UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

Endangered Species Act Section 7(a)(2) Biological Opinion

Quintillion Subsea Operations, LLC, Proposed Subsea Fiber Optic Cable-laying Activities and Associated Proposed Issuance of an Incidental Harassment Authorization in the Bering, Chukchi, and Beaufort Seas, Alaska

NMFS Consultation Number: AKR-2016-9555

Action Agencies: Alaska District, U.S. Army Corps of Engineers

Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service, NOAA

Affected Species and Effects Determinations:

		Is the Action Likely to:		
ESA-Listed Species	**Status**	**Adversely Affect Species or Critical Habitat?**	**Jeopardize the Species?**	**Destroy or Adversely Modify Critical Habitat?**
Blue whale (*Balaenoptera musculus*)	Endangered	No	No	N/A
Bowhead whale (*Balaena mysticetus*)	Endangered	Yes	No	N/A
Fin whale (*Balaenoptera physalus*)	Endangered	Yes	No	N/A
Humpback whale (*Megaptera novaeangliae*)	Endangered	Yes	No	N/A
North Pacific right whale (*Eubalaena japonica*)	Endangered	No	No	No
Sperm whale (*Physeter microcephalus*)	Endangered	No	No	N/A
Western North Pacific gray whale (*Eschrichtius robustus*)	Endangered	No	No	N/A
Arctic ringed seal (*Phoca hispida hispida*)	Threatened[1]	Yes	No	No
Beringia DPS bearded seal (*Phoca hispida hispida*)	Threatened[2]	Yes	No	N/A
Western DPS Steller sea lion (*Eumetopias jubatus*)	Endangered	No	No	No

Consultation Conducted by: Alaska Region, National Marine Fisheries Service, NOAA

Issued by:

James W. Balsiger, Ph.D.
Administrator, Alaska Region

Date: **5-18-2016**

TABLE OF CONTENTS **PAGE**

TABLES **PAGE**

FIGURES **PAGE**

Abbreviations and Acronyms

ARCWEST/CHAOZ-X	Arctic Whale Ecology Study/Chukchi Acoustics, Oceanography, and Zooplankton Study-extension
BMH	beach man hole
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
BU	branching unit
dB	decibel
DPS	distinct population segment
EIS	environmental impact statement
ESA	Endangered Species Act
ESCA	Endangered Species Conservation Act
HDD	horizontal directional drill
IHA	incidental harassment authorization
IWC	International Whaling Commission
kHz	kilohertz
kts	knots
MMPA	Marine Mammal Protection Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
Opinion	this biological opinion
p-p	peak-to-peak
PAM	passive acoustic monitoring
PBF	physical or biological features
PCE	primary constituent element
Permits Division	NMFS Office of Protected Resources, Permits and Conservation Division
PLGR	pre-lay grapnel run
PLIB	post-lay inspection and burial
PSO	protected species observer
PTS	permanent threshold shift
rms	root mean square
ROV	remotely operated vehicle
SOPEP	shipboard oil pollution emergency plan
SSV	sound source verification
TTS	temporary threshold shift
USFWS	U.S. Fish and Wildlife Service
ZOI	zone of influence
μPa	micropascal
0-p	peak

1 Introduction

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 ESA-listed species or critical habitat, consultation with National Marine Fisheries Service (NMFS) and/or the U.S. Fish and Wildlife Service (USFWS) is required (50 CFR 402.14(a)).

Section 7(b)(3) of the ESA requires that at the conclusion of consultation, NMFS and/or USFWS provide an opinion stating how the Federal agencies' actions will affect ESA-listed species and critical habitat under their jurisdiction. If incidental take is expected, section 7(b)(4) requires the consulting agency to provide an Incidental Take Statement that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts.

The U.S. Army Corps of Engineers, Alaska District (Corps), proposes to issue permit POA-2015-529 to Quintillion Subsea Operations, LLC (Quintillion), to install a subsea fiber optic cable network along the northern and western coasts of Alaska in the Bering, Chukchi, and Beaufort Seas. The NMFS Office of Protected Resources, Permits and Conservation Division (hereafter referred to as "the Permits Division"), proposes to issue an incidental harassment authorization (IHA) pursuant to section 101(a)(5)(D) of the Marine Mammal Protection Act of 1972, as amended (MMPA) (16 U.S.C. 1361 et seq.), to Quintillion for harassment of marine mammals incidental to the cable-laying activities (81 FR 17666).

The NMFS Alaska Region (hereafter referred to as "we") consulted with the Corps and Permits Division on the proposed actions. This document represents our biological opinion (Opinion) on the proposed actions and their effects on endangered and threatened species and designated critical habitat for those species.[1,2]

The Opinion and Incidental Take Statement were prepared by NMFS Alaska Region in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531, et seq.), and implementing regulations at 50 CFR 402. The Opinion and Incidental Take Statement are in compliance with the Data Quality Act (44 U.S.C. 3504(d)(1) et seq.) and underwent pre-dissemination review.

1.1 Background

This Opinion considers the effects of the proposed subsea cable-laying project and the associated proposed issuance of an IHA. These actions may affect the following species and designated critical habitat: bowhead (*Balaena mysticetus*), fin (*Balaenoptera physalus*), humpback (*Megaptera*

[1] On July 25, 2014, the U.S. District Court for Alaska issued a memorandum decision in a lawsuit challenging the listing of bearded seals under the ESA (Alaska Oil and Gas Association v. Pritzker, Case No. 4:13-cv-00018-RPB). The decision vacated NMFS's listing of the Beringia distinct population segment of bearded seals as a threatened species. NMFS has appealed that decision. While the appeal is pending, our biological opinions will continue to address effects to bearded seals so that action agencies have the benefit of NMFS's analysis of the consequences of the proposed action on the species, even though the listing is not in effect.

[2] On March 17, 2016, the U.S. District Court for Alaska issued a memorandum decision in a lawsuit challenging the listing of Arctic ringed seals under the ESA (Alaska Oil and Gas Association v. NMFS, Case No. 4:14-cv-00029-RRB). The decision vacated NMFS's listing of the Arctic ringed seals as a threatened species. NMFS has appealed that decision. While the appeal is pending, our biological opinions will continue to address effects to Arctic ringed seals so that action agencies have the benefit of NMFS's analysis of the consequences of the proposed action on the species, even though the listing is not in effect.

novaeangliae), blue (*Balaenoptera musculus*), North Pacific right (*Eubalaene japonica*), sperm (*Physeter microcephalus*), and western North Pacific gray (*Eschrichtius robustus*)whales, western Distinct Population Segment (DPS) Steller sea lions, bearded (*Erignathus barbatus nauticus*) and Arctic ringed (*Phoca hispida hispida*) seals, Steller sea lion critical habitat and North Pacific right whale critical habitat. We concur with the action agencies' determinations that this action is not likely to adversely affect the following species or critical habitats: blue, North Pacific right, sperm, and western North Pacific gray whales, western DPS Steller sea lions, North Pacific right whale critical habitat, and Steller sea lion critical habitat (see section 5.1).

This Opinion is based on information provided to us in the January 2016 IHA application and marine mammal monitoring and mitigation plan (Owl Ridge 2016a), biological assessment (Owl Ridge 2016b), and proposed IHA (81 FR 17666); updated project proposals, emails and telephone conversations between NMFS Alaska Region and NMFS Permits Division staff and the Corps' designated non-Federal representative (Owl Ridge Natural Resource Consultants, Inc. [Owl Ridge]); and other sources of information. A complete record of this consultation is on file at NMFS's field office in Anchorage, Alaska.

1.2 Consultation History

Our communication with the Permits Division and the Corps' designated non-Federal representative (Owl Ridge) regarding this consultation is summarized as follows:

- **February 10, 2016:** received a section 7 consultation initiation request from the Permits Division in a package that included Owl Ridge's IHA application and marine mammal monitoring and mitigation plan.
- **February 17, 2016:** received the Corps' biological assessment, prepared by Owl Ridge.
- **February 24, 2016:** provided comments to the Permits Division and Owl Ridge on the IHA application and marine mammal monitoring and mitigation plan.
- **March 1, 2016:** requested the Corps make effects determinations, and provide the rationale for those determinations, for all ESA-listed species that may occur in the action area.
- **March 11, 2016:** received, from Owl Ridge, a revised biological assessment with effects determinations for all ESA-listed species that may occur in the action area and received, from the Permits Division, a revised IHA application and draft proposed IHA.
- **March 17, 2016**: provided a draft Description of the Action to Owl Ridge for review and comments.
- **March 18, 2016**: provided draft Terms and Conditions to Owl Ridge for review and provided comments on the draft proposed IHA to the Permits Division.
- **March 18 to April 4, 2016**: requested and received from Owl Ridge, on many dates, revisions and comments on and supplementary information pertaining to the draft Description of the Action.
- **March 21, 2016**: received, from the Permits Division, the final proposed IHA.

2 DESCRIPTION OF THE ACTION

The proposed action for this consultation consists of two related components:

1. the proposed issuance of Corps permit POA-2015-529 to Quintillion to install a subsea fiber optic cable network along the northern and western coasts of Alaska in the Bering, Chukchi, and Beaufort Seas; and

2. the Permits Division's proposed issuance of an IHA for harassment of marine mammals incidental to the cable-laying activities.

Unless otherwise noted, all figures, tables and text describing this action are from the NMFS Biological Assessment for this action (NMFS 2016).

2.1 Quintillion's Subsea Fiber Optic Cable Network Project

Quintillion proposes to install a subsea fiber optic cable network along the northern and western coasts of Alaska to provide high speed internet connectivity to six rural Alaska communities. The subsea fiber optic cable network will link with an existing North Slope terrestrial-based fiber optic line.

The proposed network will consist of 1,904 km (1,183 mi) of subsea fiber optic cable, including a main trunk line and six branch lines to onshore facilities in Nome, Kotzebue, Point Hope, Wainwright, Barrow, and Oliktok Point (Figure 1).

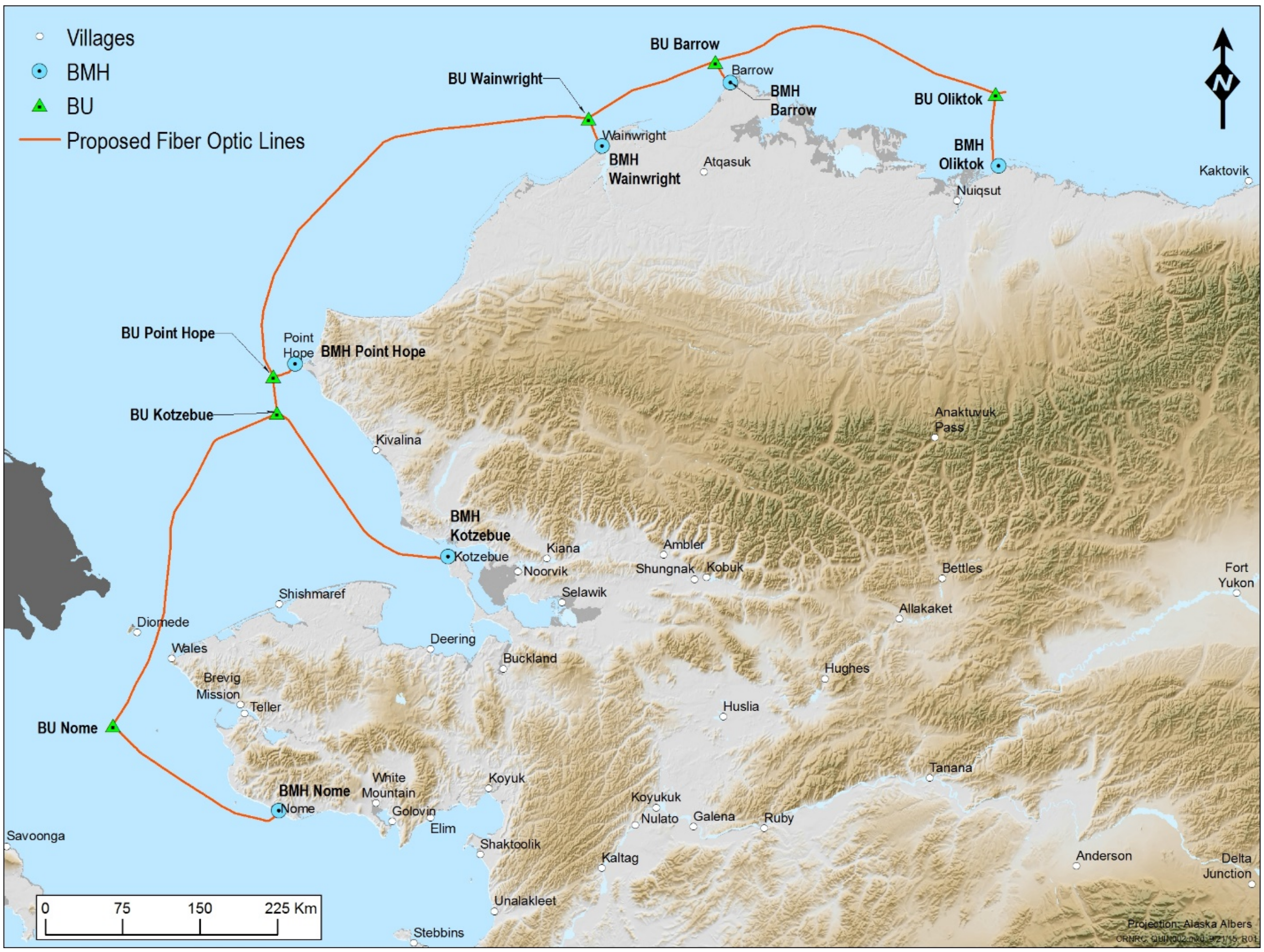

Figure 1. Quintillion's proposed subsea fiber optic cable network, Bering, Chukchi, and Beaufort Seas, Alaska.

The main trunk line will be 1,317 km (818 mi) in length, and will extend from the Nome branch line (shown as BU Nome on Figure 1) to the Oliktok Point branch line (shown as BU Oliktok on Figure 1). The lengths of the six branch lines are shown in Table 1.

Table 1. Lengths of Quintillion's proposed subsea fiber optic cable network segments, Bering, Chukchi, and Beaufort Seas, Alaska.

Network Segment	Length (km)
Main	1,317
Branch Lines	
Nome	195
Kotzebue	233
Point Hope	27
Wainwright	31
Barrow	27
Oliktok	74
TOTAL	**1,904**

Branching lines will connect to the main trunk line at the branching unit (BU), a piece of hardware that will allow the interconnection of the branching cable from the main trunk line to the shore-end facility. The cable signal will be amplified through the use of repeaters attached to the cable approximately every 60 km (37 mi). Collectively, the cable, BUs, and repeaters make up the "submerged plant". Depending on bottom substrate, water depth, and distance from shore, the cable will either be laid on the ocean floor or will be buried using a plough or a remotely operated vehicle (ROV) water jet.

Once the cable reaches the shore, it will pass through a horizontal directional drilled (HDD) conduit leading to a beach man hole (BMH), where the cable will be anchored and transitioned to a terrestrial cable. From the BMH, the terrestrial fiber optic cable will be routed underground in established rights-of-way (ROWs) to a local communications provider. The 14-cm (5-in) conduits will be installed using HDD and trenching (where necessary) along the terrestrial route. HDD will be conducted at all five villages and Oliktok Point. The HDD rig and entry holes will be located 40 to 444 m (130 to 1,458 ft) inshore, depending on location. HDD exit holes will be located 184 to 1,700 m (603 to 5,557 ft) offshore, depending on location, and will be located up to 27 m (90 ft) below the seafloor. During HDD operation, the borehole will be lubricated with drilling mud consisting primarily of water and bentonite (a naturally-occurring clay), and may also contain other nontoxic additives such as sawdust, nut shells, bentonite pellets, or other commercially available nontoxic products. After the trench is dug, the conduit will be placed, and the trench will be backfilled in lifts with side-cast material.

Transit to the project area from the staging area (i.e., Dutch Harbor) is also considered part of the action.

Details about specific project components are provided in the following sections.

2.1.1 Dates and Duration

The proposed subsea cable-laying operation is scheduled for the 2016 open-water season (June 1 to October 31). All activities, including mobilization, pre-lay grapnel run (PLGR), cable-laying, post-lay inspection and burial (PLIB), and demobilization of survey and support crews, would occur within this time period. Operations are currently scheduled to last 110 days, but activities may last all season. Upon arrival to the project area, operations will begin in Nome and continue northward (i.e., operations will follow sea ice as it retreats).

Cable-laying activities are expected to last the entire season; however, not all cable-lay vessels will be operational continuously. During the season, the *Ile de Brehat* will lay cable for approximately 70 days, *Ile de Sein* for 56 days, *CB Networ*ker for 20 days, and the small nearshore barge for 84 days. Once cable-laying activities begin, operations will continue 24 hours a day until the end of cable section is reached.

2.1.2 Vessels

In offshore waters of depths greater than 12 m (39 ft), cable-lay operations will be conducted from the *Ile de Brehat* (Figure 2) and its sister ship, the *Ile de Sein*. Both ships are 140 m (460 ft) in length and 23 m (77 ft) in breadth, with berths for a crew of 70. The ships are propelled by two 4,000-kilowatt (kW) fixed-pitch propellers. Dynamic positioning is maintained by two 1,500-kW bow thrusters, two 1,500-kW aft thrusters, and one 1,500-kW fore thruster. During cable-lay activities, the ships will move slowly (i.e., approximately 0.8 km/hr [0.4 knots (kts)]). During transit, maximum speed for the ships will be 27.8 km/hr (15 kts).

Figure 2. The *Ile de Brehat*, a cable-laying ship proposed for use in Quintillion's subsea fiber optic cable network project, Bering, Chukchi, and Beaufort Seas, Alaska.

Support vessels will include a tug and barge that will be primarily used for nearshore operations on the branch lines. During cable-laying activities in nearshore waters that are too shallow for the *Ile de Brehat* or *Ile de Sein* to operate (i.e., in water depths less than 12 m), a cable-lay barge supported by one or two utility tugs will lay the shore ends of the cable. The cable-lay barge will move very slowly (i.e., approximately 1.6 km [1.0 mi] per day) by winching along anchor lines. The anchors will be continually maneuvered by small (i.e., less than 3,000-horsepower [hp]) utility tugs.

Due to hard seafloor conditions, the *CB Networker*, a 60-m (197-ft) powered barge (Figure 3), will be used to lay the branch line to Oliktok. The *CB Networker* will move along the cable route using a combination of anchor-cable winching, three 1,000-kW main engines, and four 420-kW thrusters. During cable-lay activities, the *CB Networker* will move very slowly (i.e., cable will be laid at a rate of 1.6 km [1.0 mi] per day). During transit the barge will be pulled by the tugs at a maximum speed of 18.5 km/hr (10 kts).

Figure 3. The *CB Networker*, a cable-laying barge proposed for use in Quintillion's subsea fiber optic cable network project, Bering, Chukchi, and Beaufort Seas, Alaska.

Project staging will occur in Dutch Harbor, Unalaska, Alaska.

2.1.3 Pre-lay Grapnel Run

Before cable is laid, a PLGR will be conducted along 730 km (454 mi) of the proposed cable route where cable burial will be required. The objective of the PLGR operation is the identification and clearance of any seabed debris (i.e., wires, hawsers, wrecks, or fishing gear) which may have been deposited along the route. A small tug or contracted fishing boat will tow the grapnel by a rope, thus dragging the grapnel along the seafloor and keeping the rope taut at all times. The maximum grapnel width will be approximately 1 m (3 ft), and will be dragged at a tow speed of approximately 2 km/hr (1 kt). The grapnel will be brought aboard to check for debris approximately every 10 km during the PLGR. Approximately 0.73 km^2 (0.28 mi^2), total, of seafloor will be disturbed during the PLGR. Recovered debris will be discharged ashore on completion of the operations and disposed of in accordance with local regulations. If debris cannot be recovered, then a local reroute will be planned to avoid the debris.

2.1.4 Offshore Cable Lay

The objective of the offshore surface cable-lay operation will be to install the cable as close as possible to the planned route while simultaneously allowing slack cable, free of loops and suspensions, to conform to the contours of the seabed. A slack plan will be developed that uses direct bathymetric data and a catenary modeling system to control the ship and the cable pay out speeds to ensure the cable is accurately placed in its planned physical position.

All cable routes south of Bering Strait will be buried to avoid conflict with existing or future commercial fisheries. North of the Bering Strait, cable will be buried in all waters with depths less than 50 m (164 ft) to ensure protection from ice scour. Approximately 730 km (454 mi) of the proposed cable route will be buried. Cable burial methods will be dependent on water depth and seabed conditions. In water depths greater than approximately 12 m (40 ft) cable will be buried using a heavy duty SMD HD3 Plough (Figure 4). The plough has a submerged weight of 25 tonnes (27.6 tons) and will be pulled by tow wire. Cable will be fed through a depressor which, in turn, will push the cable into the trench. Burial depth will be controlled by adjusting the front skids and average burial depth will be approximately 1.5 m (5 ft). The normal tow speed will be approximately 0.8 km/hr (0.4 kts).

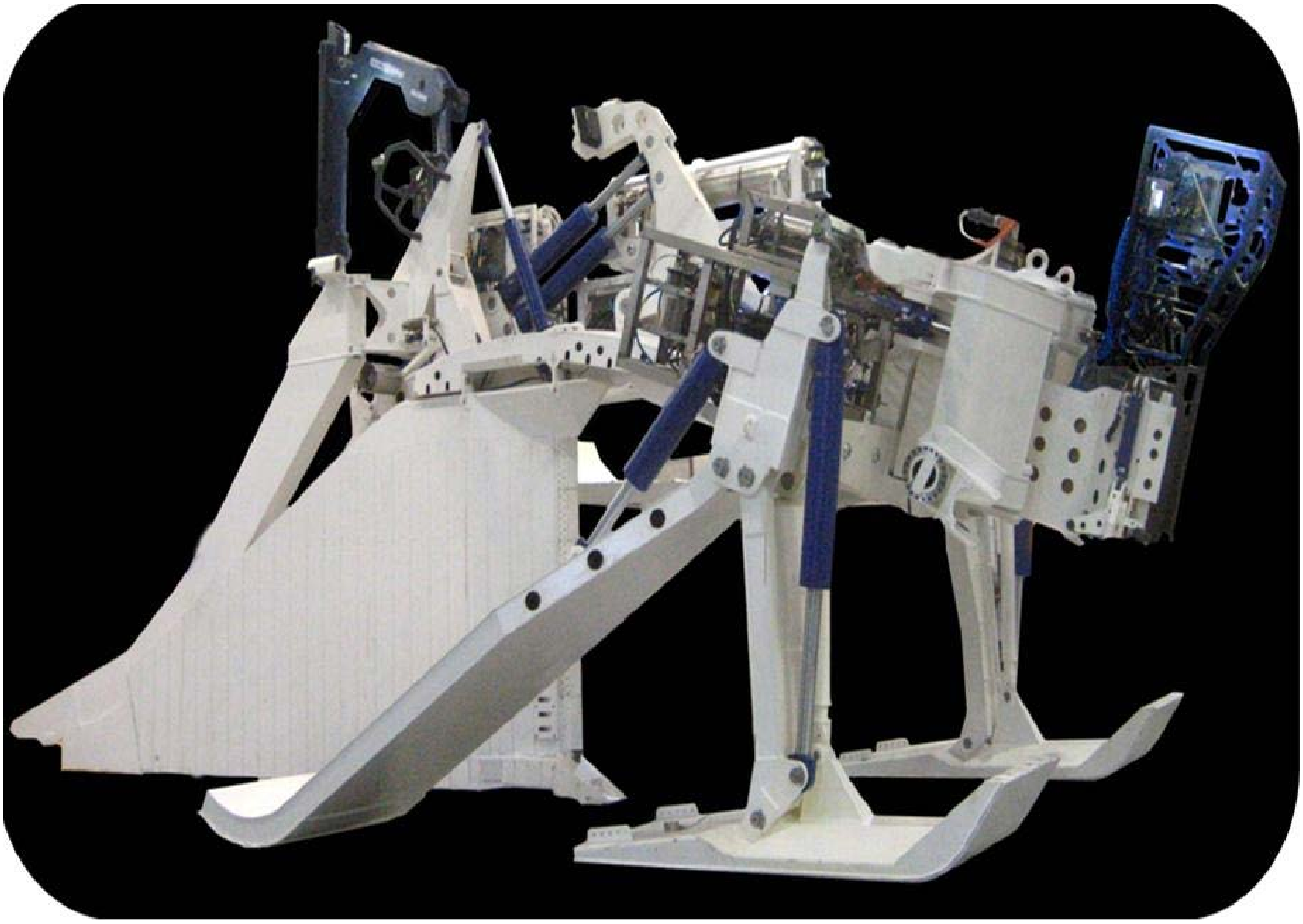

Figure 4. An SMD HD3 plough, a heavy duty subsea plow proposed for use in Quintillion's subsea fiber optic cable network project, Bering, Chukchi, and Beaufort Seas, Alaska.

In water depths less than 12 m (40 ft), cable burial will be by jet burial using a tracked remotely operated underwater vehicle (ROV). The ROV will be used in areas inaccessible to the main cable-lay vessel. The ROV will likely be a ROVJET 400 series (Figure 5), or similar. The ROVJET is 5.8 m (19.0 ft) in length, 3.4 m (11.2 ft) in width, and weighs 9,100 kg (20,062 lbs). The main and forward jet tools are capable of trenching up to 2.0 m (6.6 ft) into the seafloor.

Figure 5. A 400 series ROVJET, an ROV proposed for use in Quintillion's subsea fiber optic cable network project, Bering, Chukchi, and Beaufort Seas, Alaska.

Approximately 374,199 cubic meters (m^3 [467,749 cubic yard (yd^3)]) of seafloor will be side-cast and replaced over an area of approximately 11.9 hectares (ha [29.47 acres (ac)]).

In nearshore areas where seasonal ice scouring is a concern, subsea cables will be connected to the terrestrial cables via HDD conduit. A messenger line will be run from the terrestrial end of the HDD conduit to the marine end. The barge-end of the fiber optic cable will be attached to the messenger line and pulled back (i.e., landward) through the conduit to the BMH where it will be anchored. The small cable-lay barge, using the ROV, will then lay cable to the 15-m (49-ft) isobath, at which point the larger cable-lay ship (i.e., the *Ile de Brehat* or *Sein*) will pick up the cable and continue cable-laying operations in the offshore portion of the route.

For cable-lay operations in the hard seafloor from Oliktok Point to Oliktok BU, cable will be laid by the *CB Networker* in water depths greater than 3 m (10 ft). Cable will be laid using *CB Networker*'s vertical injector, a high-pressure water nozzle that simultaneously trenches and lays cable. Average burial depth will be approximately 1.5 m (5 ft). The small nearshore barge will be used to lay cable along the Oliktok section in water depths less than 3m.

Because it will not be feasible to bury the BUs, a maximum of four 6 m x 3 m (19.6 ft x 9.8 ft) concrete mattresses will be placed at each BU to protect them from ice scouring. In addition, one mattress will be placed at either end of the mainline where a stubbed-off cable[3] will extend slightly beyond the Nome and Oliktok Point BUs. Approximately 428 m^2 (4,610 ft^2) of seafloor, total, will be covered by 26 mattresses.

2.1.5 Offshore Post-lay Inspection and Burial

To ensure cable splices and BUs are fully buried and no plough skips occurred at locations where burial is critical, a PLIB will be conducted using the ROV (described in Section 2.1.4 of this Opinion). Quintillion estimates that PLIB will be necessary along 10 km (6.2 mi), total, of the proposed cable route.

