangliae*) in Hervey Bay, Queensland: Behaviour and responses to whale-watching vessels. Canadian Journal of Zoology **73**:1290-1299.
Corwith, H. L. and P. A. Wheeler. 2002. El Niño related variations in nutrient and chlorophyll distributions off Oregon. Progress in Oceanography **54**:361-380.
Curran, M. A. J., T. D. v. Ommen, V. I. Morgan, K. L. Phillips, and A. S. Palmer. 2003. Ice core evidence for Antarctic sea ice decline since the 1950s. Science **302**:1203-1206.
Czech, B. and P. R. Krausman. 1997. Distribution and causation of species endangerment in the United States. Science **277**:1116-1117.
Danil, K. and S. J. Chivers. 2005. Habitat-based spatial and temporal variability of life history characteristics of female common dolphins (Delphinus delphis) in the eastern tropical Pacific. Page 67 Sixteenth Biennial Conference on the Biology of Marine Mammals, San Diego, California.
Dean, R. and M. Durako. 2007. Carbon sharing through physiological intergration in the threatened seagrass *Halophila johnsonii*. Bulletin of Marine Science **81**:21-35.
Dietrich, K. S., V. R. Cornish, K. S. Rivera, and T. A. Conant. 2007. Best practices for the collection of longline data to facilitate research and analysis to reduce bycatch of protected species., NOAA Technical Memorandum NMFS-OPR-35. 101p. Report of a workshop held at the International Fisheries Observer Conference Sydney, Australia, November 8,.
Edwards, M., D. G. Johns, P. Licandro, A. W. G. John, and D. P. Stevens. 2007. Ecological Status Report: results from the CPR survey 2005/2006. Plymouth, UK.
Erbe, C. 2002. Underwater noise of whale-watching boats and potential effects on killer whales (Orcinus orca), based on an acoustic impact model. Marine Mammal Science **18**:394-418.
Feldkamp, S. D., R. L. DeLong, and G. A. Antonelis. 1991. Effects of El Niño 1983 on the foraging patterns of California sea lions (Zalophus californianus) near San Miguel Island, California. Pages 146-155 *in* F. Trillmich and K. A. Ono, editors. Pinnipeds and El Niño: Responses to environmental stress. Springer-Verlag, Berlin, Germany.
Foote, A. D., R. W. Osborne, and A. R. Hoelzel. 2004. Whale-call response to masking boat noise. Nature **428**:910.
Forcada, J., P. N. Trathan, K. Reid, and E. J. Murphy. 2005. The effects of global climate

variability in pup production of Antarctic fur seals. (Arctocephalus gazella). Ecology **86**:2408-2417.
Francis, R. C. and S. R. Hare. 1997. Regime scale climate forcing of salmon populations in the northeast Pacific--Some new thoughts and findings. Pages 113-127 *in* R. L. Emmett and M. H. Schiewe, editors. Estuarine and ocean survival of northeastern Pacific salmon: Proceedings of the workshop. NOAA.
Fraser, W. R. and E. E. Hofmann. 2003. A predator's perspective on causal links between climate change, physical forcing and ecosystem response. Marine Ecology Progress Series **265**:1-15.
Freeland, H. J. 1990. Sea surface temperatures along the coast of British Columbia: Regional evidence for a warming trend. Canadian Journal of Fisheries and Aquatic Sciences **47**:346-350.
Fuentes, M., M. Hamann, and C. J. Limpus. 2009a. Past, current and future thermal profiles of green turtle nesting grounds: Implications from climate change. Journal of Experimental Marine Biology and Ecology **383**:56-64.
Fuentes, M. M. P. B. and D. Abbs. 2010. Effects of projected changes in tropical cyclone frequency on sea turtles. Marine Ecology Progress Series **412**:283-292.
Fuentes, M. M. P. B., M. Hamann, and C. J. Limpus. 2009b. Past, current and future thermal profiles of green turtle nesting grounds: Implications from climate change. Journal of Experimental Marine Biology and Ecology **in press**:in press.
Fuentes, M. M. P. B., C. J. Limpus, and M. Hamann. 2010. Vulnerability of sea turtle nesting grounds to climate change. Global Change Biology **in press**:in press.
Fuentes, M. M. P. B., J. A. Maynard, M. Guinea, I. P. Bell, P. J. Werdell, and M. Hamann. 2009c. Proxy indicators of sand temperature help project impacts of global warming on sea turtles in northern Australia. Endangered Species Research **9**:33-40.
Garrett, C. 2004. Priority Substances of Interest in the Georgia Basin - Profiles and background information on current toxics issues. GBAP Publication No. EC/GB/04/79, Canadian Toxics Work Group Puget Sound/Georgia Basin International Task Force.
Gentry, R. L., N. Bin, E. Gentry, and J. Gilman. 1990. Responses of northern fur seals to quarrying operations. Marine Mammal Science **6**:151-155.
Geraci, J. R. 1990. Physiological and toxic effects on cetaceans.Pp. 167-197 *In:* Geraci, J.R. and D.J. St. Aubin (eds), Sea Mammals and Oil: Confronting the Risks. Academic Press, Inc.
Grant, S. C. H. and P. S. Ross. 2002. Southern Resident killer whales at risk: toxic chemicals in the British Columbia and Washington environment. Fisheries and Oceans Canada., Sidney, B.C.
Hallegraeff, G. M. 2010. Ocean climate change, phytoplankton community responses, and harmful algal blooms: a formidable predictive challenge. Journal of Phycology **46**:220-235.
Hanson, M. B., R. W. Baird, J. K. B. Ford, J. Hempelmann-Halos, D. M. Van Doornik, J. R. Candy, C. K. Emmons, G. S. Schorr, B. Gisborne, K. L. Ayres, S. K. Wasser, K. C. Balcomb, K. Balcomb-Bartok, J. G. Sneva, and M. J. Ford. 2010. Species and stock identification of prey consumed by endangered southern resident killer whales in their summer range. Endangered Species Research **11**:69-82.
Hare, S. R. and N. J. Mantua. 2000. Empirical evidence for North Pacific regime shifts in 1977 and 1989. Progress in Oceanography **47**:103-145.
Hare, S. R., N. J. Mantua, and R. C. Francis. 1999. Inverse production regimes: Alaska and west

coast Pacific salmon. Fisheries Habitat **24**:6-14.
Harris, R. E., G. W. Miller, and W. J. Richardson. 2001. Seal responses to airgun sounds during summer seismic surveys in the Alaskan Beaufort Sea. Marine Mammal Science **17**:795 - 812.
Hartwell, S. I. 2004. Distribution of DDT in sediments off the central California coast. Marine Pollution Bulletin **49**:299-305.
Hayward, T. L. 2000. El Niño 1997-98 in the coastal waters of southern California: A timeline of events. CalCOFl Reports **41**:98-116.
Hazel, J., I. R. Lawler, H. Marsh, and S. Robson. 2007. Vessel speed increases collision risk for the green turtle (*Chelonia mydas*). Endangered Species Research **3**:105-113.
Higdon, J. W. and S. H. Ferguson. 2009. Loss of Arctic sea ice causing punctuated change in sightings of killer whales (Orcinus orca) over the past century. Ecological Applications **19**:1365-1375.
Hobbs, R., K. Shelden, D. Rugh, and S. A. Norman. 2008. 2008 status review and extinction risk assessment of Cook Inlet belugas. Page 116 *in* NMFS, editor. AFSC Processed Rep 2008-02. NOAA, Seattle, WA.
Hoegh-Guldberg, O. and J. F. Bruno. 2010. The Impact of Climate Change on the World's Marine Ecosystems. Science **328**:1523-1528.
Holt, M. M. 2008. Sound exposure and Southern Resident killer whales (*Orcinus orca*): A review of current knowledge and data gaps. NMFS-NWFSC-89, U.S. Department of Commerce.
Holt, M. M., D. P. Noren, V. Veirs, C. K. Emmons, and S. Veirs. 2009. Speaking up: Killer whales (Orcinus orca) increase their call amplitude in response to vessel noise. J Acoust Soc Am **125**:EL27-32.
Horne, J. K. and S. Gauthier. 2004. Potential Prey of Killer Whales in Puget Sound: A Pilot Study. National Oceanic and Atmospheric Administration, Seattle, WA.
Hoyt, E. 2001. Whale Watching 2001: Worldwide Tourism Numbers, Expenditures, and Expanding Socioeconomic Benefits. International Fund for Animal Welfare,, Yarmouth Port, MA, USA.
IPCC, editor. 2001. Climate change 2001: The scientific basis, contribution of working group I to the third assessment report of the intergovernmental panel of climate change. Cambridge University Press, Cambridge, England.
IPCC, editor. 2002. Climate change and biodiversity.
Isaac, J. L. 2008. Effects of climate change on life history: Implications for extinction risk in mammals. Endangered Species Research.
Issac, J. L. 2009. Effects of climate change on life history: Implications for extinction risk in mammals. Endangered Species Research **7**:115-123.
Jacobsen, J. K. 2009. VM 2777, a 22.4 m female blue whale that stranded at Fort Bragg, Mendocino, California 19 October 2009.
Johnson, J. and A. Wolman. 1984. The humpback whale, *Megaptera novaeangliae*. Marine Fisheries Review **46**:30-37.
Johnson, S. R. 1989. Synthesis of information on the effects of noise and disturbance on major haulout concentrations of Bering Sea pinnipeds. LGL.
JOI/USSSP, C. G. E. a. 2003. The interplay of collisional tectonics and late Cenozoic glacial climate in Alaska and the northeastern Pacific Ocean. Continental Dynamics Program-Earth Sciences Division-National Science Foundation and Joint Oceanographic