2.1.6 Other Equipment

Table 2 (page 16) shows the type and acoustic characteristics of the additional equipment proposed for use during the project.

The Kongsberg Simrad EA 500 and Skipper GDS 101 (operating a frequency of 50 kHz) single-beam echosounders will be used in deep waters and the Skipper GDS 101 (operating a frequency of 200 kHz) will be used in nearshore areas.

[3] Leaving stubbed-off cables on either end of the mainline will allow for expansion of the network during potential future phases of cable-lay operations.

Table 2. Type and acoustic characteristics of equipment proposed for use during Quintillion's subsea fiber optic cable network project, Bering, Chukchi, and Beaufort Seas, Alaska.

Equipment	Manufacturer and Model	Operating Frequency (kHz)	Beamwidth (degrees) Horizontal	Beamwidth (degrees) Vertical	Source Level (dB re 1 μPa$_{rms}$ at 1 m)	Maximum Pulse Rate (Hz)	Mount Location
Single-beam echosounder	Kongsberg Simrad EA 500	12	50 (conical)		185	100	Hull
		50	30 (conical)		154	5	Hull
	Skipper GDS 101	200	6 (conical)		154	Not provided	Hull
Obstacle avoidance sonar	Kongsberg Mesotech MS 1171	300 to 400	2.7	30	Not provided	25	Plough
		450 to 700	1.4	40	Not provided	25	Plough
	Tritech Super SeaKing DFS	325	1.5	40	210	24	ROV
		675	3.0	20	210	24	ROV
	Blueview M900-130-D-BR	900	1.0	20	Not provided	Not provided	ROV/Plough
Acoustic positioning beacons	Sonardyne type WUMTM-8190 6G/Applied Acoustic type 900	19.23 to 33.75	120 (conical)		187	Not provided	ROV/Plough
Altimeter	Tritech PA500:6-S	500	6 (conical)		197	10	ROV

2.1.7 Mitigation and Minimization Measures

The following measures will be incorporated by Quintillion to minimize potential impacts from project activities:

- Quintillion will avoid vessel strikes of marine mammals during pre- and post-cable laying activities (i.e., during transit) by:
  - Transiting around the Bering Sea critical habitat unit established for the protection of North Pacific right whales.
  - Avoiding concentrations or groups of whales/sea lions by maneuvering around them.
  - Taking reasonable precautions to avoid potential interaction with all marine mammals observed within 1.6 km (1 mi) of a vessel.
  - Reducing speed to less than 9.3 km/hr (5 kts) when weather conditions require, such as when visibility drops, to avoid the likelihood of collision with whales.
- Each cable-lay vessel will have International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL) Annex VI and U.S. Coast Guard approved shipboard oil pollution emergency plans (SOPEPs). The SOPEPs provide ship captains with specific measures to avoid or limit spill during fueling operations, pipe leakage, hull leakage, machinery leakage, cleanup, and accident (e.g., collision, fire, and grounding).
- Each vessel will be fully equipped with the MARPOL-required pollution control equipment including scupper plugs, detergent, sand, sawdust, oil booms, and oil absorbent rolls, sheets, and pillows.

2.1.8 Marine Mammal Monitoring and Mitigation Plan

Quintillion developed a marine mammal monitoring and mitigation plan as a part of its IHA application (Owl Ridge 2016a). The plan includes:

- Vessel-based protected species observers (PSOs)
- Sound source verification (SSV)
- Passive acoustic monitoring (PAM)

The following list provides additional details about each of these elements of the plan:[4]

1. PSOs
   1.1. Vessel-based monitoring for marine mammals would be done by trained PSOs throughout the period of subsea cable-laying operation. The observers would monitor the occurrence of marine mammals near the cable-laying vessel during all daylight periods during operation. PSO duties would include watching for and identifying marine mammals; recording their numbers, distances, and reactions to the survey operations; and documenting "take by harassment."
2. SSV
   2.1. Quintillion plans to conduct SSV on thrusters on one of the cable-lay ships (i.e., the *Ile de Brehat* or *Sein*), a nearshore barge during winching along anchor lines, and the associated tugs during anchor-handling when all are operating near Nome (i.e., at the beginning of operations). An acoustical firm specializing in conducting SSVs has not been contracted yet, but the method used will follow current NMFS standards for conducing SSVs, and will be subject to approval by NMFS and USFWS.

[4] Please refer to the Marine Mammal Monitoring and Mitigation Plan, an appendix in both the IHA application (Owl Ridge 2016a) and biological assessment (Owl Ridge 2016b), for additional details about the PAM program.

3. PAM
    3.1. In lieu of deploying their own PAM equipment, Quintillion will provide funding to the 2016 joint Arctic Whale Ecology Study (ARCWEST)/Chukchi Acoustics, Oceanography, and Zooplankton Study-extension (CHAOZ-X).[5]
        3.1.1. The funding will be used to create an additional staff position, allowing the operation of three additional PAM stations and subsequent analysis of data.
        3.1.2. Quintillion will also provide real-time tracking data on cable-lay vessel movements such that Quintillion's activities can be specifically monitored as they pass PAM stations and, therefore, reported separately in 2016 field reports.

2.2 Incidental Harassment Authorization

The Permits Division proposes to issue an IHA for non-lethal "takes"[6] of marine mammals by Level B harassment (as defined by the MMPA) incidental to Quintillion's proposed action (81 FR 17666). When issued, the IHA will be valid from June 1, 2016, to October 31, 2016, and will authorize the incidental harassment of three ESA-listed whale and two ESA-listed seal species, as well as five non-ESA-listed whale and seal species. Table 3 shows the amount of proposed take for the five ESA-listed species in the proposed IHA.[7] Section 7.2 of this Opinion contains more information about the methods used to calculate these take numbers.

Table 3. Amount of proposed incidental harassment (takes) of ESA-listed species in the proposed IHA (81 FR 17666).

Common Name	Scientific Name	Proposed MMPA-authorized Takes
Bowhead whale	*Balaena mysticetus*	130
Humpback whale	*Megaptera novaeangliae*	15[8]
Fin whale	*Balaenoptera physalus*	15
Arctic ringed seal	*Phoca hispida hispida*	992
Bearded seal	*Erignathus barbatus nauticus*	475

The proposed IHA includes the following mitigation, monitoring, and reporting requirements applicable to ESA-listed species:

1. Establishing disturbance zones
    1.1. Establish a zone of influence (ZOI) surrounding the cable-laying vessel where the received level would be 120 dB re 1 μPa_{rms}.

[5] The joint ARCWEST/CHAOZ-X program has been monitoring climate change and anthropogenic activity in the Arctic waters of Alaska since 2010 by tracking satellite tagged animals, sampling lower trophic levels and physical oceanography, and passively acoustically monitoring marine mammal and vessel activity.

[6] The MMPA defines "harassment" as "any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild" (referred to as Level A harassment) or "has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering" (referred to as Level B harassment). 16 U.S.C. 1362(18)(A) and (B). For the purposes of this consultation, NMFS considers that a take by "harassment" occurs when an animal is exposed to certain sound levels described below in Section 7 of this Opinion.

[7] Please see proposed IHA (81 FR 17666) for MMPA-authorized takes of marine mammal species not listed under the ESA.

[8] The proposed IHA (81 FR 17666) indicated a requested take of 15 humpbacks from each of two populations, the western North Pacific and central North Pacific stocks. However, while the applicant calculated the percentage of each stock that would be taken in the event that their 15 requested takes came from one or the other population, their total requested take remained 15 humpback whales, not 30 as indicated in 81 FR 17666 (Greg Green, Owl Ridge, pers. comm. 5/11/2016).

1.1.1. The estimated radius of the 120 dB re 1 μPa_{rms} isopleth is 2.3 km.[9]

1.2. Immediately upon completion of data analysis of the SSV, the new 120 dB re 1 μPa_{rms} ZOI will be established based on the results.

2. Vessel movement mitigation
   2.1. When the cable-lay fleet is traveling in Alaskan waters to and from the project area (before and after completion of cable-laying), the fleet vessels will follow the measures outlined in Section 2.1.7 of this Opinion.
3. Mitigation measures for subsistence activities:
   3.1. A number of measures will be required to reduce or eliminate conflicts between subsistence whaling activities and Quintillion's proposed activities, including:
      3.1.1. Vessels transiting in the Beaufort Sea east of Bullen Point to the Canadian border will remain at least 8 km (5 mi) offshore during transit along the coast, provided ice and sea conditions allow. During transit in the Chukchi Sea, vessels will remain as far offshore as weather and ice conditions allow, and at all times at least 8 km offshore.
      3.1.2. From August 31 to October 31, transiting vessels in the Chukchi Sea or Beaufort Sea will remain at least 32 km (20 mi) offshore of the coast of Alaska from Icy Cape in the Chukchi Sea to Pitt Point on the east side of Smith Bay in the Beaufort Sea, unless ice conditions or an emergency that threatens the safety of the vessel or crew prevents compliance with this requirement. This condition will not apply to vessels actively engaged in transit to or from a coastal community to conduct crew changes or logistical support operations.
      3.1.3. Vessels will be operated at speeds necessary to ensure no physical contact with whales occurs, and to make any other potential conflicts with bowheads or whalers unlikely. Vessel speeds will be less than 18.5 km/hr (10 kts) when within 1.6 km (1 mi) of feeding whales or whale aggregations (6 or more whales in a group).
      3.1.4. If any vessel inadvertently approaches within 1.6 km of observed bowhead whales, except when providing emergency assistance to whalers or in other emergency situations, the vessel operator will take reasonable precautions to avoid potential interaction with the bowhead whales by taking one or more of the following actions, as appropriate:
         3.1.4.1. Reducing vessel speed to less than 9.3 km/hr (5 kts) within 274 m (900 ft) of the whale(s);
         3.1.4.2. Steering around the whale(s) if possible;
         3.1.4.3. Operating the vessel(s) in such a way as to avoid separating members of a group of whales from other members of the group;
         3.1.4.4. Operating the vessel(s) to avoid causing a whale to make multiple changes in direction; and
         3.1.4.5. Checking the waters immediately adjacent to the vessel(s) to ensure that no whales will be injured when the propellers are engaged.
      3.1.5. Quintillion will complete operations in time to ensure that vessels associated with the project complete transit through the Bering Strait to a point south of 59°N latitude no later than November 15, 2016. Any vessel that encounters weather or ice that will prevent compliance with this date shall coordinate its transit through the Bering Strait to a point south of 59°N latitude with the appropriate communications centers. Quintillion vessels will, weather and ice permitting, transit east of St. Lawrence Island and no closer than 16 km (10 mi) from the shore of St. Lawrence Island.

[9] See Section 7.1.2.3 of this Opinion for additional details about how the size of this zone was determined.

4. Monitoring:
    4.1. Vessel-based visual monitoring:
        4.1.1. Vessel-based visual monitoring for marine mammals will be conducted by NMFS-approved PSOs throughout the period of survey activities.
        4.1.2. PSOs will be stationed aboard the cable-laying ships and the Oliktok cable-laying barge through the duration of the subsea cable-laying operation.
            4.1.2.1. PSOs will not be aboard the smaller barge in waters of depths less than 12 m.
        4.1.3. A sufficient number of PSOs shall be onboard the survey vessel to meet the following criteria:
            4.1.3.1. 100% monitoring coverage during all periods of cable-laying operations in daylight;
            4.1.3.2. Maximum of 4 consecutive hours on watch per PSO, with a minimum 1-hour break between shifts; and
            4.1.3.3. Maximum of 12 hours of watch time in any 24-hour period per PSO.
    4.2. PSOs and training
        4.2.1. PSO teams will consist of Inupiat observers capable of carrying out requirements of the IHA and NMFS-approved field biologists.
        4.2.2. Experienced field crew leaders will supervise the PSO teams in the field. New PSOs will be paired with experienced observers to avoid situations where lack of experience impairs the quality of observations.
        4.2.3. Crew leaders and most other biologists serving as observers in 2016 will be individuals with experience as observers during recent marine mammal monitoring projects in Alaska, the Canadian Beaufort, or other offshore areas in recent years.
        4.2.4. Resumes for PSO candidates will be provided to the Permits Division for review and acceptance of their qualifications. Inupiat observers will be experienced (as hunters or have previous PSO experience) in the region and familiar with the marine mammals of the area.
        4.2.5. All PSOs will complete an observer training course designed to familiarize individuals with monitoring and data collection procedures. The training course will be completed before the anticipated start of the 2016 open-water season. The training session(s) will be conducted by qualified marine mammalogists with extensive crew-leader experience during previous vessel-based monitoring programs.
        4.2.6. Training for both Alaska native PSOs and biologist PSOs will be conducted at the same time in the same room. There will not be separate training courses for the different PSOs.
        4.2.7. Crew members should not be used as primary PSOs because they have other duties and generally do not have the same level of expertise, experience, or training as PSOs.
        4.2.8. If crew members are to be used in addition to PSOs, they will go through some basic training consistent with the functions they will be asked to perform. The best approach would be for crew members and PSOs to go through the same training together.
        4.2.9. PSOs will be trained using visual aids (e.g., videos, photos), to help them identify the species that they are likely to encounter in the conditions under which the animals will likely be seen.
        4.2.10. Quintillion will train its PSOs to follow a scanning schedule that consistently distributes scanning effort appropriate for each type of activity being monitored. All PSOs should follow the same schedule to ensure consistency in their scanning efforts.

4.2.11. PSOs will be trained in documenting the behaviors of marine mammals. PSOs should record the primary behavioral state (i.e., traveling, socializing, feeding, resting, approaching or moving away from vessels) and relative location of the observed marine mammals.

4.3. Marine mammal observation protocol

4.3.1. PSOs will watch for marine mammals from the best available vantage point on the survey vessels, typically the bridge.

4.3.2. PSOs will scan systematically with the unaided eye and 7 x 50 reticle binoculars, and night-vision equipment when needed.

4.3.3. Personnel on the bridge will assist the PSOs in watching for marine mammals; however, bridge crew observations will not be used in lieu of PSO observation efforts.

4.3.4. Monitoring will consist of recording of the following information:

4.3.4.1. The species, group size, age/size/sex categories (if determinable), the general behavioral activity, heading (if consistent), bearing and distance from vessel, sighting cue, behavioral pace, and apparent reaction of all marine mammals seen near the vessel (e.g., none, avoidance, approach, paralleling, etc.);

4.3.4.2. The time, location, heading, speed, and activity of the vessel, along with sea state, visibility, cloud cover and sun glare:

4.3.4.2.1. Any time a marine mammal is sighted

4.3.4.2.2. At the start and end of each watch

4.3.4.2.3. During a watch (whenever there is a change in one or more variable)

4.3.4.3. The identification of all vessels that are visible within 5 km (3.1 mi) of the vessel from which observation is conducted whenever a marine mammal is sighted and the time observed;

4.3.4.4. Any identifiable marine mammal behavioral response (sighting data should be collected in a manner that will not detract from the PSO's ability to detect marine mammals);

4.3.4.5. Any adjustments made to operating procedures; and

4.3.4.6. Visibility during observation periods so that total estimates of take can be corrected accordingly.

4.3.5. Distances to nearby marine mammals will be estimated with binoculars (7 x 50 binoculars) containing a reticle to measure the vertical angle of the line of sight to the animal relative to the horizon. Observers may use a laser rangefinder to test and improve their abilities for visually estimating distances to objects in the water.

4.3.6. PSOs will understand the importance of classifying marine mammals as "unknown" or "unidentified" if they cannot identify the animals to species with confidence. In those cases, they will note any information that might aid in the identification of the marine mammal sighted. For example, for an unidentified mysticete whale, the observers should record whether the animal had a dorsal fin.

4.3.7. Additional details about unidentified marine mammal sightings, such as "blow only," mysticete with (or without) a dorsal fin, "seal splash," etc., will be recorded.

4.3.8. Quintillion will use the best available technology to improve detection capability during periods of fog and other types of inclement weather. Such technology might include night-vision goggles or binoculars as well as other instruments that incorporate infrared technology.

4.4. Field data-recording and verification

- 4.4.1. PSOs will utilize a standardized format to record all marine mammal observations.
- 4.4.2. Information collected during marine mammal observations will include the following:
  - 4.4.2.1. Vessel speed, position, and activity
  - 4.4.2.2. Date, time, and location of each marine mammal sighting
  - 4.4.2.3. Marine mammal information under Item 4.3.4 of this list.
  - 4.4.2.4. Observer's name and contact information
  - 4.4.2.5. Weather, visibility, and ice conditions at the time of observation
  - 4.4.2.6. Estimated distance of marine mammals at closest approach
  - 4.4.2.7. Activity at the time of observation, including possible attractants present
  - 4.4.2.8. Animal behavior
  - 4.4.2.9. Description of the encounter
  - 4.4.2.10. Duration of encounter
  - 4.4.2.11. Mitigation action taken
- 4.4.3. Data will be recorded directly into handheld computers or as a back-up, transferred from hard-copy data sheets into an electronic database.
- 4.4.4. A system for quality control and verification of data will be facilitated by the pre-season training, supervision by the lead PSOs, and in-season data checks, and will be built into the software.
- 4.4.5. Computerized data validity checks will also be conducted, and the data will be managed in such a way that it is easily summarized during and after the field program and transferred into statistical, graphical, or other programs for further processing.

4.5. PAM

- 4.5.1. Sound source measurements:
  - 4.5.1.1. Using a hydrophone system, Quintillion is required to conduct SSV test for the dynamic positioning thrusters of the cable-laying vessel early in the season.
  - 4.5.1.2. The test results shall be reported to NMFS within 5 days of completing the test.
- 4.5.2. Marine mammal PAM
  - 4.5.2.1. Quintillion will support the 2016 ARCWEST/CHAOZ-X program.

5. Reporting:

5.1. SSV report

- 5.1.1. A report on the preliminary results of the SSV measurements, including the measured source level, will be submitted within 14 days after collection of those measurements at the start of the field season. This report will specify the distances of the ZOI that were adopted for the survey.

5.2. Technical report (90-day report)

- 5.2.1. A draft report will be submitted to the Permits Division within 90 days after the end of Quintillion's subsea cable-laying operation in the Bering, Chukchi, and Beaufort seas. The report will describe in detail:
  - 5.2.1.1. Summaries of monitoring effort (e.g., total hours, total distances, and marine mammal distribution through the project period, accounting for sea state and other factors affecting visibility and detectability of marine mammals);
  - 5.2.1.2. Summaries that represent an initial level of interpretation of the efficacy, measurements, and observations, rather than raw data, fully processed analyses, or a summary of operations and important observations;
  - 5.2.1.3. Analyses of the effects of various factors influencing detectability of marine mammals (e.g., sea state, number of observers, and fog/glare);

5.2.1.4. Species composition, occurrence, and distribution of marine mammal sightings, including date, water depth, numbers, age/size/sex categories (if determinable), group sizes, and ice cover;

5.2.1.5. Estimates of uncertainty in all take estimates, with uncertainty expressed by the presentation of confidence limits, a minimum-maximum, posterior probability distribution, or another applicable method, with the exact approach to be selected based on the sampling method and data available; and

5.2.1.6. A clear comparison of authorized takes and the level of actual estimated takes.

5.3. Unauthorized take

5.3.1. In the unanticipated event that survey operations clearly cause the take of a marine mammal in a manner prohibited by IHA, such as a serious injury or mortality (e.g., ship-strike, gear interaction, and/or entanglement), Quintillion will immediately cease cable-laying operations and immediately report the incident to the Permits Division. The report must include the following information:

5.3.1.1. Time, date, and location (latitude/longitude) of the incident;

5.3.1.2. The name and type of vessel involved;

5.3.1.3. The vessel's speed during and leading up to the incident;

5.3.1.4. Description of the incident;

5.3.1.5. Status of all sound source use in the 24 hours preceding the incident;

5.3.1.6. Water depth;

5.3.1.7. Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, and visibility);

5.3.1.8. Description of marine mammal observations in the 24 hours preceding the incident;

5.3.1.9. Species identification or description of the animal(s) involved;

5.3.1.10. The fate of the animal(s); and

5.3.1.11. Photographs or video footage of the animal (if equipment is available).

5.3.2. Activities will not resume until the Permits Division is able to review the circumstances of the prohibited take. NMFS will work with Quintillion to determine what is necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. Quintillion may not resume their activities until notified by the Permits Division via letter, email, or telephone.

5.3.3. In the event that Quintillion discovers an injured or dead marine mammal, and the lead PSO determines that the cause of the injury or death is unknown and the death is relatively recent (i.e., in less than a moderate state of decomposition as described in the next paragraph), Quintillion will immediately report the incident to the Permits Division and the NMFS Alaska Stranding Hotline (1-877-925-7773). The report must include the same information identified in Item 5.3.1 of this list. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with Quintillion to determine whether modifications in the activities are appropriate.

5.3.4. In the event that Quintillion discovers an injured or dead marine mammal, and the lead PSO determines that the injury or death is not associated with or related to the activities authorized in the IHA (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), Quintillion will report the carcass to the Permits Division and NMFS Alaska Stranding Hotline (1-877-925-7773) within 24 hours of the discovery. Quintillion will provide photographs or video footage (if available) or other documentation of the stranded animal to NMFS and the Marine Mammal Stranding Network. Quintillion can continue its operations under such a case.

3 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). For this reason, the action area is typically larger than the project area and extends out to a point where no measurable effects from the proposed action occur. The project is located off the northern and western coasts of Alaska in the Bering, Chukchi, and Beaufort Seas (see Figure 1, page 8). The action area includes the area in which cable-laying activities will take place, a 2.3-km radius around the cable-laying activities,[10] and the transit route to and from Dutch Harbor, Alaska (Figure 6).

Project activities will occur on the shelf regions of the northern Bering, Chukchi, and Beaufort Seas. The portion of the cable network within the northern Bering Sea and the Chukchi Sea, just north of the Bering Strait, will cross seafloor substrate dominated by gravelly muddy sand, muddy sand, and muddy gravel. The main trunk line will also cross mud and sandy mud substrates in the Hope Basin. The cable routes for the remainder of the Chukchi Sea portion of the network will cross primarily gravelly mud, gravelly muddy sand, and mud substrates. The Beaufort Sea section of the network is primarily mud, sandy mud, and gravelly mud. There are no areas dominated by silt, clay, or rock.

[10] See Section 7.1.2.3 of this Opinion for additional details about how this radius was determined.

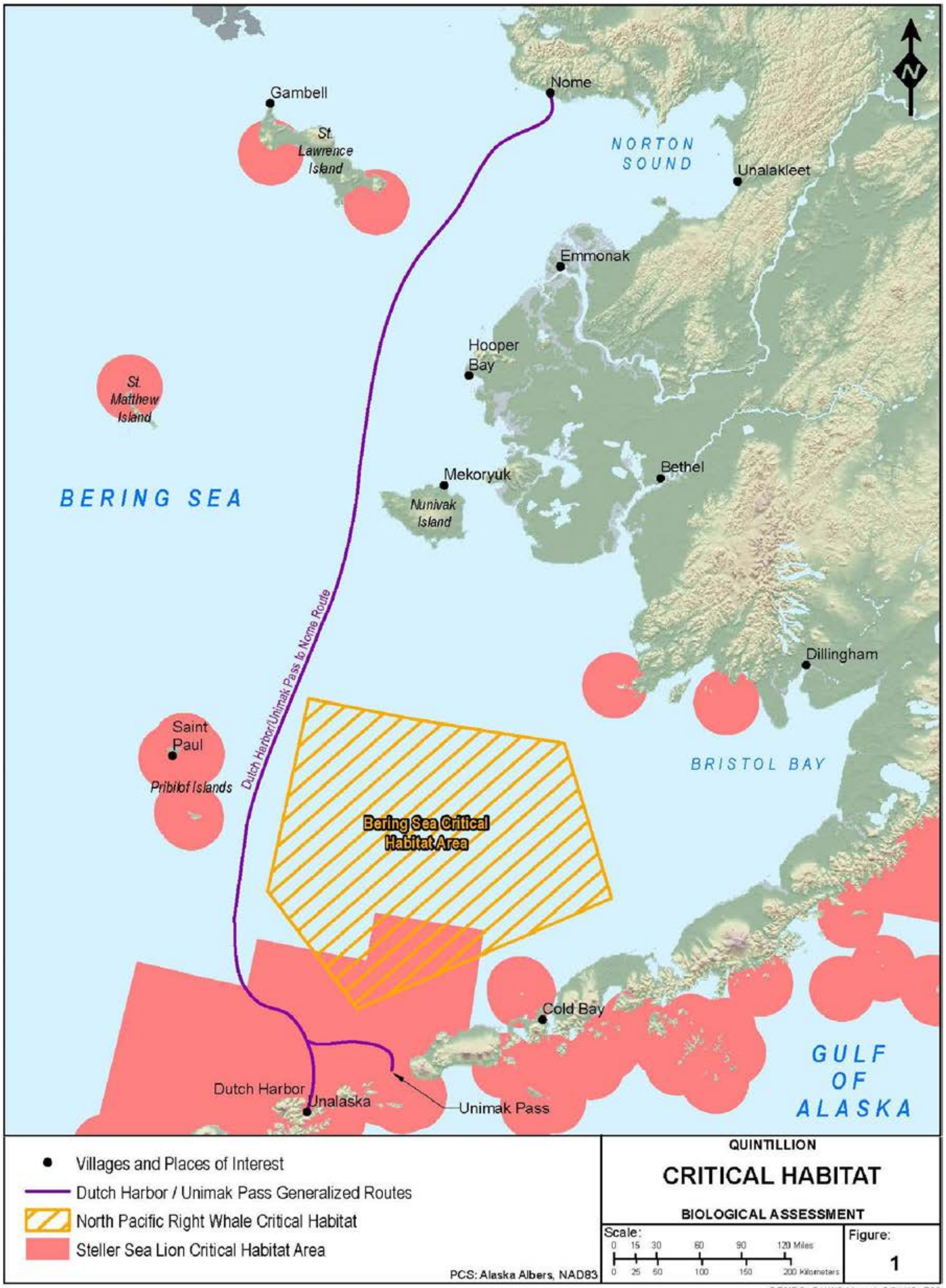

Figure 6. Generalized transit routes to and from Quintillion's project staging area in Dutch Harbor, Alaska, for the proposed subsea fiber optic cable network project in the Bering, Chukchi, and Beaufort Seas, Alaska.

4 Approach to the Assessment

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. The jeopardy analysis considers both survival and recovery of the species. The adverse modification analysis considers the impacts to the conservation value of the designated critical habitat.

"To jeopardize the continued existence of a listed species" means to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). As NMFS explained when it promulgated this definition, NMFS considers the likely impacts to a species' survival as well as likely impacts to its recovery. Further, it is possible that in certain, exceptional circumstances, injury to recovery alone may result in a jeopardy biological opinion (51 FR 19926, 19934).

We used the following approach to determine whether the proposed actions described in Section 2 of this Opinion are likely to jeopardize the continued existence of listed species or destroy or adversely modify critical habitat:

1. We identified the proposed actions and those aspects (or stressors) of the proposed actions that are likely to have direct or indirect effects on the physical, chemical, and biotic environment within the action area, including the spatial and temporal extent of those stressors.
2. We identified the ESA-listed species and designated critical habitat that are likely to co-occur with those stressors in space and time.
3. We described the environmental baseline in the action area including: past and present impacts of Federal, state, or private actions and other human activities in the action area; anticipated impacts of proposed Federal projects that have already undergone formal or early section 7 consultation, impacts of state or private actions that are contemporaneous with the consultation in process.
4. We identified the number, age (or life stage), and sex of ESA-listed individuals that are likely to be exposed to the stressors and the populations or subpopulations to which those individuals belong. This is our exposure analysis.
5. We evaluated the available evidence to determine how those ESA-listed species are likely to respond given their probable exposure. This is our response analyses.
6. We assessed the consequences of these responses to the individuals that may be exposed, the populations those individuals represent, and the species those populations comprise. This is our risk analysis.
7. The adverse modification analysis considered the impacts of the proposed action on the critical habitat features and conservation value of designated critical habitat. This biological opinion relies on the regulatory definition of "destruction or adverse modification", which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features" (50 CFR §402.02).
8. We described any cumulative effects of the proposed action in the action area. Cumulative effects, as defined in our implementing regulations (50 CFR §402.02), are the effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the

action area. Future Federal actions that are unrelated to the proposed action are not considered because they require separate section 7 consultation.