Institutions/U.S. Science Support Program, Austin, Texas.
Kastelein, R. A., R. van Schie, W. C. Verboom, and D. de Haan. 2005. Underwater hearing sensitivity of a male and a female Steller sea lion (Eumetopias jubatus). J Acoust Soc Am **118**:1820.
Kelly, B. P., J. Bengtson, P. Boveng, M. Cameron, S. Dahle, J. Jansen, E. Logerwell, J. Overland, C. Sabine, G. Waring, and J. Wilder. 2010. Status review of the ringed seal (*Phoca hispida*). U.S. Dep. Commer.
Kelly, B. P., J. J. Burns, and L. T. Quakenbush. 1988. Responses of ringed seals (Phoca hispida) to noise disturbance. Port and ocean engineering under arctic conditions **2**:27-38.
Kenney, R. D., M. A. M. Hyman, and H. E. Winn. 1985. Calculation of standing stocks and energetic requirements of the cetaceans of the northeast United States Outer Continental Shelf., NOAA Technical Memorandum NMFS-F/NEC-41. 99pp.
Kenworthy, W. J. 1997. An updated biological status review and summary of the proceedings of a workshop to review the biological status of the seagrass *Halophila johnsonii* Eiseman. Southeast Fisheries Science Center, National Marine Fisheries Service, Beaufort, North Carolina.
Kenworthy, W. J. and R. W. Virnstein. 1997. An Updated Biological Status Review and Summary of the Proceedings of Workshop to Review the Biological Status of the Seagrass, Halophila Johnsonii Eiseman. Beaufort Laboratory, NMFS, NOAA.
Ketten, D. R. 1997. Structure and function in whale ears. Bioacoustics **8**:103-135.
Ketten, D. R. and S. M. Bartol. 2006. Final report functional measures of sea turtle hearing. Office of Naval Research.
Kovacs, K. M. and S. Innes. 1990. The impact of tourism of harp seals (Phoca groenlandica) in the Gulf of St. Lawrence, Canada. Applied Animal Behaviour Science **26-Jan**:15-26.
Krahn, M. M., M. B. Hanson, R. W. Baird, R. H. Boyer, D. G. Burrows, C. K. Emmons, J. K. B. Ford, L. L. Jones, D. P. Noren, P. S. Ross, G. S. Schorr, and T. K. Collier. 2007. Persistent organic pollutants and stable isotopes in biopsy samples (2004/2006) from Southern Resident killer whales. Marine Pollution Bulletin **54**:1903-1911.
Kruse, S. 1991. The interactions between killer whales and boats in Johnstone Strait, B.C. (Orcinus orca). Dolphin Societies - Discoveries and Puzzles. Karen Pryor and Kenneth S. Norris (eds.). p.149-159. University of California Press, Berkeley. ISBN 0-520-06717-7. 397pp.
Laist, D. W., A. R. Knowlton, J. G. Mead, A. S. Collet, and M. Podesta. 2001. Collisions between ships and whales. Marine Mammal Science **17**:35-75.
Le Boeuf, B. J. and D. E. Crocker. 2005. Ocean climate and seal condition. BMC Biology **3**:9.
Learmonth, J. A., C. D. Macleod, M. B. Santos, G. J. Pierce, H. Q. P. Crick, and R. A. Robinson. 2006. Potential effects of climate change on marine mammals. Oceanography and Marine Biology: an Annual Review **44**:431-464.
Lockwood, B. L. and G. N. Somero. 2011. Invasive and native blue mussels (genus Mytilus) on the California coast: The role of physiology in a biological invasion☆. Journal of Experimental Marine Biology and Ecology.
Lurton, X. and S. DeRuiter. 2011. Sound radiation of seafloor-mapping echosounders in the water column, in relation to the risks posed to marine mammals. International Hydrographic review **November**:7-17.
Lusseau, D., D. E. Bain, R. Williams, and J. C. Smith. 2009. Vessel traffic disrupts the foraging behavior of southern resident killer whales Orcinus orca. Endangered Species Research

6:211-221.
Lusseau, D., R. Williams, B. Wilson, K. Grellier, T. R. Barton, P. S. Hammond, and P. M. Thompson. 2004. Parallel influence of climate on the behaviour of Pacific killer whales and Atlantic bottlenose dolphins. Ecology Letters **7**:1068-1076.
MacCall, A., H. Batchelder, J. King, D. Mackas, N. Mantua, G. McFarlane, I. Perry, J. Schweigert, and F. Schwing. 2005. Recent ecosystem changes in the California Current System. Page 162 *in* J. King, editor. Report of the study group on fisheries and ecosystem responses to recent regime shifts.
Macleod, C. D. 2009. Global climate change, range changes and potential implications for the conservation of marine cetaceans: A review and synthesis. Endangered Species Research **7**:125-136.
Macleod, C. D., M. B. Santos, R. J. Reid, B. E. Scott, and G. J. Pierce. 2007. Linking sandeel consumption and the likelihood of starvation in harbour porpoises in the Scottish North Sea: Could climate change mean more starving porpoises? Biology Letters **3**:185-188.
Magalhaes, S., R. Prieto, M. A. Silva, J. Goncalves, M. Afonso-Dias, and R. S. Santos. 2002. Short-term reactions of sperm whales (Physeter macrocephalus) to whale-watching vessels in the Azores. Aquatic Mammals **28**:267-274.
Mann, J., R. C. Connor, L. M. Barre, and M. R. Heithaus. 2000. Female reproductive success in bottlenose dolphins (Tursiops sp.): Life history, habitat, provisioning, and group-size effects. Behavioral Ecology **11**:210-219.
Mantua, N. 2002. Pacific-Decadal Oscillation (PDO). Pages 592-594 *in* M. C. MacCracken and J. S. Perry, editors. Encyclopedia of global environmental change. Volume 1: The earth system: Physical and chemical dimensions of global environmental change. John Wiley & Sons, Ltd., Chichister, England.
Mantua, N. J. and S. R. Hare. 2002. The Pacific Decadal Oscillation. Journal of Oceanography **58**:35-44.
Mantua, N. J., S. R. Hare, Y. Zhang, J. M. Wallace, and R. C. Francis. 1997. A Pacific interdecadal climate oscillation with impacts on salmon production. Bulletin of the American Meteorological Society **78**:1069-1079.
Matkin, C. O. and E. Saulitis. 1997. Restoration notebook: killer whale (*Orcinus orca*). Exxon Valdez Oil Spill Trustee Council, Anchorage, Alaska.
Mazaris, A. D., A. S. Kallimanis, S. P. Sgardelis, and J. D. Pantis. 2008. Do long-term changes in sea surface temperature at the breeding areas affect the breeding dates and reproduction performance of Mediterranean loggerhead turtles? Implications for climate change. Journal of Experimental Marine Biology and Ecology.
McDonald, M. A., J. A. Hildebrand, S. M. Wiggins, D. Thiele, D. Glasgow, and S. E. Moore. 2005. Sei whale sounds recorded in the Antarctic. ASA.
McFarlane, G. A. and R. J. Beamish. 1992. Climatic influence linking copepod production with strong yearclasses in sablefish, *Anoplopoma fimbria*. Canadian Journal of Fisheries and Aquatic Sciences **49**:743-753.
McGuire, T., M. Blees, and M. Bourdon. 2011. Photo-identification of beluga whales in Upper Cook Inlet, Alaska. Final Report of Field Activities and belugas resighted in 2009. Report prepared by LGL Alaska Research Associates, Inc., Anchorage, AK, for National Fish and Wildlife Foundation, Chevron, and ConocoPhillips Alaska. Inc.
McMahon, C. R. and H. R. Burton. 2005. Climate change and seal survival: Evidence for environmentally mediated changes in elephant seal, Mirounga leonina, pup survival.