9. We integrated and synthesized the above factors by considering the effects of the actions to the environmental baseline and the cumulative effects to determine whether the actions could reasonably be expected to:
    9.1. Reduce appreciably the likelihood of both survival and recovery of the ESA-listed species in the wild by reducing its numbers, reproduction rate, or distribution; or
    9.2. Reduce the conservation value of designated or proposed critical habitat. These assessments are made in full consideration of the status of the species and critical habitat.
10. We stated our conclusions regarding jeopardy and the destruction or adverse modification of critical habitat.

If, in completing the last step in the analysis, we determine that the action under consultation is likely to jeopardize the continued existence of ESA-listed species or destroy or adversely modify designated critical habitat, we must identify a reasonable and prudent alternative to the action. The reasonable and prudent alternative must not be likely to jeopardize the continued existence of ESA-listed species nor adversely modify their designated critical habitat and it must meet other regulatory requirements.

For all analyses, we used the best available scientific and commercial data. For this consultation, we relied on:

- Information submitted by the Corps and Permits Division, as described in Section 1.1 of this Opinion
- Government reports
- Past reports for similar activities
- General scientific literature

5 STATUS OF THE SPECIES AND CRITICAL HABITAT

Table 4 shows the ESA-listed species and critical habitat that occur in or near the action area.

Table 4. ESA-listed species and critical habitat that occur in or near the action area for Quintillion's subsea fiber optic cable network, Bering, Chukchi, and Beaufort Seas, Alaska.

Common Name	Scientific Name	Population[1]	Status[2]	Critical Habitat FR Notice
Cetaceans				
Blue whale	*Balaenoptera musculus*	N/A	E	N/A
Bowhead whale	*Balaena mysticetus*	N/A	E	N/A
Fin whale	*Balaenoptera physalus*	N/A	E	N/A
Gray whale	*Eschrichtius robustus*	Western North Pacific	E	N/A
Humpback whale	*Megaptera novaeangliae*	N/A	E	N/A
North Pacific right whale	*Eubalaena japonica*	N/A	E	73 FR 19000
Sperm whale	*Physeter microcephalus*	N/A	E	N/A
Pinnipeds				
Bearded seal[3]	*Erignathus barbatus*	Beringia DPS	T	N/A

Common Name	Scientific Name	Population[1]	Status[2]	Critical Habitat FR Notice
	nauticus			
Ringed seal[4]	*Phoca hispida hispida*	Arctic subspecies	T	N/A
Steller sea lion	*Eumetopias jubatus*	Western DPS	E	58 FR 45269

[1] DPS = distinct population segment

[2] Status: E = endangered
T = threatened

[3] As discussed at the beginning of this document, the U.S. District Court for the District of Alaska issued a decision that vacated the threatened status listing on July 25, 2014 (Alaska Oil and Gas Association v. Pritzker, Case No. 4:13-cv-00018-RPB). NMFS has appealed that decision.

[4] As discussed at the beginning of this document, the U.S. District Court for the District of Alaska issued a decision that vacated the threatened status listing on March 17, 2016 (Alaska Oil and Gas Association v. NMFS, Case No. 4:14-cv-00029-RRB). NMFS has appealed that decision.

5.1 Species and Critical Habitats Not Considered Further in this Opinion

If an action's effects on ESA-listed species will be insignificant, discountable, or completely beneficial, we conclude that the action is not likely to adversely affect those species and further analysis is not required. Insignificant effects relate to the size of impact and are those that one would not be able to meaningfully measure, detect, or evaluate, and should never reach the scale where take occurs. Discountable effects are those that are extremely unlikely to occur. Similarly, if proposed activities are not likely to destroy or adversely modify critical habitat, further analysis is not required.

The designations of critical habitat for species that occur in the project's action area use the term primary constituent element (PCE) or essential features. Recent revisions to our critical habitat regulations at 50 CFR §402 (81 FR 7414) replace this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a ''destruction or adverse modification'' analysis, which is the same regardless of whether the original designation identified primary constituent elements, physical or biological features, or essential features. In this Opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

In this section, we describe the species and critical habitats that are not likely to be adversely affected by the proposed action.

5.1.1 Blue, North Pacific Right, Sperm, and Western North Pacific Gray Whales

Though we do not expect blue, North Pacific right, sperm, and western North Pacific gray whales will occur in or near the portions of the action area where cable-lay activities will occur, it is possible these species may be encountered during transit between Dutch Harbor and the fiber optic cable-lay route. Therefore, it is possible the species will be at-risk for vessel strike. However, we expect that it is extremely unlikely that vessels with strike blue, North Pacific right, sperm, and western North Pacific gray whales for the following reasons:

- Few, if any, blue and sperm whales are likely to be encountered because they are generally found in deeper waters than those in which the transit route will occur.
- Few western North Pacific gray whales have been documented outside their feeding areas in waters around Sakhalin Island, Russia.

- The maximum transit speed for any vessel proposed for use is 27.8 km/hr (15 kts).
- The IHA requirements described in Section 2.2 of this Opinion further reduce the likelihood of vessel strike by requiring:
  - Transit around the Bering Sea critical habitat unit for North Pacific right whales
  - Vessels to avoid groups of whales
  - Taking measures to avoid all marine mammals
  - Reducing vessel speed to less than 9.3 km/hr (5 kts) during times of poor visibility

For these reasons, we conclude the possibility of ship strike is discountable. Therefore, blue, North Pacific right, sperm, and western North Pacific gray whales are not likely to be adversely affected by this action, and they are not discussed further in this Opinion.

5.1.2 North Pacific Right Whale Critical Habitat

Critical habitat for the North Pacific right whale was designated in the eastern Bering Sea and in the Gulf of Alaska on April 8, 2008 (73 FR 19000). Project activities will not occur in the Gulf of Alaska and transit will be routed around the Bering Sea critical habitat unit for the North Pacific right whale (see Figure 6, page 25); therefore, no project activities will occur in designated critical habitat.

The PBFs deemed necessary for the conservation of North Pacific right whales include the presence of specific copepods (*Calanus marshallae*, *Neocalanus cristatus*, and *N. plumchris*), and euphausiids (*Thysanoessa raschii*) that act as primary prey items for the species. It is extremely unlikely that project activities (e.g., vessel transit and dynamic positioning) will impact these prey species in any way; therefore, we conclude project impacts to these PBFs are discountable.

We conclude North Pacific right whale critical habitat is not likely to be adversely affected by project activities; therefore, it is not discussed further in this Opinion.

5.1.3 Western DPS Steller Sea Lion

Though we do not expect western DPS Steller sea lions will occur in or near the portions of the action area where cable-lay activities will occur, it is possible they may be encountered during transit between Dutch Harbor and the fiber optic cable-lay route. We expect any western DPS Steller sea lions that are encountered will be foraging individuals as the transit route will not will not pass near enough to landmasses to encounter hauled-out pinnipeds. We expect western DPS Steller sea lions encountered during transit will be able to easily move away from the vessels, making the possibility of ship strike extremely unlikely. Therefore, we conclude that effects from this stressor are discountable and we concur with the determination that western DPS Steller sea lions are not likely to be adversely affected by this action; they are not discussed further in this Opinion.

5.1.4 Steller Sea Lion Critical Habitat

NMFS designated critical habitat for Steller sea lions on August 27, 1993 (58 FR 45269). The following PBFs were identified at the time of listing:

1. Alaska rookeries, haulouts, and associated areas identified at 50 CFR 226.202(a), including:
   1.1. Terrestrial zones that extend 914 m (3,000 ft) landward
   1.2. Air zones that extend 914 m (3,000 ft) above the terrestrial zone
   1.3. Aquatic zones that extend 914 m (3,000 ft) seaward from each major rookery and major haulout east of 144° W. longitude

    1.4. Aquatic zones that extend 37 km (23 mi) seaward from each major rookery and major haulout west of 144° W. longitude
2. Three special aquatic foraging areas identified at 50 CFR 226.202(c):
    2.1. Shelikof Strait
    2.2. Bogoslof
    2.3. Seguam Pass

The transit route between Dutch Harbor and the fiber optic cable-lay route will pass through designated critical habitat surrounding haulouts and rookeries in the Aleutian Islands and through the Bogoslof special aquatic foraging area (Figure 7).

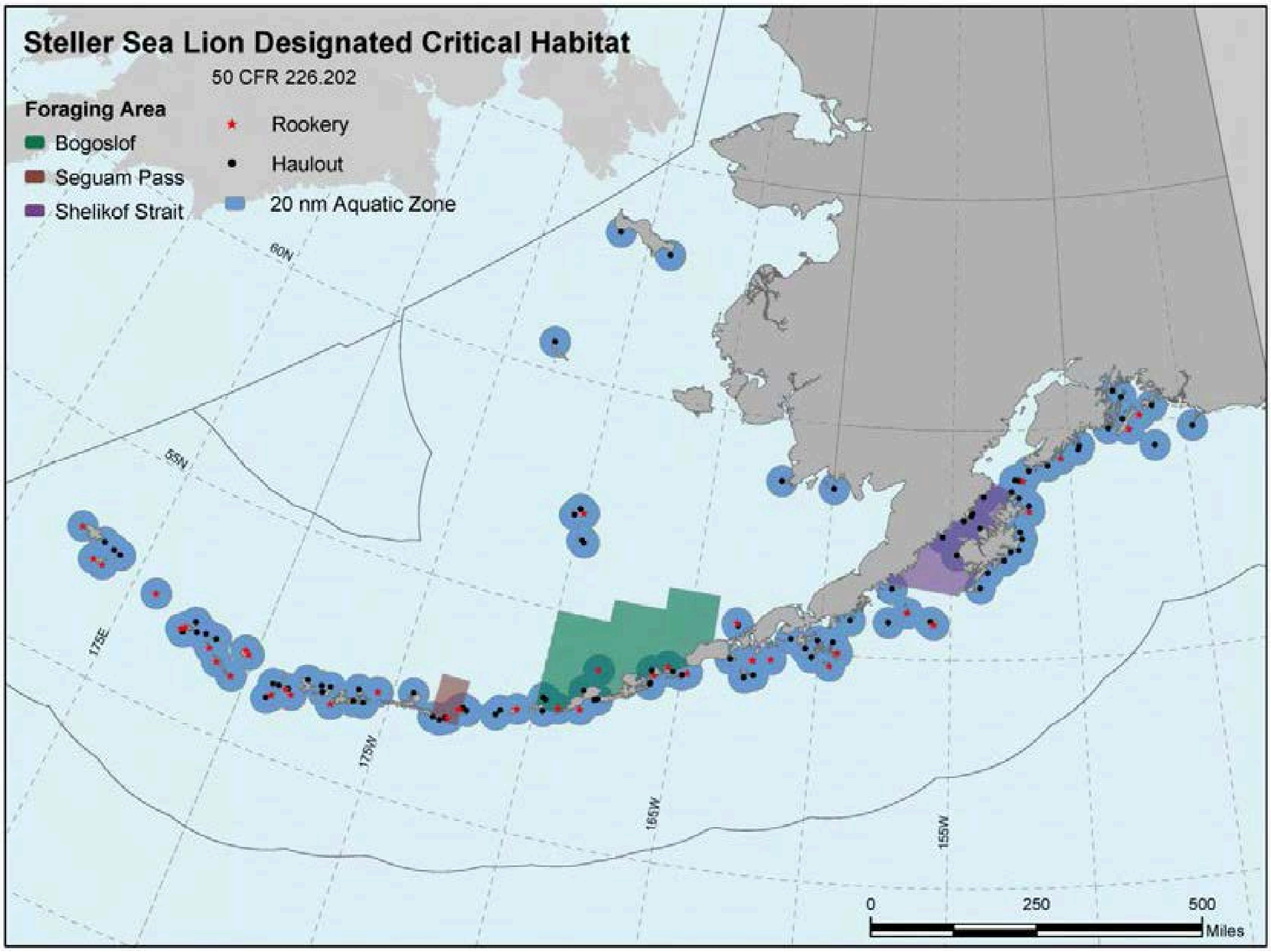

Figure 7. Designated critical habitat for western DPS Steller sea lions.

As discussed in Section 5.1.3 of this Opinion, the transit route will not pass near enough to landmasses to encounter hauled-out pinnipeds; however, foraging sea lions may be encountered during vessel transit though critical habitat surrounding haulouts and rookeries in the Aleutian Islands and through the Bogoslof special aquatic foraging area. It is unlikely, however, that vessel transit will impact critical habitat surrounding haulouts and rookeries and in the Bogoslof special aquatic foraging area to any measureable degree. We conclude any impacts to these PBFs are likely to be insignificant. Therefore, we conclude Steller sea lion critical habitat is not likely to be adversely affected by this action, and is not discussed further in this Opinion.

5.2 Species Likely to be Adversely Affected by the Action

This Opinion examines the status of each listed species that may be affected by the proposed action. The Status of the Species (Section 5 of this Opinion) helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02.

5.2.1 Bowhead Whale

We used information available in the most recent stock assessment (Allen and Angliss 2015), NMFS species information (NMFS 2015b), and recent biological opinions (NMFS 2015e, c) to summarize the status of the species, as follows.

5.2.1.1 Distribution

Bowhead whales are found throughout Arctic and near-Arctic waters, between latitudes of 54 to 85° N. They spend much of the year in shallow, relatively heavy ice-covered continental shelf waters. In winter, they generally occur at the southern limit of the pack ice or in polynyas (large, semi-stable open areas of water within the ice), and move northward as sea ice recedes during the spring.

In Alaska, the majority of bowhead whales migrate annually from northern Bering Sea wintering areas (December to March), through the Chukchi Sea in spring (April to May), to the Beaufort Sea where they spend much of the summer (June to August) before returning to Bering Sea wintering areas in fall (September through December).

It is most likely bowhead whales will be encountered in the offshore cable-lay areas in the Chukchi and Beaufort Seas, and it is unlikely bowhead whales will be encountered during transit between Dutch Harbor and Nome or in the nearshore cable-lay areas.

5.2.1.2 Life History

Bowhead whales are large baleen whales distinguished by a dark body, white chin, and lack of a dorsal fin. The lifespan of bowhead whales is thought to exceed 100 years. Sexual maturity is reached at approximately 20 years of age. Most mating occurs in the Bering Sea during winter and spring months. The gestation period of bowhead whales is approximately 13 to 14 months. Most birthing occurs in the Bering Sea during spring and summer months.

Feeding occurs primarily off the shelf waters in the Chukchi and Beaufort Seas during summer months, though bowhead whales also feed opportunistically in other areas along their migration routes. Like all baleen whales, they are filter feeders. Most feeding occurs at or near the seafloor and bowhead whale prey is primarily comprised of krill and copepods.

Bowhead whales produce a variety of vocalizations ranging from 0.05 and 5.0 kHz (Ljungblad et al. 1980, Ljungblad et al. 1982, Clark and Johnson 1984, Cummings and Holliday 1987). NMFS categorizes bowhead whales in the low-frequency cetacean (i.e., baleen whale) functional hearing group. As a group, it is estimated that baleen whales can hear frequencies between 0.007 and 25 kHz (NOAA 2015).

Additional information on bowhead whales can be found at: https://alaskafisheries.noaa.gov/pr/whales-bowhead.

5.2.1.3 Population Dynamics

Five stocks of bowhead whales are recognized in the North Atlantic and Pacific Oceans. The worldwide population of all stocks, combined, is estimated to be approximately 16,000 whales (Shelden and Rugh 1995, Heide-Jørgensen et al. 2007, Wiig et al. 2009, Wiig et al. 2011, Meschersky et al. 2014, Allen and Angliss 2015). The western Arctic stock, the only stock that occurs in the action area, is estimated to have a minimum of 13,796 whales. Population trends are not available for all bowhead stocks due to insufficient data, but growth appears to be positive in most areas. The western Arctic stock yearly growth rate is estimated to be 4.0 percent, indicating that it is resilient to current threats.

5.2.1.4 Status

The species was listed as endangered under the Endangered Species Conservation Act (ESCA) of 1969 on December 2, 1970 (35 FR 18319). Congress replaced the ESCA with the ESA in 1973, and bowhead whales continued to be listed as endangered. The bowhead whale became endangered because of past commercial whaling. Whaling for subsistence purposes still occurs for bowhead whales, though at a sustainable level. Since 1985, there have been 1,481 bowhead whale takes[11] for subsistence purposes; of those, seven were hunted by Denmark in Greenland, 21 were hunted by Russia near Chukotka, and 1,453 were hunted by the U.S. in Alaska (IWC 2016a).

Additional threats to the species include ship strikes, fisheries interactions (including entanglement) and noise. All threats to the species are discussed further in Section 6 of this Opinion.

5.2.1.5 Critical Habitat

There is no critical habitat designated for the bowhead whale.

5.2.2 Fin Whale

We used information available in the recovery plan (NMFS 2010), the five-year review (NMFS 2011), NMFS species information (NMFS 2015g), recent stock assessment reports (Allen and Angliss 2015, Carretta et al. 2015, Waring et al. 2015), the status report (COSEWIC 2005), and recent biological opinions (NMFS 2015c, d) to summarize the status of the species, as follows.

5.2.2.1 Distribution

Fin whales are distributed widely in every ocean except the Arctic Ocean (though occasional sightings have been reported in recent years). In the North Pacific Ocean, fin whales occur in summer foraging areas in the Chukchi Sea, the Sea of Okhotsk, around the Aleutian Islands, and the Gulf of Alaska; in the eastern Pacific, they occur south to California; in the western Pacific, they occur south to Japan. Fin whales in the eastern Pacific winter from California south; in the western Pacific, they winter in the Sea of Japan, the East China and Yellow Seas, and the Philippine Sea.

It is most likely fin whales will be encountered during transit between Dutch Harbor and Nome, though they may also be encountered in smaller numbers along the cable-lay route as far north as Barrow, and possibly between Barrow and Oliktok Point.

[11] These numbers include both landed and struck and lost whales.

5.2.2.2 Life History

Fin whales are large baleen whales distinguished by a sleek, streamlined body and distinctive coloration pattern of black or dark brownish-gray back and sides with a white underside. The lifespan of fin whales is estimated to be 80 to 90 years. Sexual maturity is reached at six to 10 years of age. Their gestation period is less than one year, and calves are nursed for six to seven months. The average calving interval is two to three years. Birthing and mating occur in lower latitudes during the winter months.

Fin whales eat pelagic crustaceans (primarily krill) and schooling fish such as herring, walleye pollock, and capelin. Intense foraging occurs at high latitudes during the summer. Most foraging occurs in deeper off-shore waters, though fin whales may feed in water as shallow as 10 m if prey is present at the surface.

Fin whales produce a variety of low-frequency sounds in the 0.01 to 0.2 kHz range (Watkins 1981, Watkins et al. 1987, Edds 1988, Thompson et al. 1992). NMFS categorizes fin whales in the low-frequency cetacean (i.e., baleen whale) functional hearing group. As a group, it is estimated that baleen whales can hear frequencies between 0.007 and 25 kHz (NOAA 2015).

Additional information on fin whales can be found at: http://www.fisheries.noaa.gov/pr/species/mammals/whales/fin-whale.html.

5.2.2.3 Population Dynamics

Two subspecies of fin whale are recognized:

- *B. p. physalus*: occurs in the North Atlantic
- *B. p. quoyi* (commonly called the Antarctic fin whale): occurs in the Southern Hemisphere

Though not formally recognized as a subspecies, a third population of fin whale in the North Pacific is generally considered a separate, unnamed subspecies and a fourth subspecies, *B. p. patachonica* (as described by Dr. H. Burmeister [Gray 1865]), may exist in the mid-latitudes of the Southern Hemisphere (Clarke 2004).

Globally, fin whales are sub-divided into three major groups:

- Atlantic
- Pacific
- Southern Hemisphere

The two subspecies described above appear to be organized into separate populations within these groups, though there is a lack of consensus in the published literature as to population structure. Within the Atlantic and Pacific groups, the International Whaling Commission (IWC) and NMFS recognize different stocks and populations of fin whales. Within the Antarctic group, both organizations consider fin whales to belong to the subspecies *B. p. quoyi*.

In the North Pacific, the IWC considers all fin whales to belong to one stock; however, under the MMPA, NMFS recognizes three stocks in U.S. Pacific waters:

- Northeast Pacific
- California/Oregon/Washington
- Hawaii

Fin whales in the action area are members of the northeast Pacific stock.

Abundance estimates are not available for all populations or stocks worldwide, though abundance estimates are available for stocks, or portions of stocks, within U.S. waters:

- Western North Atlantic: minimum population estimate is 1,234 whales
- Northeast Pacific: provisional minimum population estimate of abundance west of the Kenai peninsula is 1,368
- California/Oregon/Washington: minimum population estimate is 2,598
- Hawaii: minimum population estimate is 27 whales

Abundance data for stocks and populations in the Southern Hemisphere are limited and there are no reliable estimates available. The IWC (1979) estimated the Southern Hemisphere population to be 85,200 whales in 1978/1979; however NMFS considers this a poor estimate because of the calculation methods used.

Abundance appears to be increasing in Alaska (4.8 percent annually) and in the California/Oregon/Washington stock (3.5 percent annually). Trends are not available for other stocks due to insufficient data.

Though worldwide data are lacking, fin whales in the action area belong to a stock (Northeast Pacific) with a positive growth trend in Alaska, indicating this stocks is resilient to current threats.

5.2.2.4 Status

The fin whale was listed as endangered under the ESCA on December 2, 1970 (35 FR 18319), and they remain endangered under the ESA. The fin whale is endangered because of past commercial whaling. Whaling does still occur for fin whales, though at a reduced level compared to historical numbers. In the Antarctic Ocean, fin whales were taken[12] by Japanese whalers for scientific research under an Antarctic Special Permit. Between 2005/2006 and 2012/2013, 18 fin whales were taken (IWC 2016c). In 2014, the International Court of Justice issued a judgment ordering Japan to suspend their whaling activities after ruling that their activities could not be considered scientific. Iceland took 292 fin whales from 1986 to 1989 under a special permit (IWC 2016c).

The moratorium on whaling by IWC Member Nations in the Northern Hemisphere has ended legal commercial whaling for fin whales; however, fin whales are still killed commercially by countries that filed objections to the moratorium (i.e., Iceland and Norway). Iceland returned to commercial whaling of fin whales in 2006 and has taken 551 fin whales since that time (IWC 2016b). Norway has not returned to commercial whaling of fin whales.

Whaling for subsistence purposes still occurs for fin whales. Denmark has taken 335 fin whales in Greenland since 1985 for subsistence purposes (IWC 2016a).

In summary, since the moratorium on commercial whaling in 1985, 1,217 fin whales have been taken (i.e., landed or struck and lost).

[12] All references to "takes" of whales in this section include both landed and struck and lost whales.

Additional threats to the species include ship strikes, fisheries interactions (including entanglement), and noise. All threats to the species are discussed further in Section 6 of this Opinion.

5.2.2.5 Critical Habitat
There is no critical habitat designated for the fin whale.

5.2.3 Humpback Whale
We used information available in the status review (Bettridge et al. 2015), most recent stock assessment (Allen and Angliss 2015), NMFS species information (NMFS 2016a), and recent biological opinions (NMFS 2015c, d) to summarize the status of the species, as follows.

5.2.3.1 Distribution
Humpback whales are widely distributed in the Atlantic, Indian, Pacific, and Southern Oceans. Individuals generally migrate seasonally between warmer, tropical and sub-tropical waters in winter months (where they reproduce and give birth to calves) and cooler, temperate and sub-Arctic waters in summer months (where they feed). In their summer foraging areas and winter calving areas, they tend to occupy shallower, coastal waters; though during seasonal migrations they disperse widely in deep, pelagic waters and tend to avoid shallower coastal waters (Winn and Reichley 1985).

It is most likely humpback whales will be encountered during transit between Dutch Harbor and Nome, though they may also be encountered in smaller numbers along the cable-lay route as far north as Barrow.

5.2.3.2 Life History
Humpback whales are large baleen whales that are primarily dark grey in appearance, with variable areas of white on their fins, bellies, and flukes. The coloration of flukes is unique to individual whales. The lifespan of humpback whales is estimated to be 80 to 100 years. Sexual maturity is reached at five to 11 years of age. The gestation period of humpback whales is 11 months, and calves are nursed for 12 months. The average calving interval is two to three years. Birthing occurs in low latitudes during winter months.

Humpback whale feeding occurs in high latitudes during summer months. They exhibit a wide range of foraging behaviors and feed on a range of prey types, such as small schooling fishes, krill, and other large zooplankton.

Humpback whales produce a variety of vocalizations ranging from 0.02 to 10 kHz (Winn et al. 1970, Tyack and Whitehead 1983, Payne and Payne 1985, Silber 1986, Thompson et al. 1986, Richardson et al. 1995, Au 2000, Frazer and Mercado III 2000, Erbe 2002, Au et al. 2006, Vu et al. 2012). NMFS categorizes humpback whales in the low-frequency cetacean (i.e., baleen whale) functional hearing group. As a group, it is estimated that baleen whales can hear frequencies between 0.007 and 25 kHz (NOAA 2015).

Additional information on humpback whales can be found at: http://www.nmfs.noaa.gov/pr/species/mammals/whales/humpback-whale.html.

5.2.3.3 Population Dynamics
A variety of population and stock structures have been proposed for humpback whales. Humpback whale populations can be generally sub-divided into four major groups:

- North Atlantic
- North Pacific
- Arabian Sea
- Southern Hemisphere

Populations within these groups are relatively well defined. Under the MMPA, NMFS currently recognizes five stocks of humpback whales in the Atlantic and Pacific Oceans:

- Atlantic
  - Gulf of Maine stock
- Pacific
  - Western North Pacific stock
  - Central North Pacific stock
  - California/Oregon/Washington stock
  - American Samoa stock

The IWC recognizes seven stocks in the Southern Hemisphere.

NMFS recently conducted a global status review and proposed changing the status of humpback whales under the ESA (80 FR 22304; April 21, 2015). Under this proposal, 14 DPSs of humpback whales would be recognized worldwide:

- North Atlantic
  - West Indies
  - Cape Verde Islands/Northwest Africa
- North Pacific
  - Western North Pacific
  - Hawaii
  - Mexico
  - Central America
- Northern Indian Ocean
  - Arabian Sea
- Southern Hemisphere
  - Brazil
  - Gabon/Southwest Africa
  - Southeast Africa/Madagascar
  - West Australia
  - East Australia
  - Oceania
  - Southeastern Pacific

Under the existing stock structure, humpback whales in the action area may belong to either the western or central North Pacific stocks. Under the proposed DPS rule, humpback whales in the action area may belong to the western North Pacific, Hawaii, or Mexico DPSs.