Proceedings of the Royal Society of London Series B Biological Sciences **272**:923-928.
Mearns, A. J. 2001. Long-term contaminant trends and patterns in Puget Sound, the Straits of Juan de Fuca, and the Pacific Coast.*in* T. Droscher, editor. 2001 Puget Sound Research Conference. . Puget Sound Action Team, Olympia, Washington.
Minchin, D. 2007. A checklist of alien and cryptogenic aquatic species in Ireland. Aquatic Invasions **2**:341-366.
Minobe, S. 1997. A 50-70 year climatic oscillation over the North Pacific and North America. Geophysical Research Letters **24**:683-686.
Minobe, S. 1999. Resonance in bidecadal and pentadecadal climate oscillations over the North Pacific: Role in climatic regime shifts. Geophysical Research Letters **26**:855-858.
Moline, M. A., H. Claustre, T. K. Frazer, O. Schofields, and M. Vernet. 2004. Alterations of the food web along the Antarctic Peninsula in response to a regional warming trend. Global Change Biology **10**:1973-1980.
Mooney, T. A., R. T. Hanlon, J. Christensen-Dalsgaard, P. T. Madsen, D. R. Ketten, and P. E. Nachtigall. 2010. Sound detection by the longfin squid (*Loligo pealeii*) studied with auditory evoked potentials: sensitivity to low-frequency particle motion and not pressure. Journal of Experimental Biology **213**:3748-3759.
Moore, P. W. and R. J. Schusterman. 1987. Audiometric assessment of northern fur seals, Callorhinus ursinus. Marine Mammal Science **3**:31-53.
Moore, S. K., N. J. Mantua, and E. P. Salathé. 2011. Past trends and future scenarios for environmental conditions favoring the accumulation of paralytic shellfish toxins in Puget Sound shellfish. Harmful Algae **10**:521-529.
Mundy, P. R. and R. T. Cooney. 2005. Physical and biological background. Pages 15-23 *in* P. R. Mundy, editor. The Gulf of Alaska: Biology and oceanography. Alaska Sea Grant College Program, University of Alaska, Fairbanks, Alaska.
Mundy, P. R. and P. Olsson. 2005. Climate and weather. Pages 25-34 *in* P. R. Mundy, editor. The Gulf of Alaska: Biology and oceanography. Alaska Sea Grant College Program, University of Alaska, Fairbanks, Alaska.
National Marine Manufacturers Association. 2011. Recreational boating statistical abstract.
NMFS. 2006. Biological opinion on the issuance of section lO(a)(l)(A) permits to conduct scientific research on the southern resident killer whale (Orcinus orca) distinct population segment and other endangered or threatened species. National Marine Fisheries Service, Northwest Region, Seattle, Washington.
NMFS. 2011. Southern Resident killer whale 5-year review. NOAA NMFS Northwest Regional Office, Seattle, WA.
NMFS. 2012. Draft status review of the eastern distinct population segment of Steller sea lion (*Eumetopias jubatus*). Protected Resources Division, Alaska Region, National Marine Fisheries Service, Juneau, Alaska.
NOAA. 2012. Draft Programmatic Environmental Assessment for the Office of Coast Survey Hydrographic Survey Projects.*in* N. O. Service, editor., Silver Spring, MD.
Norman, S. A. 2011. Anthropogenic and environmental stressors in Cook Inlet beluga whales (*Delphinapterus leucas*) Page 113 *in* NMFS, editor. NOAA, Anchorage, AK.
Norman, S. A., C. E. Bowlby, M. S. Brancato, J. Calambokidis, P. J. G. D. Duffield, T. A. Gornall, M. E. Gosho, B. Hanson, J. Hodder, S. J. Jefferies, B. Lagerquist, D. M. Lambourn, B. Mate, B. Norberg, R. W. Osborne, J. A. Rash, S. Riemer, and J. Scordino. 2004. Cetacean strandings in Oregon and Washington between 1930 and 2002. Journal of