The worldwide population of all humpback whales is estimated to be approximately 75,000 individuals. Population trends are not available for all humpback whale stocks or populations due to insufficient data, but growth appears to be positive in most areas. The most recent minimum population estimate of the western North Pacific stock is 865 whales with an estimated growth rate of 6.7 percent, though the growth rate is likely biased high to an unknown degree. The most recent minimum population estimate of the central North Pacific stock is 7,890 whales with an estimated grown rate of 5.5 to 6.0 percent.

In the proposed rule to change the status of humpback whales under the ESA (80 FR 22304; April 21, 2015), the abundances of the proposed western North Pacific, Hawaii, and Mexico DPSs were estimated to be 1,000, 12,000, and 6,000 to 7,000 whales, respectively. The growth rate for the proposed western North Pacific DPS was estimated to be 6.9 percent, though it was noted that humpback whales of this population remain rare in some parts of their former range. The growth rate of the proposed Hawaii DPS was estimated to be between 5.5 and 6.0 percent. The growth rate of the proposed Mexico DPS was reported to be unknown, though unlikely to be in decline.

Regardless of the stock or population structure used in this analysis, humpback whales in the action area belong to populations with generally positive growth trends, indicating the stocks or populations are resilient to current threats.

5.2.3.4 Status

The humpback whale was listed as endangered under the ESCA on December 2, 1970 (35 FR 18319), and they remain endangered under the ESA. NMFS recently conducted a global status review and proposed changing the status of humpback whales under the ESA. Under this proposal, the globally-listed species would be divided into 14 DPS, two of which would remain endangered, two of which would be listed as threated, and the remaining 10 DPSs would not be listed under the ESA (80 FR 22304; April 21, 2015). As described in Section 5.2.3.3, humpback whales in the action area may belong to the proposed western North Pacific, Hawaii, or Mexico DPSs. Under the proposed rule, the western North Pacific DPS would be listed at threatened and the Hawaii and Mexico DPSs would not be listed. Because there are no visible means to differentiate between members of the DPSs, for purposes of this consultation, NMFS assumes that any humpback whales in the action area may belong to the western North Pacific DPS.

The humpback whale was listed as endangered because of past commercial whaling. Whaling for subsistence purposes still occurs for humpback whales, though at a sustainable level. Since 1985, there have been 108 humpback whale takes[13] for subsistence purposes; of those 67 were hunted by Denmark in Greenland and 41 were hunted by St. Vincent and the Grenadines in the West Indies (IWC 2016a).

Additional threats to the species include ship strikes, fisheries interactions (including entanglement) and noise. All threats to the species are discussed further in Section 6 of this Opinion.

5.2.3.5 Critical Habitat

There is no critical habitat designated for the humpback whale.

5.2.4 Arctic Ringed Seal

We used information available in the recent stock assessment report (Allen and Angliss 2015), the status review (Kelly et al. 2010), listing documents (75 FR 77476, 77 FR 76705), NMFS species information (NMFS 2016d), and recent biological opinions (NMFS 2015c, d) to summarize the status of the species, as follows.

[13] These numbers include both landed and struck and lost whales.

5.2.4.1 Distribution

The Arctic subspecies of ringed seal has a circumpolar distribution and is found in all seasonally ice-covered waters throughout the Arctic and adjacent waters. The Arctic ringed seal is the most wide-ranging of the five ringed seal subspecies and the only subspecies in the action area.

It is likely Arctic ringed seals will be encountered in all cable-lay areas in the Bering, Chukchi, and Beaufort Seas, and may be encountered along the northern portion of the transit route between Dutch Harbor and Nome.

5.2.4.2 Life History

Ringed seals are the smallest of the Arctic seals, reaching lengths of 1.5 m and weights of 50 to 70 kg. Their coat is dark with silver rings along the back and sides and silver along the underside. They are distinguished by their small head; short, cat-like snout, and plump body. The lifespan of ringed seals is 25 to 30 years. Males reach sexual maturity at 5 to 7 years of age; females mature at 4 to 8 years of age and give birth to a single pup annually. Mating generally occurs in May, though implantation of the fertilized egg is delayed for 3 to 3.5 months. Once implanted, the gestation period lasts about 8 months and pups are weaned between 5 to 9 weeks of age. Birthing and nursing occur in snow caves excavated by the female on sea ice. A wide variety of fish and invertebrate species are consumed by Arctic seals, such as shrimps, amphipods, arctic cod, and herring.

Ringed seals produce underwater vocalizations ranging from approximately 0.1 to 1.0 kHz (Jones et al. 2014). NMFS classifies ringed seals in the phocid pinniped ("true" seal) functional hearing group. As a group, it is estimated that phocid pinnipeds can hear frequencies between 0.075 and 100 kHz (NOAA 2015).

Additional information on ringed seals can be found at:
http://www.nmfs.noaa.gov/pr/species/mammals/seals/ringed-seal.html.

5.2.4.3 Population Dynamics

Arctic ringed seals have a widespread, circumpolar distribution; however, their population structure is poorly understood. Under the MMPA, NMFS recognizes one stock, the Alaska stock, in U.S. waters.

No precise population estimates for the entire subspecies are available due to its widespread distribution across political boundaries. In the status review, the population of the subspecies was estimated to be approximately 2 million individuals, though NMFS considers this a crude estimate.

Similarly, a precise population estimate of the Alaska stock of ringed seals is not available due to inconsistencies in survey methods and assumptions, lack of survey effort in some areas, and because surveys efforts are now more than a decade old. In the status review, the population of ringed seals in Alaskan waters of the Chukchi and Beaufort Seas was estimated to be at least 300,000 individuals, though it is most likely an underestimate of the true population because surveys in the Beaufort Sea were limited to within 40 km of the shore.

Due to insufficient data, the population trends for the Arctic subspecies and Alaska stock are unknown.

5.2.4.4 Status

The Arctic ringed seal was listed as threatened under the ESA on December 28, 2012 (77 FR 76739) due to climate change, especially from the expected loss of sea ice and snow cover in the foreseeable future.

As discussed at the beginning of this document, the U.S. District Court for the District of Alaska issued a decision that vacated the listing on March 17, 2016 (Alaska Oil and Gas Association v. NMFS, Case No. 4:14-cv-00029-RRB). NMFS has appealed that decision.

Ringed seals are an important species for Alaska subsistence hunters. The most recent estimate of annual statewide harvest is from 2000 and was 9,567 ringed seals. The current level of subsistence harvest is not known and there are no efforts to quantify statewide harvest numbers. Additional threats to the species include fisheries interactions (including entanglement), disturbance from vessels, noise from seismic exploration, and oil spills. All threats to the species are discussed further in Section 6 of this Opinion.

Because of their apparently large population size and the long-term nature of the threat of climate change to the DPS, NMFS determined that ESA section 4(d) protective regulations were unnecessary for the conservation of the species at the time of listing.

In summary, the Arctic ringed seal has an apparently large population, making it resilient to immediate perturbations. However, threatened by climate change in the long-term, the species is likely to become endangered in the foreseeable future.

5.2.4.5 Critical Habitat
Critical habitat for the Arctic ringed seal was proposed on December 9, 2014 (79 FR 73010). Final designation of critical habitat is on hold pending the outcome of the litigation challenging the listing.

5.2.5 Bearded Seal (Beringia DPS)
We used information available in the recent stock assessment report (Allen and Angliss 2015), the status review (Cameron et al. 2010), listing documents (75 FR 77496; 77 FR 76739), NMFS species information (NMFS 2015a), and recent biological opinions (NMFS 2015c, d) to summarize the status of the species, as follows.

5.2.5.1 Distribution
The bearded seal subspecies *E. b. nauticus* is further separated into two DPSs: the Beringia DPS and Okhotsk DPS. The Beringia DPS bearded seal is the only DPS in the action area.

The Beringia DPS bearded seal is an ice-associated species that occurs in continental shelf waters of the Bering, Chukchi, Beaufort, and East Siberian Seas. The majority of seals move seasonally, following the extent of the sea ice; however some remain near the coasts of the Bering and Chukchi Seas during the summer and early fall.

It is likely Beringia DPS bearded seals will be encountered in the cable-lay areas in the Bering, Chukchi, and Beaufort Seas, and may be encountered along the northern portion of the transit route between Dutch Harbor and Nome.

5.2.5.2 Life History
Bearded seals are the largest of the Arctic seals, reaching lengths of 2.0 to 2.5 m and weights of 260 to 360 kg. They are distinguished by their small head; small, square foreflippers; and the thick, long, white whiskers that give them their trademark "beard". The lifespan of bearded seals is 20 to 30 years. Males reach sexual maturity at 6 to 7 years of age; females mature at 5 to 6 years of age and give birth to a single pup annually. Gestation lasts 9 months and pups are weaned at approximately 3 to 4 weeks of age.

Birthing and nursing occur on sea ice. Bearded seals feed on a variety of prey in and on the seafloor, such as arctic cod, shrimp, clams, crabs, and octopus.

Male bearded seals produce a variety of underwater vocalizations ranging from approximately 0.2 to 4.3 kHz (Jones et al. 2014). NMFS classifies ringed seals in the phocid pinniped ("true" seal) functional hearing group. As a group, it is estimated that phocid pinnipeds can hear frequencies between 0.075 and 100 kHz (NOAA 2015).

Additional information on Beringia DPS bearded seals can be found at: http://www.fisheries.noaa.gov/pr/species/mammals/seals/bearded-seal.html.

5.2.5.3 Population Dynamics
Under the MMPA, NMFS recognizes an Alaska stock of bearded seals, which is the same population as the Beringia DPS identified under the ESA.

No precise population estimates for the DPS are available due to lack of surveys in portions of their range and variability among techniques for the surveys that have occurred. In the status review, the population of the DPS was estimated to have 155,000 individuals; however, NMFS considers this a crude estimate.

Due to insufficient data, the population trend for Beringia DPS bearded seals is unknown.

5.2.5.4 Status
The Beringia DPS was listed as threatened under the ESA on December 28, 2012 (77 FR 76739) due to the projected loss of sea ice and alteration of prey availability from climate change in the foreseeable future. As discussed at the beginning of this document, the U.S. District Court for the District of Alaska issued a decision that vacated the listing on July 25, 2014 (Alaska Oil and Gas Association v. Pritzker, Case No. 4:13-cv-00018-RPB). NMFS has appealed that decision.

Bearded seals are an important species for Alaska subsistence hunters. The most recent estimate of annual statewide harvest is from 2000 and was 6,788 bearded seals. The current level of subsistence harvest is not known and there are no efforts to quantify statewide harvest numbers. Additional threats to the species include disturbance from vessels, noise from seismic exploration, and oil spills. All threats to the species are discussed further in Section 6 of this Opinion.

Because of their apparently large population size and the long-term nature of the threat of climate change to the DPS, NMFS determined that ESA section 4(d) protective regulations were unnecessary for the conservation of the species at the time of listing.

In summary, the Beringia DPS bearded seal has an apparently large population, making it resilient to immediate perturbations. However, threatened by climate change in the long-term, the DPS is likely to become endangered in the foreseeable future.

5.2.5.5 Critical Habitat
NMFS has not designated or proposed critical habitat for the Beringia DPS bearded seal.

6 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).

Focusing on the impacts of activities specifically within the action area allows us to assess the prior experience and condition of the animals that will be exposed to effects from the actions under consultation. This focus is important because individuals of ESA-listed species may commonly exhibit, or be more susceptible to, adverse responses to stressors in some life history states, stages, or areas within their distributions than in others. These localized stress responses or baseline stress conditions may increase the severity of the adverse effects expected from proposed actions.

6.1 Factors Affecting Species within the Action Area

A number of human activities have contributed to the current status of populations of ESA-listed whales and seals in the action area. The factors that have likely had the greatest impact are discussed in the sections below. For more information on all factors affecting the ESA-listed species considered in this Opinion, please refer to the following documents:

- "Alaska Marine Mammal Stock Assessments, 2014" (Allen and Angliss 2015)
  - Available online at http://www.nmfs.noaa.gov/pr/sars/pdf/alaska2014_final.pdf
- "Final Recovery Plan for the Fin Whale (*Balaenoptera physalus*)" (NMFS 2010)
  - Available online at http://www.nmfs.noaa.gov/pr/pdfs/recovery/finwhale.pdf
- "Status Review of the Humpback Whale (*Megaptera novaeangliae*)" (Bettridge et al. 2015)
  - Available online at http://www.nmfs.noaa.gov/pr/species/Status%20Reviews/humpback_whale_sr_2015.pdf
- "Status Review of the Ringed Seal (*Phoca hispida*) (Kelly et al. 2010)
  - Available online at http://www.nmfs.noaa.gov/pr/species/Status%20Reviews/Ringed%20seal%202012_.pdf
- "Status Review of the Bearded Seal (*Erignathus barbatus*) (Cameron et al. 2010)
  - Available online at http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-211.pdf

6.1.1 Climate Change

The average global surface temperature rose by 0.85º C from 1880 to 2012, and it continues to rise at an accelerating pace (IPCC 2014); the 15 warmest years on record since 1880 have occurred in the 21st century, with 2015 being the warmest (NCEI 2016). The warmest year on record for average ocean temperature is also 2015 (NCEI 2016). Since 2000, the Arctic (latitudes between 60 and 90º N) has been warming at more than twice the rate of lower latitudes (Jeffries et al. 2014) due to "Arctic amplification," a characteristic of the global climate system influenced by changes in sea ice extent, atmospheric and oceanic heat transports, cloud cover, black carbon, and many other factors (Serreze and Barry 2011).

Direct effects of climate change include increases in atmospheric temperatures, decreases in sea ice, and changes in sea surface temperatures, oceanic pH, patterns of precipitation, and sea level. Indirect effects of climate change have impacted, are impacting, and will continue to impact marine species in the following ways (IPCC 2014):

- Shifting abundances
- Changes in distribution
- Changes in timing of migration
- Changes in periodic life cycles of species

Climate change is likely to have its most pronounced effects on species whose populations are already in tenuous positions (Isaac 2009). Therefore, we expect the extinction risk of at least some ESA-listed species to rise with global warming. Cetaceans with restricted distributions linked to water temperature may be particularly exposed to range restriction (Learmonth et al. 2006, Isaac 2009). MacLeod (2009) estimated that, based on expected shifts in water temperature, 88 percent of cetaceans will be affected by climate change, 47 percent will be negatively affected, and 21 percent will 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).

Arctic sea ice extent, in general, has been in decline since 1979 and has a negative trend (Jeffries et al. 2014). Arctic sea ice thickness and annual minimum sea ice extent (i.e., September sea ice extent) have accelerated in their rate of decline considerably in the first decade of the 21^{st} century and approximately three-quarters of summer Arctic sea ice volume has been lost since the 1980s (IPCC 2013). Perennial sea ice extent has declined at a rate of approximately 12 percent per decade and multi-year ice extent is declining at rate of approximately 15 percent per decade (Comiso 2011). Wang and Overland (2009) estimated that the Arctic will be nearly ice-free (i.e., sea ice extent will be less than 1 million km^2) during the summer between the years 2021 to 2043.

The depth and duration of snow cover are projected to decline substantially throughout the range of Arctic ringed seals (Hezel et al. 2012). The persistence of the Arctic ringed seal will likely be challenged as decreases in ice and, especially, snow cover lead to increased juvenile mortality from premature weaning, hypothermia, and predation (Kelly et al. 2010). It is likely, within the foreseeable future, the number of Arctic ringed seals will decline substantially, and no longer persist in substantial portions of their range (Kelly et al. 2010). The Beringia DPS bearded seal will likely be challenged as decreases in sea ice lead to the spatial separation of sea ice from shallow feeding areas, loss of suitable molting habitat, and decreases in prey density or availability (Cameron et al. 2010). Within the foreseeable future, demographic problems associated with abundance, productivity, spatial structure, or diversity might place the DPS in danger of extinction (Cameron et al. 2010).

6.1.2 Fisheries

Worldwide, fisheries interactions have an impact on many marine mammal species. More than 97 percent of whale entanglement is caused by derelict fishing gear (Baulch and Perry 2014). There is also concern that mortality from entanglement may be underreported, as many marine mammals that die from entanglement tend to sink rather than strand ashore. Entanglement may also make marine mammals more vulnerable to additional dangers, such as predation and ship strikes, by restricting agility and swimming speed. Entanglements and rope scars on bowhead whales have been reported during subsistence harvest (Allen and Angliss 2014). Between 2008 and 2012, there was one observed incidental mortality of a fin whale due to entanglement in the ground tackle of a commercial mechanical jig fishing vessel (Helker et al. 2015).

Far more fisheries interactions have been reported for humpback whales in Alaska. Between 2008 and 2012, there were two mortalities of humpback whales in the Bering Sea/Aleutian Islands pollock trawl fishery and one in the Bering Sea/Aleutian Islands flatfish trawl fishery. Because these incidents occurred in areas where the ranges of the western North Pacific and central North Pacific stocks overlap, it is not known to which stock(s) the affected whales belonged. One central North Pacific humpback whale was injured in the Hawaii shallow set longline fishery during this same time period. The estimated annual mortality rate due to interactions with all U.S. fisheries is 0.9 whales per year from the western North Pacific stock and the overall minimum estimate of mortality and serious injury rate due to fisheries for the central North Pacific stock is 8.4 whales per year. A minimum mortality rate of 1.1 to 2.4 western North Pacific humpback whales per year is estimated in the waters of Japan and Korea (Allen and Angliss 2015).

Mortalities associated with commercial fisheries for bearded seals in the Bering Sea/Aleutian Island pollock trawl and flatfish trawl fisheries averaged 1.8 seals per year from 2008 to 2012 (Allen and Angliss 2015). Estimated mortality of ringed seals in the Bering Sea/Aleutian Island pollock trawl, flatfish trawl, Pacific cod trawl, and Pacific cod longline fisheries averaged 4.1 per year from 2008 to 2012 (Allen and Angliss 2015). Lethal take of seals is authorized from 2015 to 2016 resulting from capture in the Bering Sea/Aleutian Island pollock fishery and is limited to 18 Beringia DPS bearded seals and 36 Arctic ringed seals (NMFS 2014c).

Commercial fisheries may indirectly affect whales and seals by reducing the amount of available prey or affecting prey species composition. In Alaska, commercial fisheries target known prey species of ESA-listed whales and seals, such as pollock and cod. Additionally, bottom-trawl fisheries may affect bottom-dwelling prey species of these ESA-listed species.

6.1.3 Harvest

Commercial whaling in the 19th and 20th centuries removed tens of thousands of bowhead, fin, and humpback whales from the North Pacific and Arctic (in the case of bowhead whales) Oceans. As discussed in Section 5.2 of this Opinion, commercial harvest was the primary factor for ESA-listing of these species. This historical exploitation has impacted populations and distributions of bowhead, fin, and humpback whales in the action area, and it is likely these impacts will continue to persist into the future.

Indigenous peoples have been taking bowhead whales for subsistence purposes for at least 2,000 years (Stoker and Krupnik 1993). Subsistence harvests have been regulated by a quota system under the authority of the IWC since 1977. The average subsistence take in Alaska, Russia, and Canada from 2008 to 2012 was 42 bowhead whales per year (Allen and Angliss 2015). The current U.S. portion of the IWC quota allows no more than 67 strikes of bowhead whales annually and up to 15 unused strikes from any previous year to be added to the subsequent year's strike allotment (i.e., up to 82 strikes) for the period of 2013 to 2018 (NMFS 2012). Subsistence hunters in Alaska and Russia have not been reported to take fin or humpback whales (Allen and Angliss 2015).

Substantial commercial harvest of both ringed and bearded seals in the late 19th and 20th centuries led to local depletions; however, the commercial harvest of ice seals has been prohibited in U.S. waters since 1972 under the MMPA. Since that time, only subsistence harvests of ringed and bearded seals by Alaska Native subsistence hunters are allowed in U.S. waters. Data on contemporary subsistence harvests of ringed and bearded seals in Alaska are no longer collected (Allen and Angliss 2015).

Therefore, we assume that subsistence harvest levels in the action area are similar to historical annual harvest levels that, statewide, resulted in take of an estimated 9,567 ringed seals and 6,788 bearded seals (Allen and Angliss 2015).

6.1.4 Natural and Anthropogenic Noise

ESA-listed species in the action area are exposed to several sources of natural and anthropogenic noise. Natural sources of underwater noise include sea ice, wind, waves, precipitation, and biological noise from marine mammals, fishes, and crustaceans. Anthropogenic sources of noise in the action area include:

- Vessels
  - Shipping
  - Transportation
  - Research
- Oil and gas activities:
  - Geophysical surveys (including seismic activities)
  - Drilling
  - Construction
  - Dredging
  - Pile-driving
- Icebreaking
- Sonars
- Aircraft

The combination of anthropogenic and natural noises contributes to the total noise at any one place and time.

Because responses to anthropogenic noise vary among species and individuals within species, it is difficult to determine long-term effects. Habitat abandonment due to anthropogenic noise exposure has been found in terrestrial species (Francis and Barber 2013). Clark et al. (2009) identified increasing levels of anthropogenic noise as a habitat concern for whales because of its potential effect on their ability to communicate (i.e. masking). Some research (Parks 2003, McDonald et al. 2006, Parks 2009) suggests marine mammals compensate for masking by changing the frequency, source level, redundancy, and timing of their calls. However, the long-term implications of these adjustments, if any, are currently unknown.

6.1.5 Oil and Gas Activities

Offshore petroleum exploration activities have been conducted in State of Alaska waters and the Outer Continental Shelf of the Beaufort and Chukchi Sea Planning Areas, in Canada's eastern Beaufort off the Mackenzie River Delta, in Canada's Arctic Islands, and in the Russian Arctic around Sakhalin Island to the south of the Bering Strait (NMFS 2013a). The following sections discuss oil and gas activities in the action area.

6.1.5.1 Noise Related to Oil and Gas Operations

NMFS has conducted numerous ESA section 7 consultations related to oil and gas activities in the Beaufort and Chukchi Seas. Many of the consultations have authorized the take (by harassment) of bowhead, fin, and humpback whales and bearded and ringed seals from sounds produced during geophysical (including seismic) surveys and drilling operations conducted by leaseholders during open water (i.e., summer) months.

NMFS conducted an incremental step consultation with the Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE) on the effects of the authorization of oil and gas leasing and exploration activities in the U.S. Beaufort and Chukchi Seas over a 14-year period, from March 2013 to March 2027 (i.e., the Arctic Regional Biological Opinion) (NMFS 2013b). The incidental take statement for the 14-year period in the biological opinion allows the following number of takes (by harassment) from sounds associated with high-resolution, deep penetration, and in-ice deep penetration seismic surveys:

- Bowhead whale: 87,878
- Fin whale: 896
- Humpback whale: 1,400
- Bearded seal: 91,616
- Ringed seal: 506,898

NMFS conducted another incremental step consultation with BOEM and BSEE in 2015 on lease sale 193 oil and gas exploration activities in the Chukchi Sea, Alaska, over a nine-year period, from June 2015 to June 2024 (NMFS 2015c). The incidental take statement in the biological opinion allows the following number of takes (by harassment) from sounds associated with seismic, geohazard, and geotechnical surveys, and exploratory drilling:

- Bowhead whale: 8,434
- Fin whale: 133
- Humpback whale: 133
- Ringed seal: 1,045,985
- Bearded seal: 832,013

These biological opinions were developed as incremental step consultations. Take will be more accurately evaluated for subsequent projects that fall under these larger consultation (i.e. stepwise consultations), and the cumulative take for all subsequent consultations will be tracked and tiered to these consultation.

In 2014, NMFS conducted three consultations with the Permits Division on the issuance of IHAs to take marine mammals incidental to 3D ocean bottom sensor seismic and shallow geohazard surveys in Prudhoe Bay, Foggy Island Bay, and Colville River Delta, Beaufort Sea, Alaska, during the 2014 open water season (NMFS 2014d, e, a). These consultations were either directly or indirectly linked to the Arctic regional biological opinion. The incidental take statements in the three biological opinions estimated 138 bowhead whales, 744 bearded seals, and 427 ringed seals, total, would be taken (by harassment) as a result of exposure to impulsive sounds at received levels at or above 160 dB re 1 μPa_{rms}.

In 2015, NMFS conducted two consultations with the Permits Division on the issuance of IHAs to take marine mammals incidental to shallow geohazard and 3D ocean bottom node seismic surveys in the Beaufort Sea, Alaska, during the 2015 open water season. These consultations were either directly or indirectly linked to the Arctic regional biological opinion. The incidental take statements in the three biological opinions estimated 461 bowhead whales, 202 bearded seals, and 1,472 ringed seals, total, would be taken (by harassment) as a result of exposure to impulsive sounds at received levels at or above 160 dB re 1 μPa_{rms} and one bowhead whale, 10 bearded seals, and 20 ringed seals would be taken (by harassment) as a result of exposure to impulsive sounds at received levels at or above 180 (for whales) or 190 (for seals) dB re 1 μPa_{rms}.

The first stepwise (i.e., tiered) consultation under the lease sale 193 incremental step consultation was conducted in 2015. NMFS consulted with the Permits Division on the issuance of an IHA to take marine mammals incidental to exploration drilling activities in the Chukchi Sea, Alaska, in 2015 (NMFS 2015d). The incidental take statement in the biological opinion estimates 1,083 bowhead whales, 14 fin whales, 14 humpback whales, 1,722 bearded seals, and 25,217 ringed seals would be taken (by harassment) as a result of exposure to continuous sounds at received levels at or above 120 dB re 1 μPa_{rms} and impulsive sounds at received levels at or above 160 dB re 1 μPa_{rms}.

In 2014, NMFS consulted with the Permits Division on the issuance of regulations and a letter of authorization to take marine mammals incidental to offshore oil and gas operations at the Northstar development in the U.S. Beaufort Sea, from January 13, 2014 to January 14, 2019 (NMFS 2014b). The incidental take statement in the biological opinion allows up to 15 bowhead whales, 5 bearded seals, and 31 ringed seals to be taken (by harassment) as a result of exposure to continuous sounds at received levels at or above 120 dB re 1 μPa_{rms} and impulsive sounds at received levels at or above 160 dB re 1 μPa_{rms}. The incidental take statement also included an additional 5 injurious or lethal takes of ringed seals in the event that ringed seal lairs are crushed or flooded during on-ice construction or transportation.

In 2015, NMFS consulted with the Permits Division on the issuance of an IHA to take marine mammals incidental to ice overflight and ice survey activities conducted by Shell Gulf of Mexico and Shell Offshore Inc., from May 2015 to April 2016 (NMFS 2015f). The incidental take statement authorizes take (by harassment) of 793 Arctic ringed seals and 11 Beringia DPS bearded seals as a result of exposure to visual and acoustic stimuli from aircraft.

Anticipated impacts by harassment from noise associated with oil and gas activities generally include changes in behavioral state from low energy states (i.e., foraging, resting, and milling) to high energy states (i.e., traveling and avoidance).

6.1.5.2 Spills

Since 1975, 84 exploration wells, 14 continental offshore stratigraphic test (i.e., COST), and six development wells have been drilled on the Arctic Outer Continental Shelf (BOEM 2012). Historical data on offshore oil spills for the Alaska Arctic Outer Continental Shelf region consists of all small spills (i.e., less than 1,000 barrels [31,500 gallons]) and cannot be used to create a distribution for statistical analysis (NMFS 2013a). Instead, agencies use a fault tree model[14] to represent expected spill frequency and severity of spills in the Arctic. Table 5 shows the assumptions BOEM presented regarding the size and frequency of spills in the Beaufort and Chukchi Seas Planning Area in its final programmatic environmental impact statement (EIS) for the Outer Continental Shelf oil and gas leasing program for 2012 to 2017 (BOEM 2012).

[14] Fault tree analysis is a method for estimating spill rates resulting from the interactions of other events. Fault trees are logical structures that describe the causal relationship between the basic system components and events resulting in system failure. Fault tree models are graphical techniques that provide a systematic estimate of the combinations of possible occurrences in a system, which can result in an undesirable outcome.

Table 5. Oil spill assumptions for the Beaufort and Chukchi Seas Planning Areas, 2012 to 2017.

Spill Type	Assumed Spill Volume (barrels)	Assumed Number of Spill Events	Maximum Volume of Assumed Spill Events (barrels)
Small	≥ 1 to < 50	50 to 90	9,310
	≥ 50 to < 1,000	10 to 35	34,965
Large	≥ 1,000	-	-
Pipeline	1,700	1 to 2	3,400
Platform	5,100	1	5,100
TOTAL			**52,775**

Table adapted from BOEM (2012)

Increased oil and gas development in the U.S. Arctic has led to an increased risk of various forms of pollution to whale and seal habitat, including oil spills, other pollutants, and nontoxic waste (Allen and Angliss 2015).

6.1.6 Pollutants and Discharges (Excluding Spills)

Previous development and discharges in portions of the action area are the source of multiple pollutants that may be bioavailable (i.e., may be taken up and absorbed by animals) to ESA-listed species or their prey items (NMFS 2013a). Drill cuttings and fluids contain contaminants that have high potential for bioaccumulation, such as dibenzofuran and polycyclic aromatic hydrocarbons. Historically, drill cuttings and fluids have been discharged from oil and gas developments in the Beaufort Sea near the action area, and residues from historical discharges may be present in the affected environment (Brown et al. 2010).

The Clean Water Act of 1972 (CWA) has several sections or programs applicable to activities in offshore waters. Section 402 of the CWA authorizes the U.S. Environmental Protection Agency (EPA) to administer the National Pollutant Discharge Elimination System (NPDES) permit program to regulate point source discharges into waters of the United States. Section 403 of the CWA requires that EPA conduct an ocean discharge criteria evaluation for discharges to the territorial seas, contiguous zones, and the oceans. The Ocean Discharge Criteria (40 CFR Part 125, Subpart M) sets forth specific determinations of unreasonable degradation that must be made before permits may be issued.

On October 29, 2012, EPA issued two general permits for exploration discharges to the Beaufort and Chukchi Seas, permit numbers AKG-28-2100 and AKG-28-8100, respectively, and are effective for five years. The general permits authorize discharges from thirteen categories of waste streams, subject to effluent limitations, restrictions, and requirements:

- drilling fluids and drill cuttings
- deck drainage
- sanitary wastes
- domestic wastes
- uncontaminated ballast water
- bilge water
- desalination unit wastes
- blowout preventer fluid
- boiler blowdown
- fire control system test water
- non-contact cooling water
- excess cement slurry
- muds, cuttings, and cement at seafloor

The general permits for exploration discharges include effluent limitations and monitoring requirements specific to each of the discharges, with additional restrictions for the discharge of drilling fluids and drill cuttings, including no discharge starting on August 25 until fall bowhead whale hunting activities have ceased in the communities of Nuiqsut and Kaktovik in the Beaufort Sea. Environmental monitoring programs are required to be conducted at each drill site location before, during, and after drilling activities. The general permits also include numerous seasonal and area restrictions.

In the 2013 supplemental draft EIS for the effects of oil and gas activities in the Arctic Ocean, NMFS proposed requirements to ensure reduced, limited, or zero discharge of any or all discharge streams that have the potential to impact marine mammals or marine mammal prey or habitat and requirements to recycle drilling muds (NMFS 2013a). The final supplemental EIS has not yet been released.

The EPA issued a NPDES vessel general permit that authorizes several types of discharges incidental to the normal operation of vessels, such as grey water, black water, coolant, bilge water, ballast, and deck wash (EPA 2013). The permit is effective from December 19, 2013 to December 19, 2017, and applies to owners and operators of non-recreational vessels that are at least 24 m (79 ft) in length, as well as to owners and operators of commercial vessels less than 24 m that discharge ballast water.

The US Coast Guard has regulations related to pollution prevention and discharges for vessels carrying oil, noxious liquid substances, garbage, municipal or commercial waste, and ballast water (33 CFR Part 151). The State of Alaska regulates water quality standards within three miles of the shore.

6.1.7 Scientific Research

In the following sections, we describe the types of scientific research currently permitted for ESA-listed whales and seals in the action area. NMFS issues scientific research permits that are valid for five years for ESA-listed species. When permits expire, researchers often apply for a new permit to continue their research. Additionally, applications for new permits are issued on an on-going basis; therefore, the number of active research permits is subject to change in the period during which this Opinion is valid.

Species considered in this Opinion also occur in Canadian waters. Although we do not have specific information about any permitted research activities in Canadian waters, we assume they will be similar to those described below.

6.1.7.1 Whales

Bowhead, fin, and humpback whales are exposed to research activities documenting their distribution and movements throughout their ranges. Of the 17 active research permits authorizing takes of these species in Alaskan waters, 13 have specific investigation areas outside of the Bering, Chukchi, and Beaufort Seas (NMFS 2016c). Activities associated with the remaining four permits could occur in the action area, possibly at the same time as the proposed project activities.

Currently permitted research activities include:

- Counting/surveying
- Opportunistic collection of sloughed skin and remains
- Behavioral and monitoring observations
- Various types of photography and videography
- Skin and blubber biopsy sampling
- Fecal sampling
- Suction-cup, dart/barb, satellite, and dorsal fin/ridge tagging

These research activities require close vessel approach. The permits also include incidental harassment takes to cover such activities as tagging, where the research vessel may come within 91 m (300 ft) of other whales while in pursuit of a target whale.

These activities may cause stress to individual whales and cause behavioral responses, but harassment is not expected to rise to the level where injury or mortality is expected to occur.

6.1.7.2 Seals

Bearded and ringed seals are exposed to research activities documenting their distribution and movements throughout their ranges. Of the five active research permits authorizing takes of bearded and ringed seals in Alaska, one has a specific investigation area outside of the action area (NMFS 2016b). Activities associated with the remaining research permits could occur in the action area, possibly at the same time as the proposed project activities.

Two of the current permits (Permit Nos. 15142 and 15324) include behavioral observations, counting/surveying, photo-identification, and capture and restraint (by hand, net, cage, or board), for the purposes of performing the following procedures:

- Collection of:
  - Blood
  - Clipped hair
  - Urine and feces
  - Nasal and oral swabs
  - Vibrissae (pulled)
  - Skin, blubber, or muscle biopsies
  - Weight and body measurements
- Injection of sedative
- Administration of drugs (intramuscular, subcutaneous, or topical)
- Attachment of instruments to hair or flippers, including flipper tagging
- Ultrasound

Permit Nos. 15142 and 15324 also include incidental harassment of non-target seals during the course of performing the permitted activities. Two additional permits (Permits Nos. 14610 and 18537) include harassment takes of bearded and ringed seals incidental to permitted research activities.

Activities may cause stress to individual seals, but, in most cases, harassment is not expected to rise to the level where injury or mortality is expected to occur; however, Permit No. 15324 allows the unintentional mortality of up to five ringed and five bearded seals over the course of the permit (i.e., up to 25 unintentional mortalities of each species over five years), and Permit No. 15142 allows the permanent removal from the wild of up to four bearded seals and the unintentional mortality of two bearded seals over the life of the permit (five years).

6.1.8 Ship Strike

Ship strikes are a serious concern for some species of large whales; however, between 1976 and 1992, only two bowhead whales with ship-strike injuries were identified out of 236 bowhead whales examined during Alaskan subsistence harvests (George et al. 1994). There have been no reports of bowhead whale ship strikes in more recent years.

Ship-strike mortality averaged 0.4 fin, 0.45 western North Pacific humpback, and 2.36 central North Pacific whales per year between 2008 and 2012. Most vessel collisions with humpbacks are reported from Southeast Alaska and it is not known whether the difference in ship strike rates between Southeast

Alaska and the northern portion of the humpback whale range is due to differences in reporting, amount of vessel traffic, densities of animals, or other factors (Allen and Angliss 2015).

The level of threat from shipping to bearded and ringed seals is a function of spatial and temporal overlap with bearded and ringed seal habitats, vessel speed, ship traffic volume, shipping routes, and other factors. To date, no bearded or ringed seal carcasses have been reported with propeller marks.

Icebreakers, ice-breaking cargo ships, and ice-breaking container ships pose additional threats to bearded and ringed seals. These vessels operate year round and are capable of crushing animals, destroying lairs, and harassing animals from noise propagated through air or water. Reeves (1998) noted that some ringed seals have been killed by icebreakers moving through breeding areas in land-fast ice. The presence and movements of ships in the vicinity of ringed seals may cause them to abandon their preferred breeding habitats in areas with high traffic (Smiley and Milne 1979).

6.1.9 Environmental Baseline Summary

Historically, overexploitation of large whales caused declines in abundance to the point of near-extinction. Commercial whaling of bowhead, fin, and humpback whales has largely been eliminated (the exception being commercial catches of fin whales in Iceland), and all three species are recovering. Bearded and ringed seals did not experience the same level of historic exploitation. While the primary cause for the listing of the bowhead, fin, and humpback whales (i.e., commercial whaling) lies in the past, the primary threat to bearded and ringed seals lies in the future (i.e. climate change).

The relationship between sound and marine mammal response to sound is the topic of extensive scientific research and public inquiry. Most observations report only short-term behavioral responses that include cessation of feeding, resting, or social interactions because study design precludes detection of difficult-to-detect long-term effects, if any exist. However, behavioral response could take the form of habitat abandonment, which could have implications at the population level.

7 Effects of the Action

"Effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. We organize our effects analyses using a stressor identification – exposure – response – risk assessment framework for the proposed activities. The proposed activities will expose ESA-listed whales and seals to the sounds and physical presence of fiber optic cable laying vessels and cable-laying equipment.

7.1 Stressors

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

- Discharge and/or spills from:
    - Vessels
    - HDD boring
- Vessel strike
- Entanglement in:
    - Fiber optic cable

    - Grapnel rope
- Disturbance of seafloor
- Underwater sounds from:
    - Vessels
    - HDD boring
    - Single-beam echosounder, obstacle avoidance sonar, acoustics positioning beacons, and altimeter
    - Dynamic positioning

Below we discuss each stressor's potential to affect ESA-listed species.

7.1.1 Stressors Not Likely to Adversely Affect ESA-listed Species

Based on a review of available information, we determined which of the possible stressors may occur, but for which the likely effects are discountable or insignificant and, therefore, need not be evaluated further in this Opinion.

7.1.1.1 Vessel Spill

Vessel discharge in the form of leakages of fuel or oil is possible. No refueling will be performed during project activities, so any discharge of diesel fuel would be from a vessel fuel tank rupture, likely as a result of vessel collision, sinking, fire, or running aground. We expect such catastrophic events are extremely unlikely to occur during project activities. Additionally, as discussed in Section 2.1.7 of this Opinion, each cable-lay vessel will have SOPEPs onboard that outline mitigation and minimization measures in the event of a catastrophic event. Therefore, we conclude the effects from this stressor are discountable.

7.1.1.2 Discharge

Vessel discharge (e.g., ballast or bilge water containing oils or oily detergents from deck washdown operations, hydraulic fluids, and motor fuels and oils) is possible, though if discharges do occur, we expect the amounts of leakage will be small, resources will be available to minimize migration of the material, facilitate cleanup, and remediate affected media, and any leakage not contained will dissipate quickly. We expect any effects on ESA-listed whales or seals would be minor and not measurable. Therefore, we conclude the effects from this stressor are insignificant.

It is possible that drilling mud may be released into the marine environment during HDD operations if the bore-hole hits a void in the substrate, or if the hole becomes fractured. However, due to the type of sediment in the project area, Quintillion does not expect the substrate in the action area will be likely to fracture and if a void is encountered, it will be below the seafloor at depths of as much as 27 m. Should an inadvertent release of drilling mud occur, we expect the amount of mud released will be small and have no measurable effect on ESA-listed whales or seals or their prey items; therefore, we conclude the effects from this stressor are insignificant.

7.1.1.3 Vessel Strike

The possibility of vessel strike is extremely unlikely. During cable-laying activities and the PLGR, vessel speed will be very low (i.e., 2 km/hr [1 kt] or less) and the maximum transit speed for any vessel proposed for use is 27.8 km/hr (15 kts). The permit requirements described in Section 2.2 of this Opinion, such as transiting around the Bering Sea critical habitat unit for North Pacific right whales, requiring the vessel to avoid groups of whales, taking measures to avoid all marine mammals, and reducing vessel speed to less than 9.3 km/hr (5 kts) during time of poor visibility, will further reduce the likelihood of vessel strike. Therefore, we conclude the effects from this stressor are discountable.

7.1.1.4 Entanglement

Though it is possible that the fiber optic cable or grapnel rope could come in direct contact with ESA-listed species, entanglement is highly unlikely because the fiber optic cable will be kept free of loops and suspensions during cable-laying and the grapnel rope will be taut while it is being towed. We do not expect marine mammals to become entangled in the fiber optic cable after it is laid (the portions of which are not buried) because the cables will conform to and rest on the seafloor. Therefore, we conclude the effects from this stressor are discountable.

7.1.1.5 Disturbance of Seafloor

The seafloor will be disturbed during the PLGR, cable burial activities, HDD exit hole boring, and placement of concrete mattresses. These activities may crush, injure, or kill individuals of prey species of ESA-listed whale and seal species; however, these effects will be limited to the area directly impacted by these activities (i.e., a total area of less than 6.0 km^2 [2.3 mi^2]). We do not expect these activities will affect prey availability to any measurable degree; therefore, we conclude the effects from this stressor are insignificant.

Muddy sediments will be disturbed and will temporarily impact water quality during project activities. For the majority of the proposed activities (i.e., all activities with the exception of water jetting), we expect this impact will occur in the area immediately surrounding (i.e., a few to tens of meters) the sediment-disturbing activities and we expect suspended sediment will re-settle on the seafloor quickly (i.e., within a few hours). Water jetting from the ROV and/or vertical injector may result in the suspension of a greater amount of sediments for a longer period of time (i.e., up to several days). During this time, suspended sediments may be transported and resettle several kilometers from the source. Approximately 374,199 cubic meters (m^3 [467,749 cubic yard (yd^3)]) of seafloor will be side-cast and replaced over an area of approximately 11.9 hectares (ha [29.47 acres (ac)]). Because this volume of disturbed sediment will be distributed along approximately 730 km (454 mi) of the buried portions of the proposed cable route, we do not expect project activities, including water jetting, will affect ESA-listed whales or seals directly or impact water quality to any measurable degree; therefore, we conclude the effects from this stressor are insignificant.

7.1.1.6 Sounds from Vessels, HDD Boring, and Other Acoustic Devices

During transit, noise from the vessels will propagate into the marine environment. Brief interruptions in communication via masking are possible, though unlikely given the movements of whales and seals as well as the vessels. Therefore, we conclude the effects from this stressor are insignificant.

Sound will be produced during HDD boring; however, boring will be occurring below the seafloor in saturated materials at depths up to 27 m. Given these conditions, we do not expect sound from HDD boring will propagate into the marine environment to any measurable degree; therefore, we conclude the effects from this stressor are insignificant.

It is extremely unlikely that the acoustic devices with operating frequencies between 200 and 900 kHz shown in Table 2 (see page 16) (i.e., the obstacle avoidance sonars, altimeter, and single-beam echosounder [operating at 200 kHz]) will affect the ESA-listed species considered in this Opinion because these frequencies are above the assumed hearing ranges of baleen whales (i.e., between 0.007

and 25 kHz) and seals (i.e., between 0.075 and 100 kHz). In the unlikely event that these acoustic devices operating between 200 to 900 kHz shown in Table 2 are audible to ESA-listed whales and seals, it is unlikely that the pulsed sounds produced by these devices will reach these species because the sounds are produced in narrow beams and attenuate rapidly. To hear such sounds, ESA-listed species would need to be within a few meters of the source and within the narrow beam of sound (i.e., directly under the vessel or in front of the ROV or plough), a behavior of ESA-listed whales and seals we expect will be extremely unlikely to occur. Furthermore, the near-source sound pressure level of the single-beam echosounder (operating at 200 kHz) (i.e., 154 dB re 1 μPa_{rms} at 1 m) is below the threshold for Level B harassment from pulsed sources (i.e., 160 dB re 1 μPa_{rms}). For these reasons, we conclude the effects from the obstacle avoidance sonars, altimeter, and single-beam echosounder (operating at 200 kHz) are discountable.

The single-beam echosounder operating at 50 kHz is within the assumed hearing range of seals and likely will be audible to them; however, the near-source sound pressure level (i.e., 154 dB re 1 μPa_{rms} at 1 m) is below the threshold for Level B harassment from pulsed sources (i.e., 160 dB re 1 μPa_{rms}). We expect it will be audible to ESA-listed whales. Like the sources described above, the sound is emitted in a relatively narrow (i.e., 30-degree conical) beam. As described above, we expect it will be extremely unlikely for a seal to behave in a manner that would expose it to sounds from this source; therefore, we conclude the effects from the single-beam echosounder (operating at 50 kHz) are discountable.

7.1.1.7 Summary of Stressors Not Likely to Adversely Affect ESA-listed Species

In conclusion, based on review of available information, we determined effects from vessel spill, vessel strike, entanglement in fiber optic cable or grapnel rope, or exposure to sounds from acoustic devices with operating frequencies of 50 kHz and between 200 and 900 kHz are extremely unlikely to occur. We consider the effects to ESA-listed whales and seals to be discountable.

We determined vessel and HDD discharge, disturbance of seafloor, and sounds from vessels and HDD will not have measureable impact; therefore, we consider effects ESA-listed whales and seals to be insignificant.

7.1.2 Stressors Likely to Adversely Affect ESA-listed Species

The following sections analyze the one stressor likely to adversely affect ESA-listed species: underwater sounds from dynamic positioning, single-beam echosounder (operating at 12 kHz) and acoustic positioning beacons. First, we present a brief explanation of the sound measurements used in the discussions of acoustic effects in this Opinion.

7.1.2.1 Sound Measurements Used in this Document

"Sound pressure" is the sound force per unit micropascals (μPa), where 1 pascal (Pa) is the pressure resulting from a force of one newton exerted over an area of one square meter. "Sound pressure level" is expressed as the ratio of a measured sound pressure and a reference level. The commonly used reference pressure in underwater acoustics is 1 μPa, and the units for sound pressure levels are dB re 1 μPa. Sound pressure level (in dB) = 20 log (pressure/reference pressure).

Sound pressure level is an instantaneous measurement and can be expressed as "peak" (0-p), "peak-to-peak" (p-p), or "root mean square" (rms). Root mean square, which is the square root of the arithmetic average of the squared instantaneous pressure values, is typically used in discussions of the effects of sounds on vertebrates. All references to sound pressure level in this document are expressed as rms, unless otherwise indicated. In instances where sound pressure levels for airguns were originally expressed as 0-p or p-p, we used the following rough conversions in order to express those values in rms (Harris et al. 2001):

- rms is approximately 10 dB lower than 0-p
- rms is approximately 16 dB lower than p-p

We reported the original 0-p or p-p measurements in footnotes. Note that sound pressure level does not take the duration of a sound into account.

7.1.2.2 Sound Exposure Thresholds

The proposed action is expected to result in non-lethal, non-injurious harassment of ESA-listed whales and seals. The ESA does not define harassment and NMFS has not defined this term through regulation pursuant to the ESA. As noted above in Footnote 6 of this Opinion (see page 18), the MMPA includes definitions for Level A and B harassment.

Since 1997 NMFS has used generic sound exposure thresholds to determine whether an activity produces underwater sounds that might result in impacts to marine mammals (70 FR 1871). NMFS is currently developing comprehensive guidance on sound levels likely to cause injury and behavioral disruption to marine mammals. However, until such guidance is available, NMFS uses the following conservative thresholds of underwater sound pressure levels, expressed in root mean square (rms), from broadband sounds that cause behavioral disturbance, and referred to as Level B harassment under section 3(18)(A)(ii) of the MMPA:

- impulsive sound: 160 dB re 1 μPa_{rms}
- continuous sound: 120 dB re 1 μPa_{rms}

NMFS uses the following conservative thresholds for underwater sound pressure levels from broadband sounds that cause injury, referred to as Level A harassment under section 3(18)(A)(i) of the MMPA:

- 180 dB re 1 μPa_{rms} for whales
- 190 dB re 1 μPa_{rms} for pinnipeds (seals and sea lions)

Our analysis considers that behavioral harassment or disturbance is not limited to the Level B thresholds. Our analysis considers an individual to be harassed if the individual changes its behavioral state (e.g., from resting to traveling away from the acoustic source or from traveling to evading), regardless of the received sound level to which it was exposed (i.e., animals could be harassed at received levels less than 120 or 160 dB re 1 μPa_{rms}).

7.1.2.3 Dynamic Positioning

During dynamic positioning of the cable-laying ships, cavitating noise from the thrusters (i.e., the noise created from the random collapsing of bubbles produced by the thrusters) may affect marine mammals. Each cable laying-ship (i.e., the *Iles de Brehat* and *Sein*) will maintain dynamic positioning during cable-laying activities by operating two 1,500 kW bow thrusters, two 1,500 kW aft thrusters, and one 1,500 kW fore thruster. Sound source measurements have not been conducted specific to the *Iles de Brehat* or *Sein*, but SSV will be conducted at the beginning of project activities. Until the SSV results are available, our effects analysis must rely on existing sound source studies. Other projects using dynamic positioning have reported near-source thruster noise levels between 171 and 180 dB re 1 μPa_{rms}

at 1 m (Nedwell et al. 2003, MacGillivray 2006, Samsung 2009, Warner and McCrodan 2011, Deepwater Wind 2013, Tetra Tech 2013).

Acoustical models of dynamic positioning in the Atlantic Ocean in water depths similar those in the proposed project's action area resulted in 120 dB re 1 μPa$_{rms}$ isopleth radii between 1.4 and 3.6 km (Samsung 2009, Deepwater Wind 2013, Tetra Tech 2013); however, all of the distances were based on conservative modeling that included maximum parameters and worst-case assumptions. During dynamic positioning of the 104-m (341-ft) *Fugro Synergy* in the Chukchi Sea, using thrusters more powerful than those on the *Iles de Brehat* or *Sein* (i.e., 2,500 kW vs. 1,500 kW), Warner and McCrodan (2011) measured a 2.3-km radius (90th percentile) to the 120 dB re 1 μPa$_{rms}$ isopleth with dominant frequencies from 0.11 to 0.14 kHz (i.e., within the range of hearing of all ESA-listed species considered in the Opinion). The near-source thruster noise was estimated to be approximately 171 dB re 1 μPa$_{rms}$ at 1 m.

Quintillion used the 2.3-km radius reported by Warner and McCrodan (2011) as a representative distance to the 120 dB re 1 μPa$_{rms}$ isopleth in their IHA application (Owl Ridge 2016a) because it is a measured value from one of the water bodies where the proposed activities will occur, as opposed to a modeled value in a different waterbody. The Permits Division adopted this distance in the effects analysis in the proposed IHA (81 FR 17666) and we, in turn, have adopted it here.

To determine a total ensonified area, Quintillion assumed in its IHA application that dynamic positioning would occur along all trunk and branch lines within the proposed fiber optics cable network, regardless of the type of cable-lay vessel used. The total length of the proposed network is approximately 1,902.7 km. Using the findings from Warner and McCrodan (2011), the radius to the 120 dB re 1 μPa$_{rms}$ isopleth is assumed to be 2.3 km; therefore, the total ensonified area is 1,902.7 km in length and 4.6 km (i.e., 2 x 2.3 km) in width, or 8,752.4 km^2. Of the total ensonified area, 1,296.3 km^2 is located in the Bering Sea, 5,947.3 km^2 is located in the Chukchi Sea, and 1,508.8 km^2 is located in the Beaufort Sea.

Because sound source levels for dynamic positioning reported by Warner and McCrodan (2011) did not exceed 180 dB re 1 μPa$_{rms}$, the calculated ensonifed area represents a Level B harassment zone only (i.e., no area is expected to be ensonified to Level A thresholds [sounds of at least 180 dB re 1 μPa$_{rms}$ for whales and 190 dB re 1 μPa$_{rms}$ for pinnipeds]).

7.1.2.4 Single-beam Echosounder (12 kHz) and Acoustic Positioning Beacons

The sounds produced by the single-beam echosounder (12 kHz) and acoustic positioning beacons (19.23 to 33.75 kHz) are likely to be audible to the ESA-listed whales and seals considered in this Opinion. These systems operate at a higher frequency than will be produced during dynamic positioning (i.e., their frequencies will attenuate more rapidly than frequencies emitted during dynamic positioning). During dynamic positioning, whales and seals will be exposed to noise from dynamic positioning well before noise from the 12 kHz echosounder or acoustic positioning beacons will reached them; therefore, dynamic positioning will mitigate exposure to sounds from these sources.

Boebel et al. (2006) and Lurton and DeRuiter (2011) concluded that single-beam echosounders present a very low risk of auditory damage or other injury to marine mammals. Because echosounders emit energy in concentrated beams, a whale or seal would have to pass a vessel at very close range (i.e., a few meters) and match the vessel's speed in order to experience temporary threshold shift (TTS), a type of temporary hearing impairment (Kremser et al. 2005).[15] The acoustic positioning beacons proposed for use in this project emit energy in a wider beam than the 12 kHz echosounder, but at higher frequencies (19.23 to 33.75 kHz) that attenuate more rapidly. Therefore, to experience exposure to these sounds, whales and seals would have to move in a similar fashion.

7.2 Exposure

Our exposure analyses are designed to identify the ESA-listed resources that are likely to co-occur with the action's effects in space and time, as well as the nature of that co-occurrence. In this step of our analysis, we try to identify the number, age (or life stage), and sex of the individuals that are likely to be exposed to the action's effects and the population(s) or subpopulation(s) those individuals represent.

7.2.1 Dynamic Positioning

The number of marine mammals expected to be taken by behavioral harassment is usually calculated by multiplying the expected densities of marine mammals in the survey area by the area ensonified in excess of 120, but less than 180 dB re 1 μPa_{rms}, though the method to calculate take may vary from consultation to consultation, depending on the information available.

In its IHA application, Quintillion estimated densities of whales during the open-water season (June-October) using aerial survey data collected in the Chukchi and Beaufort seas during the BOEM-funded 2011 to 2013 Aerial Surveys of Arctic Marine Mammals program conducted by NMFS' Alaska Fisheries Science Center Marine Mammal Laboratory, (Clarke et al. 2012, 2013, Clarke et al. 2014, Clarke et al. 2015). Quintillion used data from (Aerts et al. 2014) to calculate ringed seal densities in the Chukchi Sea; however, because of lack of bearded seal density data in the Beaufort Sea, Quintillion assumed a bearded seal density of five percent of ringed seal density in the Beaufort Sea.

During this consultation, we reviewed with the Permits Division the densities Quintillion used in its IHA application (Owl Ridge 2016a) and agreed they constituted the best available scientific information. Quintillion used these densities to calculate exposure in its IHA application. The Permits Division adopted the calculated exposures for use in the proposed IHA and we have adopted them for our exposure analysis. Table 6 summarizes densities and estimated exposures for ESA-listed marine mammals.[16]

Table 6. Densities and estimated exposure of ESA-listed whales and seals to sound levels greater than 120 dB re 1 μPa_{rms} during cable-laying activities in the Bering, Chukchi, and Beaufort Seas, Alaska. Fall density is used for the Beaufort Sea and summer density is used for the Chukchi and Bering Seas because this most closely corresponds to the season during which the majority of work will occur in each area.