Cetacean Research and Management **6**:87-99.
Nowacek, D. P., M. P. Johnson, and P. L. Tyack. 2004. North Atlantic right whales (Eubalaena glacialis) ignore ships but respond to alerting stimuli. Proc Biol Sci **271**:227-231.
Nowacek, S. M., R. S. Wells, and A. R. Solow. 2001. Short-term effects of boat traffic on bottlenose dolphins, Tursiops truncatus, in Sarasota Bay, Florida. Marine Mammal Science **17**:673-688.
NRC. 2003. National Research Council: Ocean noise and marine mammals. . National Academies Press, Washington, D.C.
Parks, S. E., C. W. Clark, and P. L. Tyack. 2007a. Short- and long-term changes in right whale calling behavior: the potential effects of noise on acoustic communication. J Acoust Soc Am **122**:3725-3731.
Parks, S. E., D. R. Ketten, J. T. O'Malley, and J. Arruda. 2007b. Anatomical predictions of hearing in the North Atlantic right whale. The Anatomical Record **290**:734-744.
Parsons, K. M., K. C. B. III, J. K. B. Ford, and J. W. Durban. 2009. The social dynamics of southern resident killer whales and conservation implications for this endangered population. (Orcinus orca). Animal Behaviour **77**:963-971.
Payne, P., J. Nicholas, L. O'Brien, and K. Powers. 1986. The distribution of the humpback whale, Megaptera novaeangliae, on Georges Bank and in the Gulf of Maine in relation to densities of the sand eel, Ammodytes americanus. Fisheries Bulletin **84**:271-277.
Payne, P. M., D. N. Wiley, S. B. Young, S. Pittman, P.J. Clapham, and J. W. Jossi. 1990. Recent fluctuations in the abundance of baleen whales in the southern Gulf of Maine in relation to changes in selected prey. Fishery Bulletin **88**:687-696.
Pendoley, K. 1997. Sea turtles and management of marine seismic programs in Western Australia. PESA **25**:9.
Philippart, C. J. M., R. Anadón, R. Danovaro, J. W. Dippner, K. F. Drinkwater, S. J. Hawkins, T. Oguz, G. O'Sullivan, and P. C. Reid. 2011. Impacts of climate change on European marine ecosystems: Observations, expectations and indicators☆. Journal of Experimental Marine Biology and Ecology.
Pilot, M., M. E. Dahlheim, and A. R. Hoelzel. 2010. Social cohesion among kin, gene flow without dispersal and the evolution of population genetic structure in the killer whale (Orcinus orca). J Evol Biol **23**:20-31.
Poloczanska, E. S., C. J. Limpus, and G. C. Hays. 2009. Vulnerability of marine turtles in climate change. Pages 151-211 Advances in Marine Biology. Academic Press, New York.
Purvis, A., J. L. Gittleman, G. Cowlishaw, and G. M. Mace. 2000. Predicting extinction risk in declining species. Proceedings of the Royal Society B-Biological Sciences **267**:1947-1952.
Reid, K. and J. Croxall. 2001. Environmental response of upper trophic-level predators reveals a system change in an Antarctic marine ecosystem. Proceedings of the Royal Society London Series B **268**:377–384.
Reina, R. D., J. R. Spotila, F. V. Paladino, and A. E. Dunham. 2008. Changed reproductive schedule of eastern Pacific leatherback turtles Dermochelys coriacea following the 1997–98 El Niño to La Niña transition. Endangered Species Research.
Rice, D. W. 1989. Sperm whale, *Physeter macrocephalus* Linnaeus, 1758. Pp.177-233 In: S. H. Ridgway and R. Harrison (Eds), Handbook of Marine Mammals: Volume 4, River Dolphins and the Larger Toothed Whales. Academy Press, London.

Richardson, W. J., J. Charles R. Greene, C. I. Malme, and D. H. Thomson. 1995. Marine mammals and noise. Academic Press, Inc., San Diego, CA. ISBN 0-12-588440-0 (alk. paper). 576pp.
Richter, C. F., S. M. Dawson, and E. Slooten. 2003. Sperm whale watching off Kaikoura, New Zealand: Effects of current activities on surfacing and vocalisation patterns., Department of Conservation, Wellington, New Zealand. Science For Conservation 219. 78p.
Robinson, R. A., H. Q. P. Crick, J. A. Learmonth, I. M. D. Maclean, C. D. Thomas, F. Bairlein, M. C. Forchhammer, C. M. Francis, J. A. Gill, B. J. Godley, J. Harwood, G. C. Hays, B. Huntley, A. M. Hutson, G. J. Pierce, M. M. Rehfisch, D. W. Sims, M. B. Santos, T. H. Sparks, D. A. Stroud, and M. E. Visser. 2008. Travelling through a warming world: climate change and migratory species. Endangered Species Research.
Rolland, R. M., S. E. Parks, K. E. Hunt, M. Castellote, P. J. Corkeron, D. P. Nowacek, S. K. Wasser, and S. D. Kraus. 2012. Evidence that ship noise increases stress in right whales. Proc Biol Sci **279**:2363-2368.
Romano, T., M. Keogh, C. Kelly, P. Feng, L. Berk, C. Schlundt, D. Carder, and J. Finneran. 2004. Anthropogenic sound and marine mammal health: measures of the nervous and immune systems before and after intense sound exposure. Canadian Journal of Fisheries and Aquatic Sciences **61**:1124-1134.
Royer, T. C. 2005. Hydrographic responses at a coastal site in the northern Gulf of Alaska to seasonal and interannual forcing. Deep-Sea Research II **52**:267-288.
Royer, T. C. and T. Weingartner. 1999. Coastal hydrographic responses in the northern Gulf of Alaska to the 1997-98 ENSO event. Proceedings of the 1998 Science Board Symposium on the impacts of the 1997/98 El Niño event on the North Pacific Ocean and its marginal seas.
Ruiz, G. M., P. Fofonoff, and A. H. Hines. 1999. Non-indigenous species as stressors in estuarine and marine communities: Assessing invasion impacts and interactions. Limnology and Oceanography **44**:950–972.
Samuel, Y., S. J. Morreale, C. W. Clark, C. H. Greene, and M. E. Richmond. 2005. Underwater, low-frequency noise in a coastal sea turtle habitat. J Acoust Soc Am **117**:1465.
Samuels, A., L. Bejder, and S. Heinrich. 2000. A review of the literature pertaining to swimming with wild dolphins., Final report to the Marine Mammal Commission. Contract No. T74463123. 58pp.
Samuels, A. and T. Gifford. 1998. A quantitative assessment of dominance relations among bottlenose dolphins. The World Marine Mammal Science Conference, 20-24 January Monaco. p.119. (=Twelth Biennial Conference on the Biology of Marine Mammals).
Scheidat, M., C. Castro, J. Gonzalez, and R. Williams. 2004. Behavioural responses of humpback whales (Megaptera novaeangliae) to whalewatching boats near Isla de la Plata, Machalilla National Park, Ecuador. Journal of Cetacean Research and Management **6**:63-68.
Shane, S. H. 1994. Occurrence and habitat use of marine mammals at Santa Catalina Island, California from 1983-91. Bulletin of the Southern California Academy of Sciences **93**:13-29.
Shane, S. H. 1995. Behavior patterns of pilot whales and Risso's dolphins off Santa Catalina Island, California. Aquatic Mammals **21**:195-197.
Sherr, E. B., B. F. Sherr, and P. A. Wheeler. 2005. Distribution of coccoid cyanobacteria and small eukaryotic phytoplankton in the upwelling ecosystem off the Oregon coast during

2001 and 2002. Deep-Sea Research II **52**:317-330.
Simmonds, M. P. and W. J. Eliott. 2009. Climate change and cetaceans: Concerns and recent developments. Journal of the Marine Biological Association of the United Kingdom **89**:203-210.
Southall, B. L., A. E. Bowles, W. T. Ellison, J. J. Finneran, R. L. Gentry, C. R. Greene, D. Kastak, D. R. Ketten, J. H. Miller, P. E. Nachtigall, W. J. Richardson, J. A. Thomas, and P. L. Tyack. 2007. Marine mammal noise exposure criteria: initial scientific recommendations. Marine Mammal Science **33**:521.
Stabeno, P. J., N. A. Bond, A. J. Hermann, N. B. Kachel, C. W. Mordy, and J. E. Overland. 2004. Meteorology and oceanography of the northern Gulf of Alaska. Continental Shelf Research **24**:859-897.
Stewart, B. S. 2010. Interactions between beluga whales (Delphinapterus leucas) and boats in Knik Arm, upper Cook Inlet, Alaska: Behavior and Bioacoustics. National Marine Fisheries Service:10-11.
Stewart, B. S., F. T. Awbrey, and W. E. Evans. 1983. Belukha whale (Delphinapterus leucas) responses to industrial noise in Nushagak Bay, Alaska: 1983. US Department of Commerce, National Oceanic and Atmospheric Administration, Outer Continental Shelf Environmental Assessment Program Final Report **43**:587-616.
Swingle, W. M., S. G. Barco, T. D. Pitchford, W. A. McLellan, and D. A. Pabst. 1993. Appearance of Juvenile Humpback Whales Feeding in the Nearshore Waters of Virginia. Marine Mammal Science **9**:309-315.
Szymanski, M. D., D. E. Bain, K. Kiehl, S. Pennington, S. Wong, and K. R. Henry. 1999. Killer whale (Orcinus orca) hearing: Auditory brainstem response and behavioral audiograms. J Acoust Soc Am **106**:1134.
Terhune, J. M. and K. Ronald. 1975. Underwater hearing sensitivity of two ringed seals (Pusa hispida). Canadian Journal of Zoology **53**:227-231.
Terhune, J. M. and K. Ronald. 1976. The upper frequency limit of ringed seal hearing. Canadian Journal of Zoology **54**:1226-1229.
Thomas, A. and P. T. Strub. 2001. Cross-shelf phytoplankton pigment variability in the California Current. Continental Shelf Research **21**:1157-1190.
Thomas, J. A., R. A. Kastelein, and F. T. Awbrey. 1990. Behavior and blood catecholamines of captive belugas during playbacks of noise from an oil drilling platform. Zoo Biology **9**:393-402.
Twiss, S. D., C. Thomas, V. Poland, J. A. Graves, and P. Pomeroy. 2007. The impact of climatic variation on the opportunity for sexual selection. Biology Letters **3**:12-15.
Urick, R. J. and R. J. Urick. 1983. Principles of underwater sound. McGraw-Hill New York.
USFWS and NMFS. 1998. Consultation Handbook: Procedures for conducting consultation and conference activities under section 7 of the Endangered Species Act.
Wahlberg, M. and H. Westerberg. 2005. Hearing in fish and their reactions to sounds from offshore wind farms. Marine Ecology Progress Series **288**:295-309.
Waring, G. T., E. Josephson, C. P. Fairfield, and K. Maze-Foley. 2008. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 2007. NOAA Technical Memorandum NMFS-NE-???, National Marine Fisheries Service Northeast Fisheries Science Center, Woods Hole, Massachusetts.
Wartzok, D. and D. R. Ketten. 1999. Marine mammal sensory systems. Biology of marine mammals:117-175.