	Beaufort Sea		Chukchi and Bering Seas		
Species	Fall Density (# animals/km^2)	Estimated Exposure (# animals)	Summer Density (# animals/km^2)	Estimated Exposure (# animals)	Total Estimated Exposure (# animals)
Cetaceans					
Bowhead whale	0.0742	112	0.0025	18	**130**

[15] Please refer to Section 7.3.1 of this Opinion for further discussion about TTS.

[16] For additional details about how marine mammal densities were derived, please refer to Quintillion's IHA application (Owl Ridge 2016a) or the proposed IHA (81 FR 17666).

Species	Beaufort Sea Fall Density (# animals/km^2)	Beaufort Sea Estimated Exposure (# animals)	Chukchi and Bering Seas Summer Density (# animals/km^2)	Chukchi and Bering Seas Estimated Exposure (# animals)	Total Estimated Exposure (# animals)
Fin whale	N/A	N/A	N/A	N/A	**15**
Humpback whale	N/A	N/A	N/A	N/A	**15**
Pinnipeds					
Bearded seal	0.0125	19	0.0630	456	**475**
Ringed seal	0.2510	379	0.0846	613	**992**

Table adapted from proposed IHA (81 FR 17666).

Although there is evidence of the occasional occurrence of fin and humpback whales in the Chukchi Sea, and occasional occurrence of humpback in the Beaufort Sea, it is unlikely that more than a few individuals will be encountered in those areas. However, Clarke et al. (2011, 2013) and Hartin et al. (2013) reported humpback and fin whale sightings only as far south as the southern extent of their survey area near Point Hope, recent unpublished aerial survey data from the Marine Mammal Laboratory (NMFS unpublished data) indicate higher local densities of humpback and fin whales occurring from Point Hope west to 169^{o} W and south of 69^{o} N. Specifically, Aerial Surveys of Arctic Marine Mammals (ASAMM) results indicate fin whales observed between 2008 and 2015 were all seen during August and September between 67 and 69.5^{o} N. Humpbacks were seen primarily in September between 66.9 and 71.2^{o} N. ASAMM survey effort did not extend south of the southern limit of reported humpback whale sightings (66.9^{o} N).

Given these reported observations near Point Hope, we conclude it is reasonable to expect that project vessels may encounter individual or groups of humpback and fin whales more frequently near to and south of Point Hope than they will while operating north of Cape Lisburne.

Because of the slow speed at which the cable-laying vessel will progress through areas where humpback and fin whale individuals or groups may be feeding, it is reasonable to assume that individual animals may be taken multiple times over the course of multiple days (which would constitute multiple takes because takes are calculated in units of animal days). In the absence of data sufficient to refine the MMPA IHA applicant's requested take of 15 humpback and 15 fin whales, we conclude that these levels of requested take serve as a reasonable approximation of expected take.

We assume the estimated exposures in Table 6 represent the maximum number of whales and seals expected to be exposed to sound levels of at least 120, but less than 180 (for whales) or 190 (for pinnipeds) dB re 1 μPa_{rms} because Quintillion calculated its exposures assuming that dynamic positioning (i.e., the loudest source of sound proposed for use during cable-laying activities) will be used along the entire length of the proposed cable network.

We expect that each whale or seal exposed to sound levels of at least 120, but less than 180 (for whales) or 190 (for pinnipeds) dB re 1 μPa_{rms} during cable-laying activities may exhibit behavioral responses. We expect individuals could be exposed multiple times throughout the survey. Exposed individuals may be male or female and of any age. We expect exposures will be limited to Level B harassment because, as discussed in Section 7.1.2.3 of this Opinion, we do not expect areas to be ensonified to Level A thresholds (i.e., sounds of at least 180 dB re 1 μPa_{rms} for whales and 190 dB re 1 μPa_{rms} for pinnipeds) during dynamic positioning.

Sound source verification, as discussed in Section 2.1.8 of this Opinion, will be conducted on thrusters on one of the cable-lay ships (i.e., dynamic positioning), a nearshore barge during winching along anchor lines, and the associated tugs during anchor-handling when all are operating near Nome. As discussed in Section 2.2 of this Opinion, results of the SSV will be reported to NMFS within 14 days.

7.2.2 Single-beam Echosounder (12 kHz) and Acoustic Positioning Beacons

Though it is possible that whales and seals could be exposed to sounds above the 160 dB re 1 μPa_{rms} threshold from the pulsed sounds produced by the single-beam echosounder (12 kHz) and acoustic positioning beacons, the ensonified area associated with single-beam echosounder operation will be fully encompassed by the ensonified area associated with dynamic positioning and will be operating concurrently with dynamic positioning. Therefore we do not anticipate any additional take associated with this stressor.

7.3 Response

Strong underwater sounds can result in physical effects on the marine environment that can affect marine organisms. Possible responses by ESA-listed whales and seals to the continuous sound produced by dynamic positioning considered in this analysis are:

- Threshold shifts
- Auditory interference (masking)
- Behavioral responses
- Non-auditory physical or physiological effects

This analysis also considers information on the potential effects on prey of ESA-listed species in the action area.

7.3.1 Threshold Shifts

Exposure of marine mammals to very strong sounds can result in physical effects, such as changes to sensory hairs in the auditory system, which may temporarily or permanently impair hearing. Temporary threshold shift (TTS) is a temporary hearing change and its severity is dependent upon the duration, frequency, sound pressure, and rise time of a sound (Finneran and Schlundt 2013). TTSs can last minutes to days. Full recovery is expected and this condition is not considered a physical injury. At higher received levels, or in frequency ranges where animals are more sensitive, permanent threshold shift (PTS) can occur. When PTS occurs, auditory sensitivity is unrecoverable (i.e., permanent hearing loss). Both TTS and PTS can result from a single pulse or from accumulated effects of multiple pulses from an impulsive sound source (i.e., 12 kHz single-beam echosounder and acoustic positioning beacon) or from accumulated effects of non-pulsed sound from a continuous sound source (i.e., thrusters during dynamic positioning). In the case of exposure to multiple pulses, each pulse need not be as loud as a single pulse to have the same accumulated effect.

7.3.1.1 Whales

Few data are available to define the hearing range, frequency sensitivities, or sound levels necessary to induce TTS or PTS in whales. The best available information comes from captive studies of toothed whales, studies of terrestrial mammal hearing, and extensive modeling (Finneran et al. 2000, Schlundt et al. 2000, Finneran et al. 2002, Finneran et al. 2003a, Nachtigall et al. 2003, Nachtigall et al. 2004, Finneran et al. 2005, Finneran et al. 2007, Lucke et al. 2009, Mooney et al. 2009a, Mooney et al. 2009b, Finneran et al. 2010a, Finneran et al. 2010b, Finneran and Schlundt 2010, Popov et al. 2011a, Popov et al. 2011b, Kastelein et al. 2012a, Kastelein et al. 2012b).

Both duration and pressure level of a sound are factors in inducement of threshold shift. Exposure to non-pulsed sound (i.e., thruster noise from dynamic positioning) may induce more threshold shift than exposure to a pulsed sound with the same energy; however, this is dependent on the duty cycle of the pulsed source (because some recovery may occur between exposures) (Kryter et al. 1966, Ward 1997). For example, exposure to one pulse of a sound with a higher sound pressure level than a continuous sound may induce the same impairment as that continuous sound; however, exposure to the continuous sound may cause more impairment than exposure to a series of several intermittent softer sounds with the same total energy (Ward 1997). Temporary threshold shift was reported in toothed whales after exposure to relatively short, continuous sounds (ranging from 1 to 64 sec) at relatively high sound pressure levels (ranging from 185 to 201 dB re 1 μPa_{rms}) (Ridgway et al. 1997, Schlundt et al. 2000, Finneran et al. 2005, Finneran et al. 2007); however, toothed whales experienced TTS at lower sound pressure levels (160 to 179 dB re 1 μPa_{rms}) when exposed to continuous sounds of relatively long duration (ranging from 30 to 54 min) (Nachtigall et al. 2003, Nachtigall et al. 2004).

For a single pulse at a given frequency, sound levels of approximately 196 to 201 dB re 1 μPa_{rms} are required to induce low-level TTS (Southall et al. 2007). PTS is expected at levels approximately 6 dB greater than TTS levels on a peak-pressure basis (Southall et al. 2007).

To experience TTS from a continuous source, a whale will have to remain in the 2.3 km-radius ZOI for an extended period of time and will need to remain in the ZOI even longer to experience PTS. Once cable-laying activities using dynamic positioning begin on a given section, they will continue 24 hours a day until the end of the cable section is reached. In general, we expect whales will transit through or around the ensonified area during dynamic positioning, though it is possible they may remain in the area if highly motivated by the presence of a food source. In this instance, it is possible that a whale could experience TTS if it chooses to remain in the ensonifed area for an extended period. Though the exact time a whale will need to remain in the ensonified area to experience threshold shift is not known, based on the findings from Nachtigall et al. (2003) and Nachtigall et al. (2004), we estimate a whale will need to remain in the ensonified zone for tens of minutes to experience low-level TTS and likely several to tens of hours to experience PTS, if at all.

As described in section 7.1.2.4 of this Opinion, whales would have to pass a vessel at close range and match the vessel's speed in order to experience TTS; however, the near-source sound pressure levels of the 12 kHz single-beam echosounder or acoustic positioning beacons (i.e., pulsed sources) proposed here have lower near-source sound pressure levels (185 and 187 dB re 1 μPa_{rms}, respectively) than the 196 dB re 1 μPa_{rms} sound pressure level estimated to induce TTS in whales. Due to the comparatively low source level, in order to experience TTS during the proposed activities, whales would need to remain within a few meters of the vessel for an extended period, a behavior of whales we consider extremely unlikely to occur.

7.3.1.2 Pinnipeds

Data are lacking on effects to pinnipeds exposed to impulsive sounds (Southall et al. 2007, NOAA 2015), and the energy levels required to induce TTS or PTS in pinnipeds are not known. Finneran et al.

(2003b) exposed two California sea lions to single underwater pulses up to 183 dB re 1 μPa_{p-p} and found no measurable TTS following exposure. Southall et al. (2007) estimated TTS will occur in pinnipeds exposed to a single pulse of sound at 212 dB re 1 μPa_{0-p} and PTS will occur at 218 dB re 1 μPa_{0-p}. Kastak et al. (2005) indicated pinnipeds exposed to continuous sounds in water experienced the onset of TTS from 152 to 174 dB re 1 μPa_{rms}.[17] Southall et al. (2007) estimated PTS will occur in pinnipeds exposed to continuous sound pressure levels of 218 dB re: 1 μPa_{0-p}.

During dynamic positioning, it is possible that ringed or bearded seals will remain in the ZOI if highly motivated by the presence of food and experience TTS; however, we expect it is highly unlikely bearded or ringed seals will experience PTS as a result of the exposure to noise from dynamic positioning because of the relatively low estimated thruster near-source sound pressure level (171 dB re 1 μPa_{rms} at 1 m).

White it is possible that bearded or ringed seals may hear the 12 kHz single-beam echosounder or the acoustic positioning beacons if they come within a few meters of the devices, it is extremely unlikely that bearded or ringed seals will experience TTS or PTS as a result of exposure to the pulses due to their relatively low near-source sound pressure levels (185 and 187 dB re 1 μPa_{rms}, respectively). In addition, this source will not be operating in isolation, and we expect co-occurrence with vessel operations. Many pinnipeds would move away in response to the approaching vessel before they would be in close enough proximity to echosounder or acoustic positioning beacons for exposure to occur.

7.3.2 Auditory Interference (Masking)

Auditory interference, or masking, occurs when an interfering noise is similar in frequency and loudness to (or louder than) the auditory signal received by an animal while it is processing echolocation signals or listening for acoustic information from other animals (Francis and Barber 2013). Masking can interfere with an animal's ability to gather acoustic information about its environment, such as predators, prey, conspecifics, and other environmental cues (Francis and Barber 2013).

There are overlaps in frequencies between dynamic positioning noise, the 12 kHz single-beam echosounder, and the acoustic positioning devices and the assumed hearing ranges of the ESA-listed whales and seals considered in this Opinion. The proposed activities could mask vocalizations or other important acoustic information. This could affect communication among individuals or affect their ability to receive information from their environment. We generally expect whales and seals will transit through or around the ZOI during dynamic positioning and that any masking during this time will be brief; however, it is possible that individuals may remain in ZOI if they are highly motived to stay due to the presence of a food source. In this instance, masking may affect an individual's ability to locate prey or interfere with communication among individuals.

It is possible that whales and seals may pass near enough to the 12 kHz single-beam echosounder, and the acoustic positioning devices to experience masking; however, given the short duration of pulses (generally less than one second) of these types of devices, any masking that occurs will be brief and we do not expect the pulses will mask vocalization or interfere with communication of whales or seals to a significant extent.

[17] Values originally reported as sound exposure level of 183 to 206 dB re 1 μPa^2-s.

7.3.3 Behavioral Responses

We expect the majority of bowhead, fin, and humpback whale and bearded and ringed seal responses to the proposed activities will occur in the form of behavioral response.

Marine mammals may exhibit a variety of behavioral changes in response to underwater sound, which can be generally summarized as:

- Modifying or stopping vocalizations
- Changing from one behavioral state to another
- Movement out of feeding or breeding areas

In cases where whale or seal response is brief (i.e., changing from one behavior to another, relocating a short distance, or ceasing vocalization), effects are not likely to be significant at the population level, but could rise to the level of take of individuals as indicated in Table 6.

Marine mammal responses to anthropogenic sound vary by species, state of maturity, prior exposure, current activity, reproductive state, time of day, and other factors (Ellison et al. 2012). This is reflected in a variety of aquatic, aerial, and terrestrial animal responses to anthropogenic noise that may ultimately have fitness consequences (Francis and Barber 2013).

7.3.3.1 Whales

We are not aware of studies which address behavioral responses of ESA-listed whales to dynamic positioning or the pulsed sources considered in this Opinion, though several studies have investigated the responses of whales to drilling operations (a continuous noise source) and airguns (a pulsed noise source). Though drilling operations and airguns generally produce stronger acoustic output (i.e., louder sounds that attenuate more slowly) than the sources proposed for use in this project, these studies are relevant in determining potential responses of whales to sounds from the proposed activities in the action area.

Several studies describe bowhead whale calling behavior in response to sounds from airguns in the Beaufort Sea. In general, calling rates of bowhead whales tend to decrease in the presence of seismic activities at distances up to 45 km (28 mi) (Greene Jr. et al. 1999, Blackwell et al. 2013); however, there is no consensus on the cause of the decrease. Calling rates may decrease in the presence of airgun sound because bowhead whales are making fewer calls, avoiding the area, or a combination of both. An increase in bowhead calling rate near seismic surveys has also been documented; though this could have been the result of insufficient data for comparison of calling rates (Greene Jr. et al. 1999).

Exposure to sound from dynamic positioning, the 12 kHz single-beam echosounder, or acoustic positioning beacons may cause ESA-listed whales to change from one behavioral state to another. An individual whale's behavioral response to sound is likely a function of many factors, including sound frequency, intensity, duration, the behavior in which the whale is engaged, and other factors. Based on responses of whales to seismic and drilling activities, possible responses of whales during the proposed activities include alterations in breathing patterns, feeding patterns, migration routes, and behavioral shifts (Malme et al. 1983, 1984, Richardson et al. 1985, Malme et al. 1986, Richardson et al. 1986, Koski and Johnson 1987, Ljungblad et al. 1988, Wartzok et al. 1989, Richardson et al. 1990, Richardson and Malme 1993, Richardson et al. 1995, Miller et al. 1999, Richardson et al. 1999, Schick and Urban 2000, Bisson et al. 2013, Quakenbush et al. 2013).

We do not expect every whale will respond to sounds from the proposed activities in the same manner, and some whales may exhibit no obvious response. Given the documented responses of whales to seismic and drilling activities (i.e., sources more powerful than those proposed for use in this project), we expect that for whales that do exhibit behavioral responses to dynamic positioning, the following will be the most impactful effects:

- temporary displacement from feeding areas to other, perhaps less productive, feeding areas
- temporary disruption of breeding activities
- deflection of a few kilometers from travel or migration routes

We do not expect dynamic positioning will substantially impact feeding or breeding opportunities and we do not expect traveling or migrating whales will alter their routes by large distances (i.e., more than a few kilometers around proposed project activities).

As discussed in Section 7.1.2.4 of this Opinion, whales will need to be within a few meters of the 12 kHz single-beam echosounder and acoustic positioning beacons to be exposed to sounds from the devices. In general, we expect whales will not be exposed to these sounds; however, if they are, we expect any behavioral response will be in the form of a brief startle.

7.3.3.2 Seals

Information on behavioral reactions of pinnipeds in water to multiple pulses is known from exposures to small explosives used in fisheries interactions, impact pile driving, and seismic surveys. In general, exposure of pinnipeds in water to multiple pulses of sound pressure levels ranging from approximately 150 to 180 dB re 1μPa$_{rms}$ has limited potential to induce avoidance behavior (Southall et al. 2007). Received levels exceeding 190 dB re 1μPa$_{rms}$ are likely to induce avoidance responses in at least some ringed seals (Harris et al. 2001, Blackwell et al. 2004, Miller et al. 2005). During seismic operations in the Beaufort Sea, seals tended to avoid entering the zone around the seismic vessel in which received levels exceeded 190 dB re 1μPa$_{rms}$, though some seals did enter that zone (Harris et al. 2001). Most ringed seals exposed to airgun pulses from approaching seismic vessels showed little avoidance unless received levels were high enough that TTS was likely (Southall et al. 2007). Seals at the surface of the water experience less powerful sounds than they do if they are the same distance away, but underwater, which may account for the apparent lack of strong reactions in ice seals (NMFS 2013a).

Less information is available on behavioral reactions of pinnipeds in water to continuous sounds. Using data from pinniped exposures to acoustic harassment devices, a research tomography source, and underwater data communication sources, Southall et al. (2007) suggested that exposure to continuous sound sources with sound pressure levels between approximately 90 to 140 dB re: 1 μPa have limited potential to induce strong behavioral responses in pinnipeds.

The examples provided above involve much more powerful acoustic sources than those proposed for use in this project; therefore, we do not expect bearded or ringed seals will exhibit strong behavioral reactions to the proposed activities. Because seals do not tend to avoid areas of received sound pressure levels of 150 to 180 dB re 1μPa$_{rms}$, we expect that bearded and ringed seals will occasionally enter the ZOI during dynamic positioning activities. Because we do not expect bearded or ringed seals will exhibit strong reaction to dynamic positioning activities, we do not expect project activities will impact feeding, breeding, or resting opportunities.

As discussed in Section 7.1.2.4 of this Opinion, seals will need to be within a few meters of the 12 kHz single-beam echosounder and acoustic positioning beacons to be exposed to sounds from the devices. In general, we expect seals will not be exposed to these sounds; however, if they are, we expect any behavioral response will be in the form of a brief startle.

7.3.4 Physical and Physiological Effects

Individuals exposed to noise can experience stress and distress, where stress is an adaptive response that does not normally place an animal at risk, and distress is a stress response resulting in a biological consequence to the individual. Both stress and distress can affect survival and productivity (Curry and Edwards 1998, Cowan and Curry 2002, Herráez et al. 2007, Cowan and Curry 2008). Mammalian stress levels can vary by age, sex, season, and health status (St. Aubin et al. 1996, Gardiner and Hall 1997, Hunt et al. 2006, Keay et al. 2006, Romero et al. 2008).

Loud noises generally increase stress indicators in mammals (Kight and Swaddle 2011). During the time following September 11, 2001, shipping traffic and associated ocean noise decreased along the northeastern U.S. This decrease in ocean noise was associated with a significant decline in fecal stress hormones in North Atlantic right whales, suggesting that chronic exposure to increased noise levels, although not acutely injurious, can produce stress (Rolland et al. 2012). These levels returned to their previous level within 24 hrs after the resumption of shipping traffic. Exposure to loud noise can also adversely affect reproductive and metabolic physiology (Kight and Swaddle 2011). In a variety of factors, including behavioral and physiological responses, females appear to be more sensitive or respond more strongly than males (Kight and Swaddle 2011).

Whales and seals use hearing as a primary way to gather information about their environment and for communication; therefore, we assume that limiting these abilities is stressful. Stress responses may also occur at levels lower than those required for TTS (NMFS 2006). Therefore, exposure to levels sufficient to trigger onset of PTS or TTS are expected to be accompanied by physiological stress responses (National Research Council 2003, NMFS 2006).

As discussed in the previous sections of this Opinion, we expect individuals may experience TTS (but are not likely to experience PTS), may experience masking, and may exhibit behavioral responses from project activities. Therefore, we expect ESA-listed whales and seals may experience stress responses. If whale and seals are not displaced and remain in a stressful environment (i.e. within the ZOI dynamic positioning activities), we expect the stress response will dissipate shortly after leaves the area or after the cessation of dynamic positioning. Similarly, if whales or seals are exposed to sounds from the 12 kHz single-beam echosounder or acoustic positioning beacons, we expect a stress response will accompany a brief startle response. However, in any of the above scenarios, we do not expect significant or long-term harm to individuals from a stress response.

7.3.5 Strandings

There is evidence that sound from some sonar sources has played a role in the strandings of marine mammals. Investigations of a 2008 stranding event in Madagascar suggested a 12 kHz multi-beam sonar played a significant role in the mass stranding of melon-headed whales (Southall et al. 2013). Though the authors note that pathological data suggesting direct physical effects are lacking, all other possibilities were either ruled out or believed to be of much lower likelihood as a cause of or contributor to the stranding (Southall et al. 2013). This incident highlights the caution needed when interpreting effects that may or may not stem from anthropogenic sound sources, such as the 12 kHz single-beam echosounder and acoustic positioning beacons proposed for use in this project. Though the use of these types of sonar are common worldwide and effects of this magnitude have not been documented for ESA-listed species, it is possible that the combination of exposure to sonar sources with other factors, such as those below, could combine to produce a response that is greater than would otherwise be anticipated or has been documented (Ellison et al. 2012, Francis and Barber 2013):

- Behavioral and reproductive state
- Oceanographic and bathymetric conditions
- Movement of the source
- Previous experience of individuals with the stressor

The 12 kHz single-beam echosounder proposed for use in this project differs from the 12 kHz multibeam sonar system used in Madagascar in the following ways (Southall et al. 2013):

- The multibeam sonar's source levels were higher (236 to 242 vs. 185 dB re 1µPa$_{rms}$)
- The beamwidth was greater (150 vs. 50 degrees)
- The system was composed of multiple beams (191 vs. 1)

Because of these differences, the area ensonifed by the 12 kHz single-beam echosounder will be much smaller than the multi-beam sonar used in Madagascar. The acoustic positioning beacons will not operate at frequencies of 12 kHz (frequencies will range from 19.23 to 33.75 kHz).

Stranding events associated with the operation of naval sonar suggest that mid-frequency sonar sounds may have the capacity to cause serious impacts to marine mammals (NMFS and Navy 2001). The acoustic systems proposed for use in this project differ from sonars used during naval operations, which generally have a longer pulse duration and more horizontal orientation than the 12 kHz single-beam echosounder and acoustic positioning beacons. The sound energy received by any individuals exposed to these systems during the proposed activities will be lower than that of naval sonars, and will be briefer. The area of possible influence is also smaller, consisting of a small area around and below the sources.

As discussed in Section 7.1.2.4 of this Opinion, whales and seals will need to be within a few meters of the 12 kHz single-beam echosounder and acoustic positioning beacons to be exposed to sounds from the devices. In general, we expect whales and seals will not be exposed to these sounds; however, if they are, we expect any behavioral response will be in the form of a brief startle. We do not expect exposure to sounds from sub-bottom profilers will result in stranding events.

7.3.6 Marine Mammal Prey

Anthropogenic noises may have indirect, adverse effects on prey availability through lethal or sub-lethal damage, stress responses, or alterations in their behavior or distribution. Effects from exposure to high-intensity sound sources have been documented in fish and invertebrates, including stress (Santulli et al. 1999), injury (McCauley et al. 2003), TTS (Popper et al. 2005), and changes in balance (Dalen and Knutsen 1986). In general, we expect fish will be capable of moving away from project activities if they experience discomfort. We expect the area in which stress, injury, TTS, or changes in balance, of prey species may occur (if at all) will be limited to a few meters directly around the thrusters and acoustic sources proposed for use in this project. Prey species may startle and disperse when exposed to sounds from project activities, but we expect any disruptions will be temporary. We do not expect effects to prey species will be sufficient to affect ESA-listed whales and seals.

Cable-laying activities may impact prey species of ESA-listed whales and seals by crushing, dislodging, smothering (i.e., clogging of the gills or other feeding structures) with displaced sediment, or killing aquatic organisms in or on the seafloor during the PLGR and cable-burying activities. The PLGR will disturb the seafloor in an area of approximately 0.73 km^2 (1 m [grapnel width] × 730 km [PLGR length]) and cable-burying activities will disturb approximately 2.19 km^2 (3 m [assumed ROV or plough width] × 730 km [length of cable burial route]), for a total area of disturbance from PLGR and cable-burial activities of approximately 2.92 km^2 in the Bering, Chukchi, and Beaufort Seas. We do not expect that impacts to prey species in this comparatively small area will be sufficient to affect ESA-listed whales and seals.

7.3.7 Response Summary

Of the responses considered above, we do not expect PTS or strandings will occur. We expect TTS, masking, behavioral responses, and physical and physiological effects may occur in bowhead, fin, and humpback whales, and Arctic ringed and Beringia DPS bearded seals. Though project activities may cause TTS, interruptions in communications (masking), avoidance of the action area, and stress associated with these disruptions in exposed individual whales and seals, we expect all effects will be temporary. Prey species may experience stress, injury, TTS, or changes in balance in a small radius directly around the thrusters and acoustic sources or startle and disperse when exposed to sounds from project activities. Prey species on or in the seafloor may be crushed, dislodged, smothered, or killed during PLGR and cable-burying activities. We do not expect effects to prey species will be sufficient to affect ESA-listed whales or seals.

8 CUMULATIVE EFFECTS

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation, per section 7 of the ESA.

We searched for information on non-Federal actions reasonably certain to occur in the action area. We did not find any information about non-Federal actions other than what has already been described in the Environmental Baseline (Section 6 of this Opinion). We expect climate change, fisheries, harvest, noise, oil and gas activities, pollutants and discharges, scientific research, and ship strike will continue into the future. We expect moratoria on commercial whaling and bans on commercial sealing will remain in place, aiding in the recovery of ESA-listed whales and seals.

9 INTEGRATION AND SYNTHESIS OF EFFECTS

The narrative that follows integrates and synthesizes the information contained in the Status of the Species (Section 5), the Environmental Baseline (Section 6) and the Effects of the Action (Section 7) sections of this Opinion to assess the risk that the proposed activities pose to ESA-listed whales and seals.

The survival and recovery of bowhead, fin, and humpback whales, and Arctic ringed and Beringia DPS bearded seals in the action area may be affected by:

- Climate change
  - Prey distribution
  - Habitat quality

- Fisheries interactions
- Subsistence harvests
- Natural and anthropogenic noise
- Oil and gas activities
- Pollutants and discharges
- Scientific research
- Ship strike

Despite these pressures, available trend information indicates bowhead, fin, and humpback whale populations are increasing. Population trends for Arctic ringed and Beringia DPS bearded seals are not known, but we expect loss of seasonal sea ice will endanger these species in the foreseeable future.

We concluded in the Effects of the Action (Section 7 of this Opinion) that ESA-listed whales and seals may be harassed by the proposed activities. We expect the following number of whales and seals represent the maximum number of individuals that will be exposed to sounds of at least 120 dB re 1 μPa_{rms} but less than 180 (for whales) or 190 (for seals) dB re 1 μPa_{rms} (i.e., will be exposed to Level B harassment) from thruster noise during dynamic positioning:

- 130 bowhead whales
- 15 fin whales
- 15 humpback whales
- 475 bearded seals
- 992 ringed seals

We expect these exposures may cause TTS and interruptions in communication (i.e., masking) and could elicit the following behavioral responses:

- Temporary displacement from feeding areas
- Temporary disruption of breeding activities
- Avoidance of the ensonified area

We expect low-level, brief stress responses will accompany these responses. We do not expect whales or seals exposed to these sounds will experience a reduction in fitness.

Prey species may experience stress, injury, TTS, changes in balance, or may be displaced when exposed to sounds from project activities. Prey species on or in the seafloor may be crushed, dislodged, smothered, or killed during PLGR and cable-burying activities. We do not expect these effects will limit the prey available to ESA-listed whales and seals.

In summary, we do not expect exposure to any of the stressors related to the proposed project to reduce fitness in any individual whale or seal. Therefore, we do not expect fitness consequences to ESA-listed whale or seal populations or species.

10 Conclusion

After reviewing the current status of ESA-listed whale and seal species, the environmental baseline for the action area, the anticipated effects of the proposed activities, and the possible cumulative effects, it is NMFS's biological opinion that the proposed issuance of Corps permit POA-2015-529 to Quintillion for the proposed fiber optic cable-laying project in the Bering, Chukchi, and Beaufort Seas, Alaska, and the Permits Division's proposed related action of issuing an IHA to Quintillion are **not likely to jeopardize the continued existence of the following species:**

- **Bowhead whale**
- **Fin whale**
- **Humpback whale**
- **Arctic ringed seal**
- **Beringia DPS bearded seal**

In addition, the proposed action is not likely to adversely affect the following species or critical habitat:

- Blue whale
- North Pacific right whale
- Sperm whale
- Western DPS gray whale
- Western DPS Steller sea lion
- North Pacific right whale critical habitat
- Steller sea lion critical habitat

11 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the "take" of endangered species 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. 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.

Section 7(b)(4)(C) of the ESA specifies that in order to provide an Incidental Take Statement for an endangered or threatened species of marine mammal, the taking must first be authorized under section 101(a)(5) of the MMPA. Accordingly, **the terms of this Incidental Take Statement and the exemption from Section 9 of the ESA become effective only upon the issuance of MMPA authorization to take the marine mammals identified here (Section 9 of the ESA, however, does not apply to ringed or bearded seals)**. Absent such authorization, this Incidental Take Statement is inoperative.

The Terms and Conditions described below are nondiscretionary, and must be undertaken by the Corps and Permits Division so that they become binding conditions for the exemption in section 7(o)(2) to apply. Section 7(b)(4) of the ESA requires that when a proposed agency action is found to be consistent with section 7(a)(2) of the ESA and the proposed action may incidentally take individuals of ESA-listed species, NMFS will issue a statement that specifies the impact of any incidental taking of endangered or threatened species.

The ESA does not prohibit the taking of threatened species unless special regulations have been promulgated, pursuant to ESA Section 4(d), to promote the conservation of the species. ESA Section 4(d) rules have not been promulgated for Arctic ringed or Beringia DPS bearded seals; therefore, ESA section 9 take prohibitions do not apply. This incidental take statement includes numeric limits on taking of these species because this amount of take was analyzed in our jeopardy analysis. These numeric limits provide guidance to the action agency on its requirement to re-initiate consultation if the amount of take estimated in the jeopardy analysis of this biological opinion is exceeded. This ITS includes reasonable and prudent measures and terms and conditions designed to minimize and monitor take of these threatened species.

11.1 Amount or Extent of Take

The section 7 regulations require NMFS to estimate the number of individuals that may be taken by proposed actions or the extent of land or marine area that may be affected by an action, if we cannot assign numerical limits for animals that could be incidentally taken during the course of an action (50 CFR § 402.14 (i); see also 51 FR 19926, 19953-54 (June 3, 1986)).

NMFS anticipates the proposed Quintillion subsea fiber optic cable-laying project in the Bering, Chukchi, and Beaufort Seas, Alaska, between June 2016 and October 2016, is likely to result in the incidental take of ESA-listed species by harassment. As discussed in Section 7.2 of this Opinion, the proposed action is expected to take, by Level B harassment, the following number of ESA-listed individuals:

- 130 bowhead whales
- 15 fin whales
- 15 humpback whales
- 475 bearded seals
- 992 ringed seals

Harassment of these individuals will occur by exposure to received sound from continuous sound sources with received sound levels of least 120 dB re 1 μPa_{rms} (i.e., within the ZOI for dynamic positioning), but less than 180 dB re 1 μPa_{rms} (for whales) or 190 dB re 1 μPa_{rms} (for seals). The take estimate is based on the best available information of whale and seal densities in the area that will be ensonified at sound pressure levels equal to or greater than 120 dB re 1 μPa_{rms}. This incidental take will result primarily from exposure to acoustic energy from thrusters during dynamic positioning and will be in the form of harassment. Death or injury is not expected for any individual whales or seals that are exposed to these sounds.

ESA-listed whales and seals observed within the ZOI during dynamic positioning will be considered to be taken, even if they exhibit no overt behavioral reactions.

Any incidental take of ESA-listed whales and seals considered in this consultation is restricted to the permitted action as proposed. If the actual incidental take exceeds the predicted level or type, the Corps and Permits Division must reinitiate consultation. Likewise, if the action deviates from what is described in Section 2 of this Opinion, the Corps and Permits Division must reinitiate consultation. All anticipated takes will be by harassment, as described previously, involving temporary changes in behavior.

11.2 Effect of the Take

In this Opinion, NMFS has determined that the level of incidental take is not likely to jeopardize the continued existence of any ESA-listed species.

11.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02). NMFS concludes the reasonable and prudent measure described below, along with its implementing terms and conditions, is necessary and appropriate to minimize the amount of incidental take of ESA-listed whales resulting from the proposed actions. These measures are non-discretionary and must be a binding condition of the Corps' and Permits Division's authorizations for the exemption in section 7(o)(2) to apply. If the Corps and/or Permits Division fails to ensure Quintillion's compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse:

- The Corps and Permits Division must require Quintillion to implement and monitor the effectiveness of mitigation measures incorporated as part of the proposed authorization for the incidental taking of ESA-listed marine mammals pursuant to section 101(a)(5)(D) of the MMPA, as specified below. In addition, they must submit reports to NMFS AKR that evaluate the mitigation measures and report the results of the monitoring program, as specified below.

This Reasonable and Prudent Measure, along with its implementing terms and conditions, is also designed to minimize the impact of incidental take of Beringia DPS bearded seals and Arctic ringed seals that might otherwise result from the proposed action.

11.4 Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the Corps and Permits Division must require Quintillion to comply with the following terms and conditions, which implement the reasonable and prudent measure described above and outline the mitigation, monitoring, and reporting measures required by section 7 regulations (50 CFR 402.14(i)). These terms and conditions are non-discretionary. If the Permits Division fails to ensure compliance with these terms and conditions and their implementing reasonable and prudent measures, the protective coverage of section 7(o)(2) may lapse.

To implement the reasonable and prudent measure, the Corps and Permits Division will ensure that Quintillion adheres to all portions of the description of the action (Section 2 of this Opinion), especially mitigation and monitoring measures described in Sections 2.1.7 and 2.2 of this Opinion. The Corps and Permits Division will also ensure that Quintillion adheres to the following Terms and Conditions:[18]

1. Monthly PSO reports, a final PSO report, and completed marine mammal observation record forms (developed by Quintillion) will be provided during the project. Items 1.1 through 1.4, below, provide details about what must be included in the reports.
    - 1.1. The reporting period for each monthly PSO report will be the entire calendar month, and reports will be submitted by close of business on the 5th business day of the month following the end of the reporting period (e.g., The monthly report covering June 1 through 30, 2016, will be submitted to NMFS Alaska Region by close of business [i.e., 5:00 pm, AKDT] on July 8, 2016).
        - 1.1.1. Completed marine mammal observation record forms, in electronic format, will be provided to NMFS Alaska Region in monthly reports.
        - 1.1.2. Observer report data will include the following for each listed marine mammal observation (or "sighting event" if repeated sightings are made of the same animal[s]):
            - 1.1.2.1. Species, date, and time for each sighting event

[18] These terms and conditions are in addition to reporting required by the Permits Division.

1.1.2.2. Number of animals per sighting event and number of adults/juveniles/calves/pups per sighting event
1.1.2.3. Primary, and, if observed, secondary behaviors of the marine mammals in each sighting event
1.1.2.4. Geographic coordinates for the observed animals, with the position recorded by using the most precise coordinates practicable (coordinates must be recorded in decimal degrees, or similar standard, and defined coordinate system)
1.1.2.5. Time and description of most recent project activity prior to marine mammal observation
1.1.2.6. Environmental conditions as they existed during each sighting event, including, but not limited to:
1.1.2.6.1. Beaufort Sea State
1.1.2.6.2. Weather conditions
1.1.2.6.3. Visibility (km/mi)
1.1.2.6.4. Lighting conditions
1.1.2.6.5. Percentage of ice cover
1.1.3. Observer report data will also include the following for each take of a marine mammal that occurs in the manner and extent as described in Section 11.1 of this Opinion:
1.1.3.1. All information listed under Item 1.1.2, above
1.1.3.2. Cause of the take (e.g., bowhead whale within Level B zone during cable-laying from the *Ile de Brehat*)
1.1.3.3. Time the animal(s) entered the zone, and, if known, the time it exited the zone
1.1.3.4. Any mitigation measures implemented prior to and after the animal entered the zone
1.2. A final technical report will be submitted to NMFS Alaska Region within 90 days after the final cable has been laid and all vessels have left the action area. The report will summarize all project activities and results of marine mammal monitoring conducted during project activities. The final technical report will include all elements from Item 1.1, above, as well as:
1.2.1. Summaries that include monitoring effort (e.g., total hours, total distances, and marine mammal distribution through the study period, accounting for sea state and other factors that affect visibility and detectability of marine mammals)
1.2.2. Analyses on the effects from various factors that influences detectability of marine mammals (e.g., sea state, number of observers, fog, glare, etc.)
1.2.3. Species composition, occurrence, and distribution of marine mammal sightings, including date, water depth, numbers, age/size/sex categories (if determinable), group sizes, and ice cover
1.2.4. Species composition, occurrence, and distribution of marine mammal takes, including date, water depth, numbers, age/size/sex categories (if determinable), group sizes, and ice cover
1.2.5. Analyses of effects of project activities on listed marine mammals
1.2.6. Number of marine mammals observed and taken (by species) during periods with and without project activities (and other variables that could affect detectability), such as:
1.2.6.1. Initial sighting distances versus project activity at time of sighting
1.2.6.2. Observed behaviors and movement types versus project activity at time of sighting

1.2.6.3. Numbers of sightings/individuals seen versus project activity at time of sighting
1.2.6.4. Distribution around the action area versus project activity at time of sighting

1.3. If unauthorized take occurs, (i.e., Level A take of ESA-listed species in Table 3 or any take of ESA-listed species not included in the same table), it must be reported to NMFS Alaska Region within one business day to the contact listed in Item 1.4, below. Observation records for ESA-listed marine mammals taken in a manner or to the extent other than described in Section 11.1 of this Opinion must include:
1.3.1. All information listed under Item 1.1, above
1.3.2. Number of listed animals taken
1.3.3. Date and time of each take
1.3.4. Cause of the take (e.g., sperm whale observed within Level B zone or ship-strike of a humpback whale)
1.3.5. Time the animal(s) entered the zone, and, if known, the time it exited the zone, if applicable
1.3.6. Mitigation measures implemented prior to and after the animal entered the zone, if applicable

1.4. NMFS Contact:
Monthly and final reports and reports of unauthorized take will be submitted to:
NMFS Alaska Region, Protected Resources Division
Greg Balogh
greg.balogh@noaa.gov
907-271-3023 or 907-271-5006

12 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on ESA-listed species or critical habitat, help implement recovery plans, or develop information (50 CFR 402.02).

We offer the following conservation recommendations, which will provide information for future consultations involving the issuance of permits that may affect ESA-listed whales and seals:

- **Behavioral responses of marine mammals**: We recommend that the Permits Division summarize findings from past IHA holders about behavioral responses of ESA-listed species to sounds from dynamic positioning. Better understanding of how ESA-listed species have responded to sounds from past projects will inform our exposure and response analyses in the future.
- **Collaboration with operators**: We recommend that Quintillion collaborate with other industrial operators in the area (i.e., SAE and Fairweather) to integrate and synthesize monitoring results as much as possible (such as submitting sightings from their monitoring projects to an online data archive like OBIS-SEAMAP), and archiving and making the complete database available upon request.

In order for the NMFS Alaska Region to be kept informed of actions minimizing or avoiding adverse effects on, or benefiting, ESA-listed species or their habitats, the Permits Division should notify the NMFS Alaska Region of any conservation recommendations it implements.

13 Reinitiation Notice

This concludes formal consultation on the proposed issuance of Corps permit POA-2015-529 and an IHA to Quintillion for the installation of a subsea fiber optic cable network along the northern and western coasts of the Bering, Chukchi, and Beaufort Seas, Alaska. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if:

- The amount or extent of proposed take is exceeded.
- New information reveals effects of the agency action that may affect ESA-listed species or critical habitat in a manner, or to an extent, not considered in this opinion.
- The agency action is subsequently modified in a manner that causes an effect to the ESA-listed species, or critical habitat not considered in this opinion.
- A new species is ESA-listed or critical habitat designated that may be affected by the action.

In instances where the amount or extent of authorized take and/or effects to critical habitat is exceeded, the Corps and Permits Division must immediately request reinitiation of section 7 consultation.

14 LITERATURE CITED

Aerts, L. A. M., C. L. Christman, C. A. Schudel, W. Hetrick, and D. Snyder. 2014. Marine mammal distribution and abundance in the northeastern Chukchi Sea from shipboard surveys during summer and early fall, 2008–2013. Final report prepared by LAMA Ecological, Anchorage, Alaska, for ConocoPhillips Company, Shell Exploration & Production Company, and Statoil USA E & P, Inc., all of Anchorage, Alaska.

Allen, B. M., and R. P. Angliss. 2015. Alaska marine mammal stock assessments, 2014. NOAA Technical Memorandum NMFS-AFSC-301, Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Seattle, Washington.

Au, W. W. L. 2000. Hearing in whales and dolphins: an overview. Pages 1-42 *in* W. W. L. Au, A. N. Popper, and R. R. Fay, editors. Hearing by Whales and Dolphins. Springer-Verlag, New York.

Au, W. W. L., A. A. Pack, M. O. Lammers, L. M. Herman, M. H. Deakos, and K. Andrews. 2006. Acoustic properties of humpback whale songs. Journal of the Acoustical Society of America 120:1103-1110.

Baulch, S., and C. Perry. 2014. Evaluating the impacts of marine debris on cetaceans. Marine Pollution Bulletin 80:210-221.

Bettridge, S., C. S. Baker, J. Barlow, P. J. Clapham, M. Ford, D. Gouveia, D. K. Mattila, R. M. Pace III, P. E. Rosel, G. K. Silber, and P. R. Wade. 2015. Status review of the humpback whale (*Megaptera novaeangliae*) under the Endangered Species Act. NOAA-TM-NMFS-SWFSC-540, Southwest Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, La Jolla, California.

Bisson, L. N., H. J. Reider, H. M. Patterson, M. Austin, J. R. Brandon, T. Thomas, and M. L. Bourdon. 2013. Marine mammal monitoring and mitigation during exploratory drilling by Shell in the Alaskan Chukchi and Beaufort Seas, July–November 2012: draft 90-day report. LGL Report P1272D–1, Report prepared by LGL Alaska Research Associates, Inc., Anchorage, Alaska, USA, and JASCO Research Ltd., Applied Sciences Division, Victoria, British Columbia, Canada, for Shell Offshore, Inc., Houston, Texas, USA, Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland, USA, and Marine Mammal Management, U.S. Fish and Wildlife Service, U.S. Department of the Interior, Anchorage, Alaska, USA.

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. Journal of the Acoustical Society of America 115:2346-2357.

Blackwell, S. B., C. S. Nations, T. L. McDonald, C. R. Greene Jr., A. M. Thode, M. Guerra, and A. M. Macrander. 2013. Effects of airgun sounds on bowhead whale calling rates in the Alaskan Beaufort Sea. Marine Mammal Science 29:E342-E365.

Boebel, O., H. Bornemann, E. Burkhardt, and C. Ruholl. 2006. Risk assessment of Atlas Hydrographic Hydrosweep DS-2 deep sea multi-beam and Parasound DS-2 sediment echosounders. Pages 69-70 Twentieth Annual Conference of the European Cetacean Society, Gdynia, Poland.

BOEM. 2012. Outer continental shelf oil and gas leasing program: 2012-2017. Final programmatic environmental impact statement. OCS EIS/EA BOEM 2012-030, Bureau of Ocean Energy Management, U.S. Department of the Interior.

Brown, J., P. Boehm, L. Cook, J. Trefry, W. Smith, and G. Durell. 2010. cANIMIDA Task 2: Hydrocarbon and metal characterization of sediments in the cANIMIDA study area. OCS Study

MMS 2010-004, Final report, Contract No. M04PC00001, submitted by Exponent, Maynard, Massachusetts, to Alaska Outer Continental Shelf Region, Minerals Management Service, U.S. Department of the Interior, Anchorage, Alaska.

Cameron, M. F., J. L. Bengtson, P. L. Boveng, J. K. Jansen, B. P. Kelly, S. P. Dahle, E. A. Logerwell, J. E. Overland, G. L. Sabine, G. T. Waring, and J. M. Wilder. 2010. Status review of the bearded seal (*Erignathus barbatus*). NOAA Technical Memorandum NMFS-AFSC-211, Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Seattle, Washington.

Carretta, J. V., E. Oleson, D. W. Weller, A. R. Lang, K. A. Forney, J. Baker, M. M. Muto, B. Hanson, A. J. Orr, H. Huber, M. S. Lowry, J. Barlow, J. E. Moore, D. Lynch, L. Carswell, and R. L. Brownell Jr. 2015. U.S. Pacific marine mammal stock assessments: 2014. Technical Memorandum NOAA-TM-NMFS-SWFSC-549, Southwest Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

Clark, C., W. T. Ellison, B. Southall, L. Hatch, S. M. Van Parijs, A. S. Frankel, D. Ponirakis, and G. C. Gagnon. 2009. Acoustic masking of baleen whale communications: potential impacts from anthropogenic sources. Page 56 Eighteenth Biennial Conference on the Biology of Marine Mammals, Quebec City, Canada.

Clark, C. W., and J. H. Johnson. 1984. The sounds of the bowhead whale, *Balaena mysticetus*, during the spring migrations of 1979 and 1980. Canadian Journal of Zoology 62:1436-1441.

Clarke, J. T., A. A. Brower, C. L. Christman, and M. C. Ferguson. 2014. Distribution and relative abundance of marine mammals in the northeastern Chukchi and western Beaufort Seas, 2013 annual report. OCS Study BOEM 2014-018, Report prepared by National Marine Mammal Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Seattle, Washington, for Environmental Studies Program, Alaska Outer Continental Shelf Region, Bureau of Ocean Energy Management, Anchorage, Alaska.

Clarke, J. T., A. A. Brower, M. C. Ferguson, A. S. Kennedy, and A. L. Willoughby. 2015. Distribution and relative abundance of marine mammals in the northeastern Chukchi and western Beaufort Seas, 2014 final report. OCS Study BOEM 2015-040, Report prepared by National Marine Mammal Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Seattle, Washington, for Environmental Studies Program, Alaska Outer Continental Shelf Region, Bureau of Ocean Energy Management, Anchorage, Alaska.

Clarke, J. T., C. L. Christman, A. A. Brower, and M. C. Ferguson. 2012. Distribution and relative abundance of marine mammals in the Alaskan Chukchi and Beaufort Seas, 2011. OCS Study BOEM 2012-009, Report prepared by National Marine Mammal Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Seattle, Washington, for Environmental Studies Program, Alaska Outer Continental Shelf Region, Bureau of Ocean Energy Management, Anchorage, Alaska.

Clarke, J. T., C. L. Christman, A. A. Brower, and M. C. Ferguson. 2013. Distribution and relative abundance of marine mammals in the northeastern Chukchi and western Beaufort Seas, 2012. OCS Study BOEM 2013-00117, Report prepared by National Marine Mammal Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Seattle, Washington, for

Environmental Studies Program, Alaska Outer Continental Shelf Region, Bureau of Ocean Energy Management, Anchorage, Alaska.

Clarke, R. 2004. Pygmy fin whales. Marine Mammal Science 20:329-334.

Comiso, J. C. 2011. Large decadal decline of the Arctic multiyear ice cover. Journal of Climate 25:1176-1193.

COSEWIC. 2005. COSEWIC assessment and update status report on the fin whale *Balaenoptera physalus* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, Ontario, Canada.

Cowan, D. E., and B. E. Curry. 2008. Histopathology of the alarm reaction in small odontocetes. Journal of Comparative Pathology 139:24-33.

Cowan, D. F., and B. E. Curry. 2002. Histopathological assessment of dolphins necropsied onboard vessels in the eastern tropical Pacific tuna fishery. Administrative Report LJ-02-24C, Southwest Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, La Jolla, California.

Cummings, W. C., and D. V. Holliday. 1987. Sounds and source levels from bowhead whales off Point Barrow, Alaska. Journal of the Acoustical Society of America 82:814-821.

Curry, B. E., and E. F. Edwards. 1998. Investigation of the potential influence of fishery-induced stress on dolphins in the eastern tropical Pacific Ocean: research planning. NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-254, Southwest Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, La Jolla, California.

Dalen, J., and G. M. Knutsen. 1986. Scaring effects in fish and harmful effects on eggs, larvae and fry by offshore seismic explorations. Pages 93-102 *in* H. M. Merklinger, editor. Progress in Underwater Acoustics. Plenum, New York.

Deepwater Wind. 2013. Appendix A: Block Island Wind Farm and Block Island Transmission System underwater acoustic report, revision 1. Request for the taking of marine mammals incidental to the construction of the Block Island Wind Farm. Incidental harassment authorization request prepared by Tetra Tech, Inc., Boston, Massachusetts for Deepwater Wind Block Island, LLC, Providence, Rhode Island, for submission to Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland.

Edds, P. L. 1988. Characteristics of finback *Balaenoptera physalus* vocalizations in the St. Lawrence Estuary. Bioacoustics 1:131-149.

Ellison, W. T., B. L. Southall, C. W. Clark, and A. S. Frankel. 2012. A new context-based approach to assess marine mammal behavioral responses to anthropogenic sounds. Conservation Biology 26:21-28.

EPA. 2013. Vessel general permit for discharges incidental to the normal operation of vessels (VGP): authorization to discharge under the National Pollutant Discharge Elimination System. U.S. Environmental Protection Agency.

Erbe, C. 2002. Hearing abilities of baleen whales. Atlantic report CR 2002-065. Contract Number: W7707-01-0828. Defence R&D Canada.

Finneran, J. J., D. A. Carder, and S. H. Ridgway. 2003a. Temporary threshold shift (TTS) measurements in bottlenose dolphins (*Tursiops truncatus*), belugas (*Delphinapterus leucas*), and California sea lions (*Zalophus californianus*). Environmental Consequences of Underwater Sound (ECOUS) Symposium, San Antonio, Texas

Finneran, J. J., D. A. Carder, C. E. Schlundt, and R. L. Dear. 2010a. Temporary threshold shift in a bottlenose dolphin (*Tursiops truncatus*) exposed to intermittent tones. Journal of the Acoustical Society of America 127:3267-3272.

Finneran, J. J., D. A. Carder, C. E. Schlundt, and S. H. Ridgway. 2005. Temporary threshold shift in bottlenose dolphins (*Tursiops truncatus*) exposed to mid-frequency tones. Journal of the Acoustical Society of America 118:2696-2705.

Finneran, J. J., R. Dear, D. A. Carder, and S. H. Ridgway. 2003b. Auditory and behavioral responses of California sea lions (*Zalophus californianus*) to single underwater impulses from an arc-gap transducer. Journal of the Acoustical Society of America 114:1667-1677.

Finneran, J. J., D. S. Houser, P. W. Moore, B. K. Branstetter, J. S. Trickey, and S. H. Ridgway. 2010b. A method to enable a bottlenose dolphin (*Tursiops truncatus*) to echolocate while out of water. Journal of the Acoustical Society of America 128:1483-1489.

Finneran, J. J., and C. E. Schlundt. 2010. Frequency-dependent and longitudinal changes in noise-induced hearing loss in a bottlenose dolphin (*Tursiops truncatus*). Journal of the Acoustical Society of America 128:567-570.

Finneran, J. J., and C. E. Schlundt. 2013. Effects of fatiguing tone frequency on temporary threshold shift in bottlenose dolphins (*Tursiops truncatus*). Journal of the Acoustical Society of America 133:1819-1826.

Finneran, J. J., C. E. Schlundt, B. Branstetter, and R. L. Dear. 2007. Assessing temporary threshold shift in a bottlenose dolphin (*Tursiops truncatus*) using multiple simultaneous auditory evoked potentials. Journal of the Acoustical Society of America 122:1249-1264.

Finneran, J. J., C. E. Schlundt, R. Dear, D. A. Carder, and S. H. Ridgway. 2000. Masked temporary threshold shift (MTTS) in odontocetes after exposure to single underwater impulses from a seismic watergun. Journal of the Acoustical Society of America 108:2515.

Finneran, J. J., C. E. Schlundt, R. Dear, D. A. Carder, and S. H. Ridgway. 2002. Temporary shift in masked hearing thresholds in odontocetes after exposure to single underwater impulses from a seismic watergun. Journal of the Acoustical Society of America 111:2929-2940.

Francis, C. D., and J. R. Barber. 2013. A framework for understanding noise impacts on wildlife: An urgent conservation priority. Frontiers in Ecology and the Environment 11:305-313.

Frazer, L. N., and E. Mercado III. 2000. A sonar model for humpback whale song. IEEE Journal of Oceanic Engineering 25:160-182.

Gardiner, K. J., and A. J. Hall. 1997. Diel and annual variation in plasma cortisol concentrations among wild and captive harbor seals (*Phoca vitulina*). Canadian Journal of Zoology 75:1773-1780.

George, J. C., L. M. Philo, K. Hazard, D. Withrow, G. M. Carroll, and R. Suydam. 1994. Frequency of killer whale (*Orcinus orca*) attacks and ship collisions based on scarring on bowhead whales (*Balaena mysticetus*) of the Bering-Chukchi-Beaufort Seas stock. Arctic 47:247-255.

Gray, J. E. 1865. Dr. H. Burmeister on a new whale. Proceedings of the Zoological Society of London 33:190-195.

Greene Jr., C. R., N. S. Altman, and W. J. Richardson. 1999. The influence of seismic survey sounds on bowhead whale calling rates. Journal of the Acoustical Society of America 106:2280.

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.

Heide-Jørgensen, M. P., K. Laidre, D. Borchers, F. Samarra, and H. Stern. 2007. Increasing abundance of bowhead whales in West Greenland. Biology Letters 3:577-580.

Helker, V. T., B. M. Allen, and L. A. Jemison. 2015. Human-caused injury and mortality of NMFS-managed Alaska marine mammal stocks, 2009-2013. National Marine Mammal Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

Herráez, P., E. Sierra, M. Arbelo, J. R. Jaber, A. Espinosa de los Monteros, and A. Fernández. 2007. Rhabdomyolysis and myoglobinuric nephrosis (capture myopathy) in a striped dolphin. Journal of Wildlife Diseases 43:770-774.