Watkins, W. A. 1986. Whale Reactions to Human Activities in Cape-Cod Waters. Marine Mammal Science **2**:251-262.

Watkins, W. A. and W. E. Schevill. 1975. Sperm whales (Physeter catodon) react to pingers. Deep Sea Research and Oceanogaphic Abstracts **22**:123-129, +121pl.

Weber, T. C. 2008. Observations of clustering inside oceanic bubble clouds and the effect on short-range acoustic propagation. J Acoust Soc Am **124**:2783.

Wells, R. S. and M. D. Scott. 1997. Seasonal incidence of boat strikes on bottlenose dolphins near Sarasota, Florida. Marine Mammal Science **13**:475-480.

Wheeler, P. A. and J. Hill. 1999. Biological effects of the 1997-1998 El Niño event off Oregon: Nutrient and chlorophyll distributions.*in* H. J. Freeland, W. T. Peterson, and A. Tyler, editors. Proceedings of the 1998 Science Board Symposium on the impacts of the 1997/98 El Niño event on the North Pacific Ocean and its marginal seas. North Pacific Marine Science Organization (PICES): PICES Scientific Report No. 10.

Whitney, F. A., D. L. Mackas, D. W. Welch, and M. Robert. 1999. Impact of the 1990s El Niños on nutrient supply and productivity of Gulf of Alaska waters. Proceedings of the 1998 Science Board Symposium on the impacts of the 1997/98 El Niño event on the North Pacific Ocean and its marginal seas. PICES Scientific Report No. 10.

Wilcove, D. S., D. Rothstein, J. Dubow, A. Phillips, and E. Losos. 1998. Quantifying threats to imperiled species in the United States. BioScience **48**:607-615.

Wiley, D. N., R. A. Asmutis, T. D. Pitchford, and D. P. Gannon. 1995. Stranding and mortality of humpback whales, Megaptera novaeangliae, in the mid-Atlantic and southeast United States, 1985-1992. Fishery Bulletin **93**:196-205.

Wilkinson, C. and D. Souter. 2008. Status of Caribbean coral reefs after bleaching and hurricanes in 2005. Global Coral Reef Monitoring Network, and Reef and Rainforest Research Centre, Townsville.

Williams, R., D. E. Bain, J. K. B. Ford, and A. W. Trites. 2002a. Behavioural responses of male killer whales to a "leapfrogging" vessel. (Orcinus orca). Journal of Cetacean Research and Management **4**:305-310.

Williams, R., D. E. Bain, J. C. Smith, and D. Lusseau. 2009. Effects of vessels on behaviour patterns of individual southern resident killer whales Orcinus orca. Endangered Species Research **6**:199-209.

Williams, R. and P. O'Hara. 2009. Modelling ship strike risk to fin, humback and killer whales in British Columbia, Canada. J. Cetaceans Res. Manage.

Williams, R., r. W. Trites, and D. E. Bain. 2002b. Behavioural responses of killer whales (Orcinus orca) to whale-watching boats: Opportunistic observations and experimental approaches. Journal of Zoology **256**:255-270.

Williams, S. L. 2007. Introduced species in seagrass ecosystems: Status and concerns. Journal of Experimental Marine Biology and Ecology **350**:89-110.