Hezel, P. J., X. Zhang, C. M. Bitz, B. P. Kelly, and F. Massonnet. 2012. Projected decline in spring snow depth on Arctic sea ice caused by progressively later autumn open ocean freeze-up this century. Geophysical Research Letters 39:n/a-n/a.

Houghton, J. 2001. The science of global warming. Interdisciplinary Science Reviews 26:247-257.

Hunt, K. E., R. M. Rolland, S. D. Kraus, and S. K. Wasser. 2006. Analysis of fecal glucocorticoids in the North Atlantic right whale (*Eubalaena glacialis*). General and Comparative Endocrinology 148:260-272.

IPCC. 2013. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, New York, USA.

IPCC, editor. 2014. Summary for policymakers. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

IWC. 1979. Report of the scientific committee, Annex G: report of the sub-committee on protected stocks.

IWC. 2016a. Aboriginal subsistence whaling catches since 1985. International Whaling Commission.

IWC. 2016b. Catches under objection or under reservation since 1985. International Whaling Commission.

IWC. 2016c. Special permit catches since 1985. International Whaling Commission.

Jeffries, M. O., J. Richter-Menge, and J. E. Overland, Eds. 2014. Arctic report card 2014. Available online at: http://www.arctic.noaa.gov/reportcard.

Jones, J. M., B. J. Thayre, E. H. Roth, M. Mahoney, I. Sia, K. Merculief, C. Jackson, C. Zeller, M. Clare, and A. Bacon. 2014. Ringed, bearded, and ribbon seal vocalizations north of Barrow, Alaska: seasonal presence and relationship with sea ice. Arctic 67:203-222.

Kastak, D., B. L. Southall, R. J. Schusterman, and C. R. Kastak. 2005. Underwater temporary threshold shift in pinnipeds: effects of noise level and duration. Journal of the Acoustical Society of America 118:3154-3163.

Kastelein, R. A., R. Gransier, L. Hoek, and C. A. F. d. Jong. 2012a. The hearing threshold of a harbor porpoise (*Phocoena phocoena*) for impulsive sounds (L). Journal of the Acoustical Society of America 132:607-610.

Kastelein, R. A., R. Gransier, L. Hoek, and J. Olthuis. 2012b. Temporary threshold shifts and recovery in a harbor porpoise (*Phocoena phocoena*) after octave-band noise at 4 kHz. Journal of the Acoustical Society of America 132:3525-3537.

Keay, J. M., J. Singh, M. C. Gaunt, and T. Kaur. 2006. Fecal glucocorticoids and their metabolites as indicators of stress in various mammalian species: a literature review. Journal of Zoo and Wildlife Medicine 37:234-244.

Kelly, B. P., J. L. Bengtson, P. L. Boveng, M. F. Cameron, S. P. Dahle, J. K. Jansen, E. A. Logerwell, J. E. Overland, C. L. Sabine, G. T. Waring, and J. M. Wilder. 2010. Status review of the ringed seal (*Phoca hispida*). NOAA Technical Memorandum NMFS-AFSC-212, Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Department of Commerce.

Kight, C. R., and J. P. Swaddle. 2011. How and why environmental noise impacts animals: an integrative, mechanistic review. Ecology Letters.

Koski, W. R., and S. R. Johnson. 1987. Behavioral studies and aerial photogrammetry. Section 4. Responses of Bowhead Whales to an Offshore Drilling Operation in the Alaska Beaufort Sea, Autumn 1986. LGL Limited and Greeneridge Science, Inc., Santa, Barbara, California and Anchorage, Alaska.

Kremser, U., P. Klemm, and W.-D. Kötz. 2005. Estimating the risk of temporary acoustic threshold shift, caused by hydroacoustic devices, in whales in the Southern Ocean. Antarctic Science 17:3-10.

Kryter, K. D., W. D. Ward, J. D. Miller, and D. H. Eldredge. 1966. Hazardous exposure to intermittent and steady-state noise. Journal of the Acoustical Society of America 39:451-464.

Ljungblad, D. K., S. Leatherwood, and M. E. Dahlheim. 1980. Sounds recorded in the presence of an adult and calf bowhead whale. Marine Fisheries Review 42:86-87.

Ljungblad, D. K., P. O. Thompson, and S. E. Moore. 1982. Underwater sounds recorded from migrating bowhead whales, *Balaena mysticetus*, in 1979. Journal of the Acoustical Society of America 71:477-482.

Ljungblad, D. K., B. Würsig, S. L. Swartz, and J. M. Keene. 1988. Observations on the behavioral responses of bowhead whales (*Balaena mysticetus*) to active geophysical vessels in the Alaskan Beaufort Sea. Arctic 41:183-194.

Loeng, H., K. Brander, E. Carmack, S. Denisenko, K. Drinkwater, B. Hansen, K. Kovacs, P. Livingston, F. McLaughlin, and E. Sakshaug. 2005. Marine systems. Pages 453-538 *in* C. Symon, L. Arris, and B. Heal, editors. Arctic Climate Impact Assesment. Cambridge University Press.

Lucke, K., U. Siebert, P. A. Lepper, and M.-A. Blanchet. 2009. Temporary shift in masked hearing thresholds in a harbor porpoise (*Phocoena phocoena*) after exposure to seismic airgun stimuli. Journal of the Acoustical Society of America 125:4060-4070.

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 2011:7-17.

MacGillivray, A. O. 2006. An acoustic modelling study of seismic airgun noise in Queen Charlotte Basin. Master of Science. University of Victoria.

Malme, C. I., P. R. Miles, C. W. Clark, P. Tyack, and J. E. Bird. 1983. Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. Final report for the period of 7 June 1982 - 31 July 1983. Report No. 5366, Report prepared by Bolt Beranek and Newman Inc., Cambridge, Massachusetts, for submission to Alaska OCS Office, Minerals Management Service, U.S. Department of the Interior, Anchorage, Alaska, Anchorage, Alaska.

Malme, C. I., P. R. Miles, C. W. Clark, P. Tyack, and J. E. Bird. 1984. Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. Phase II: January 1984 migration. Report No. 5586, Report prepared by Bolt Beranek and Newman Inc., Cambridge, Massachusetts, for submission to Alaska OCS Office, Minerals Management Service, U.S. Department of the Interior, Anchorage, Alaska.

Malme, C. I., B. Würsig, J. E. Bird, and P. Tyack. 1986. Behavioral responses of gray whales to industrial noise: feeding observations and predictive modeling. Final report, Outer Continental Shelf Environmental Assessment Program, Research Unit 675. Report No. 6265, Report prepared by BBN Laboratories Inc., Cambridge, Massachusetts, for submission to Alaska Outer

Continental Shelf Office, Minerals Management Service, U.S. Department of the Interior, Anchorage, Alaska.

McCauley, R. D., J. Fewtrell, and A. N. Popper. 2003. High intensity anthropogenic sound damages fish ears. Journal of the Acoustical Society of America 113:638-642.

McDonald, M. A., J. A. Hildebrand, and S. M. Wiggins. 2006. Increases in deep ocean ambient noise in the Northeast Pacific west of San Nicolas Island, California. Journal of the Acoustical Society of America 120:711-718.

Meschersky, I. G., A. N. Chichkina, O. V. Shpak, and V. V. Rozhnov. 2014. Molecular genetic analysis of the Shantar summer group of bowhead whales *(Balaena mysticetus* L.) in the Okhotsk Sea. Russian Journal of Genetics 50:395-405.

Miller, G. W., R. E. Elliot , W. R. Koski , V. D. Moulton, and W. J. Richardson. 1999. Whales.*in* W. J. Richardson, editor. Marine mammal and acoustical monitoring of Western Geophysical's open-water seismic program in the Alaskan Beaufort Sea, 1998. LGL Report TA2230-3. Report prepared by LGL Ltd., King City, Ontario, Canada, and Greeneridge Sciences Inc., Santa Barbara, California, USA, for Western Geophysical, Houston, Texas, USA, and National Marine Fisheries Service, Anchorage, Alaska, and Silver Spring, Maryland, USA.

Miller, G. W., V. D. Moulton, R. A. Davis, M. Holst, P. Millman, A. MacGillivray, and D. Hannay. 2005. Monitoring seismic effects on marine mammals—southeastern Beaufort Sea, 2001-2002. Pages 511-542 *in* S. L. Armsworthy, P. J. Cranford, and K. Lee, editors. Offshore Oil and Gas Environmental Effects Monitoring: Approaches and Technologies. Battelle Press, Columbus, Ohio.

Mooney, T. A., P. E. Nachtigall, M. Breese, S. Vlachos, and W. W. L. Au. 2009a. Predicting temporary threshold shifts in a bottlenose dolphin (*Tursiops truncatus*): The effects of noise level and duration. Journal of the Acoustical Society of America 125:1816-1826.

Mooney, T. A., P. E. Nachtigall, and S. Vlachos. 2009b. Sonar-induced temporary hearing loss in dolphins. Biology Letters 5:565-567.

Nachtigall, P. E., J. L. Pawloski, and W. W. L. Au. 2003. Temporary threshold shifts and recovery following noise exposure in the Atlantic bottlenosed dolphin (*Tursiops truncatus*). Journal of the Acoustical Society of America 113:3425-3429.

Nachtigall, P. E., A. Y. Supin, J. L. Pawloski, and W. W. L. Au. 2004. Temporary threshold shifts after noise exposure in the bottlenose dolphin (*Tursiops truncatus*) measured using evoked auditory potentials. Marine Mammal Science 20:672-687.

National Research Council. 2003. Ocean noise and marine mammals. The National Academies Press, Washington, D.C.

NCEI. 2016. State of the climate: global analysis for annual 2015. National Centers for Environmental Information, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Published online at: http://www.ncdc.noaa.gov/sotc/global/201513.

Nedwell, J., J. Langworthy, and D. Howell. 2003. Assessment of sub-sea acoustic noise and vibration from offshore wind turbines and its impact on marine wildlife; initial measurements of underwater noise during construction of offshore windfarms, and comparison with background noise Report No. 544 R 0424, Report prepared by Subacoustech, Ltd., Southamptom, England, U.K., for submission to The Crown Estates Office, London, England, U.K.

NMFS. 2006. Endangered Species Act section 7 consultation biological opinion on the United States Navy's 2006 Rim-of-the-Pacific Joint Training Exercises. Office of Protected Resources, National Marine Fisheries ServiceNational Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland.

NMFS. 2010. Final recovery plan for the fin whale (*Balaenoptera physalus*). Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland.

NMFS. 2011. 5-year review: summary and evaluation of fin whale (*Balaenoptera physalus*). Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland.

NMFS. 2012. Endangered Species Act section 7 consultation biological opinion on the issuance of annual quotas authorizing the harvest of bowhead whales to the Alaska Eskimo Whaling Commission for the period 2013 through 2018. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland.

NMFS. 2013a. Effects of oil and gas activities in the Arctic Ocean: supplemental draft Environmental Impact Statement. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland.

NMFS. 2013b. Endangered Species Act section 7(a)(2) biological opinion for oil and gas leasing and exploration activities in the U.S. Beaufort and Chukchi Seas, Alaska. NMFS Consultation Number F/AKR/2011/0647, Alaska Region, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Juneau, Alaska.

NMFS. 2014a. Endangered Species Act section 7 consultation biological opinion for the issuance of Incidental Harassment Authorization under 101(a)(5)(D) of the Marine Mammal Protection Act to SAExploration, Inc. (SAE) for marine 3D ocean bottom node seismic activities in the U.S. Beaufort Sea, Colville River Delta, Alaska, during the 2014 open water season. NMFS consultation number: AKR-2014-9383, Alaska Region, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Juneau, Alaska.

NMFS. 2014b. Endangered Species Act section 7 consultation biological opinion on the issuance of regulations and a letter of authorization to take marine mammals incidental to offshore oil and gas operations at the Northstar development in the U.S. Beaufort Sea, January 13, 2014-January 14, 2019. Alaska Region, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Juneau, Alaska.

NMFS. 2014c. Endangered Species Act section 7(a)(2) biological opinion for Alaska groundfish fisheries as authorized by the Fishery Management Plan for groundfish of the Bering Sea and Aleutian Islands Management Area and State of Alaska parallel groundfish fisheries and issuance of an exempted fishing permit to test a salmon excluder device in the Bering Sea pollock fishery. Alaska Region, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Juneau, Alaska.

NMFS. 2014d. Endangered Species Act section 7(a)(2) biological opinion on the issuance of an incidental harassment authorization under 101(a)(5)(D) of the Marine Mammal Protection Act to BP Exploration (Alaska), Inc. (BPXA) for marine 3D ocean bottom sensor seismic activities in the U.S. Beaufort Sea, Prudhoe Bay, Alaska, during the 2014 open water season. NMFS consultation number: AKR-2014-9369, Alaska Region, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Juneau, Alaska.

NMFS. 2014e. Endangered Species Act section 7(a)(2) biological opinion on the issuance of an incidental harassment authorization under 101(a)(5)(D) of the Marine Mammal Protection Act to

BP Exploration (Alaska), Inc. (BPXA) for shallow geohazard survey in the U.S. Beaufort Sea, Foggy Island Bay, Alaska, during the 2014 open water season. NMFS consultation number: AKR-2014-9370, Alaska Region, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Juneau, Alaska.

NMFS. 2015a. Bearded seal (*Erignathus barbatus*). Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, http://www.fisheries.noaa.gov/pr/species/mammals/seals/bearded-seal.html.

NMFS. 2015b. Bowhead whale (*Balaena mysticetus*). Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, http://www.fisheries.noaa.gov/pr/species/mammals/whales/bowhead-whale.html.

NMFS. 2015c. Endangered Species Act section 7(a)(2) biological opinion and section 7(a)(4) conference report on Lease Sale 193 oil and gas exploration activities, Chukchi Sea, Alaska. Consultation Number AKR-2015-9422, Alaska Region, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Juneau, Alaska.

NMFS. 2015d. Endangered Species Act section 7(a)(2) biological opinion on the issuance of incidental harassment authorization under section 101(a)(5)(a) of the Marine Mammal Protection Act to Shell for the non-lethal taking of whales and seals in conjuction with planned exploration drilling activities during 2015 Chukchi Sea, Alaska. Consultation Number AKR-2015-9449, Alaska Region, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Juneau, Alaska.

NMFS. 2015e. Endangered Species Act section 7(a)(2) biological opinion on the issuance of incidental harassment authorization under section 101(a)(5)(D) of the Marine Mammal Protection Act to SAExploration, Inc. (SAE) for marine 3D ocean bottom node seismic activities in the U.S. Beaufort Sea, Alaska, during the 2015 open water season. Consultation Number AKR-2015-9451, Alaska Region, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Juneau, Alaska.

NMFS. 2015f. Endangered Species Act section 7(a)(2) consultation biological opinion and section 7(a)(4) conference opinion on the issuance of incidental harassment authorization under section 101(a)(5)(a) of the Marine Mammal Protection Act to Shell Gulf of Mexico and Shell Offshore Inc. (Shell) for aviation operations associated with ice condition monitoring over the Beaufort and Chukchi Seas from May 2015 through April 2016. NMFS consultation number: AKR-2015-9448, Alaska Region, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Juneau, Alaska.

NMFS. 2015g. Fin whale (*Balaenoptera physalus*). Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, http://www.fisheries.noaa.gov/pr/species/mammals/whales/fin-whale.html.

NMFS. 2016a. Humpback whale (*Megaptera novaeangliae*). Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, http://www.nmfs.noaa.gov/pr/species/mammals/whales/humpback-whale.html.

NMFS. 2016b. NOAA APPS: scientific research permits issued for bearded and ringed seals in Alaska. National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

NMFS. 2016c. NOAA APPS: scientific research permits issued for bowhead, fin, and humpback whales in Alaska. National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

NMFS. 2016d. Ringed seal (*Phoca hispida*). Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, http://www.nmfs.noaa.gov/pr/species/mammals/seals/ringed-seal.html.

NMFS, and Navy. 2001. Joint interim report Bahamas marine mammal stranding event 15-16 March 2000. National Marine Fisheries Service, National Oceanic and Amospheric Administration, U.S. Department of Commerce and Installations and Environment, Department of the Navy.

NOAA. 2015. Draft guidance for assessing the effects of anthropogenic sound on marine mammal hearing: underwater acoustic threshold levels for onset of permanent and temporary threshold shifts. National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

Oreskes, N. 2004. The scientific consensus on climate change. Science 306:1686.

Owl Ridge. 2016a. Application for the incidental harassment authorization for the taking of marine mammals in conjunction with proposed Alaska phase of the Quintillion Subsea project, 2016 - revised final. Application prepared by Owl Ridge Natural Resource Consultants, Inc., Anchorage, Alaska, on behalf of Quintillion Subsea Operations, LLC, Anchorage, Alaska, for submission to Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland.

Owl Ridge. 2016b. Quintillion Subsea Project - Alaska, National Marine Fisheries Service Biological Assessment - Section 7. Assessment prepared by Owl Ridge Natural Resource Consultants, Inc., Anchorage, Alaska, on behalf of Alaska District, U.S. Army Corpy of Engineers, for submission to Protected Resources Division, Alaska Region, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Anchorage, Alaska, and Quintillion Subsea Operations, LLC, Anchorage, Alaska.

Parks, S. E. 2003. Response of North Atlantic right whales (*Eubalaena glacialis*) to playback of calls recorded from surface active groups in both the North and South Atlantic. Marine Mammal Science 19:563-580.

Parks, S. E. 2009. Assessment of acoustic adaptations for noise compensation in marine mammals. Office of Naval Research.

Parry, M. L., O. F. Canziani, J. P. Palutikof, P. J. V. d. Linden, and C. E. Hanson. 2007. Contribution of working group II to the fourth assessment report of the intergovernmental panel on climate change. Intergovernmental Panel on Climate Change, Cambridge, United Kingdom.

Payne, K., and R. Payne. 1985. Large scale changes over 19 years in songs of humpback whales in Bermuda. Zeitschrift fur Tierpsychologie 68:89-114.

Popov, V. V., V. O. Klishin, D. I. Nechaev, M. G. Pletenko, V. V. Rozhnov, A. Y. Supin, E. V. Sysueva, and M. B. Tarakanov. 2011a. Influence of acoustic noises on the white whale hearing thresholds. Doklady Biological Sciences 440:332-334.

Popov, V. V., A. Y. Supin, D. Wang, K. Wang, L. Dong, and S. Wang. 2011b. Noise-induced temporary threshold shift and recovery in Yangtze finless porpoises *Neophocaena phocaenoides asiaeorientalis*. Journal of the Acoustical Society of America 130:574-584.

Popper, A. N., M. E. Smith, P. A. Cott, B. W. Hanna, A. O. MacGillicray, M. E. Austin, and D. A. Mann. 2005. Effects of exposure to seismic airgun use on hearing of three fish species. Journal of the Acoustical Society of America 117:3958-3971.

Quakenbush, L. T., R. J. Small, and J. J. Citta. 2013. Satellite tracking of bowhead whales: movements and analysis from 2006 to 2012. OCS Study BOEM 2013-01110, Report prepared under BOEM contract M10PC00085 by Alaska Department of Fish and Game, Juneau, Alaska, for Alaska

Outer Continental Shelf Region, Bureau of Ocean Energy Management, U.S. Department of the Interior.

Reeves, R. R. 1998. Distribution, abundance and biology of ringed seals (*Phoca hispida*): an overview. Pages 9-45 *in* M. P. Heide-Jørgensen and C. Lydersen, editors. Ringed Seals in the North Atlantic. NAMMCO Scientific Publications, Tromsø, Norway.

Richardson, W. J., M. A. Fraker, B. Würsig, and R. S. Wells. 1985. Behavior of bowhead whales *Balaena mysticetus* summering in the Beaufort Sea: reactions to industrial activities. Biological Conservation 32:195-230.

Richardson, W. J., C. R. Greene Jr., C. I. Malme, and D. H. Thomson. 1995. Marine Mammals and Noise. Academic Press, San Diego, California.

Richardson, W. J., and C. I. Malme. 1993. Man-made noise and behavioral responses. Pages 631-700 *in* J. J. Burns, J. J. Montague, and C. J. Cowles, editors. The Bowhead Whale. Society for Marine Mammology, .

Richardson, W. J., G. W. Miller, and C. R. Greene Jr. 1999. Displacement of migrating bowhead whales by sounds from seismic surveys in shallow waters of the Beaufort Sea. Journal of the Acoustical Society of America 106:2281.

Richardson, W. J., B. Würsig, and C. R. Greene Jr. 1986. Reactions of bowhead whales, *Balaena mysticetus*, to seismic exploration in the Canadian Beaufort Sea. Journal of the Acoustical Society of America 79:1117-1128.

Richardson, W. J., B. Würsig, and C. R. Greene Jr. 1990. Reactions of bowhead whales, *Balaena mysticetus*, to drilling and dredging noise in the Canadian Beaufort Sea. Marine Environmental Research 29:135-160.

Ridgway, S. H., D. A. Carder, R. R. Smith, T. Kamolnick, C. E. Schlunt, and W. R. Elsberry. 1997. Behavioural responses and temporary shift in masked hearing threshold of bottlenose dolphins, *Tursiops truncatus*, to 1-second tones of 141 to 201 dB re 1 mPa. Naval Command, Control and Surveillance Center, RDT&E Division, San Diego, California.

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. Proceedings of the Royal Society of London Series B Biological Sciences 279:2363-2368.

Romero, L. M., C. J. Meister, N. E. Cyr, G. J. Kenagy, and J. C. Wingfield. 2008. Seasonal glucocorticoid responses to capture in wild free-living mammals. American Journal of Physiology-Regulatory Integrative and Comparative Physiology 294:R614-R622.

Samsung. 2009. Underwater noise measurements for HN1688 145,000 m^3 LNG SRV. Report by Samsung Ship Model Basin, Daejeon, Korea for Neptune LNG Project, Boston, Massachusetts, USA.

Santulli, A., A. Modica, C. Messina, L. Ceffa, A. Curatolo, G. Rivas, G. Fabi, and V. D'Amelio. 1999. Biochemical responses of European sea bass (*Dicentrarchus labrax* L.) to the stress induced by offshore experimental seismic prospecting. Marine Pollution Bulletin 38:1105-1114.

Schick, R. S., and D. L. Urban. 2000. Spatial components of bowhead whale (*Balaena mysticetus*) distribution in the Alaskan Beaufort Sea. Canadian Journal of Fisheries and Aquatic Sciences 57:2193-2200.

Schlundt, C. E., J. J. Finneran, D. A. Carder, and S. H. Ridgway. 2000. Temporary shift in masked hearing thresholds of bottlenose dolphins, *Tursiops truncatus*, and white whales, *Delphinapterus leucas*, after exposure to intense tones. Journal of the Acoustical Society of America 107:3496-3508.

Serreze, M. C., and R. G. Barry. 2011. Processes and impacts of Arctic amplification: a research synthesis. Global and Planetary Change 77:85-96.

Shelden, K. E. W., and D. J. Rugh. 1995. The bowhead whale, *Balaena mysticetus*: its historic and current status. Marine Fisheries Review 57:1-20.

Silber, G. K. 1986. The relationship of social vocalizations to surface behavior and aggression in the Hawaiian humpback whales (*Megaptera novaeangliae*). Canadian Journal of Zoology 64:2075-2080.

Smiley, B. D., and A. R. Milne. 1979. LNG transport in Parry Channel: Possible environmental hazards. Institute of Ocean Sciences, Department of Fisheries and the Environment, Sidney, British Columbia, Canada.

Southall, B. L., A. E. Bowles, W. T. Ellison, J. J. Finneran, R. L. Gentry, C. R. Greene Jr., 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. Aquatic Mammals 33:411-521.

Southall, B. L., T. Rowles, F. Gulland, R. W. Baird, and P. D. Jepson. 2013. Final report of the Independent Scientific Review Panel investigating potential contributing factors to a 2008 mass stranding of melonheaded whales (*Peponocephala electra*) in Antsohihy, Madagascar. Independent Scientific Review Panel.

St. Aubin, D. J., S. H. Ridgway, R. S. Wells, and H. Rhinehart. 1996. Dolphin thyroid and adrenal hormones: circulating levels in wild and semidomesticated *Tursiops truncatus*, and influence of sex, age, and season. Marine Mammal Science 12:1-13.

Stocker, T. F., D. Qin, G.-K. Plattner, L. V. Alexander, S. K. Allen, N. L. Bindoff, F.-M. Bréon, J. A. Church, U. Cubasch, S. Emori, P. Forster, P. Friedlingstein, N. Gillett, J. M. Gregory, D. L. Hartmann, E. Jansen, B. Kirtman, R. Knutti, K. K. Kumar, P. Lemke, J. Marotzke, V. Masson-Delmotte, G. A. Meehl, I. I. Mokhov, S. Piao, V. Ramaswamy, D. Randall, M. Rhein, M. Rojas, C. Sabine, D. Shindell, L. D. Talley, D. G. Vaughan, and S.-P. Xie. 2013. Technical summary.*in* T. F. Stocker, D. Qin, G.-K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, and P. M. Midgley, editors. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, New York.

Stoker, S. W., and I. I. Krupnik. 1993. Subsistence whaling. Pages 579-629 *in* J. J. Burns, J. J. Montague, and C. J. Cowles, editors. The Bowhead Whale. Society for Marine Mammology, Lawrence, Kansas.

Tetra Tech. 2013. Attachment 6: Block Island transmission system: Scarborough Beach underwater acoustic assessment. Block island transmission system and Block Island wind farm modification to environmental report in response to comments USACE file # NEA-2009-789. Letter dated September 26, 2013, from Deepwater Wind Block Island, LLC, Providence, Rhode Island, to Permits and Enforcement Branch, New England District, U.S. Army Corps of Engineers, Concord, Massachusetts.

Thompson, P. O., W. C. Cummings, and S. J. Ha. 1986. Sounds, source levels, and associated behavior of humpback whales, Southeast Alaska. Journal of the Acoustical Society of America 80:735-740.

Thompson, P. O., L. T. Findley, and O. Vidal. 1992. 20-Hz pulses and other vocalizations of fin whales, *Balaenoptera physalus*, in the Gulf of California, Mexico. Journal of the Acoustical Society of America 92:3051-3057.

Tyack, P., and H. Whitehead. 1983. Male competition in large groups of wintering humpback whales. Behaviour 83:132-154.

Vu, E. T., D. Risch, C. W. Clark, S. Gaylord, L. T. Hatch, M. A. Thompson, D. N. Wiley, and S. M. Van Parijs. 2012. Humpback whale song occurs extensively on feeding grounds in the western North Atlantic Ocean. Aquatic Biology 14:175-183.

Wang, M. Y., and J. E. Overland. 2009. A sea ice free summer Arctic within 30 years? Geophysical Research Letters 36:1-5.

Ward, W. D. 1997. Effects of high-intensity sound. Pages 1497-1507 *in* M. J. Crocker, editor. Encyclopedia of Acoustics. Wiley, New York, New York.

Waring, G. T., E. Josephson, K. Maze-Foley, and P. E. Rosel, editors. 2015. US Atlantic and Gulf of Mexico marine mammal stock assessments - 2014. NOAA Technical Memorandum NMFS-NE-231. Northeast Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Woods Hole, Massachusetts.

Warner, G., and A. McCrodan. 2011. Underwater sound measurements.*in* H. K. G., L. N. Bisson, S. A. Case, D. S. Ireland, and D. Hannay, editors. Marine mammal monitoring and mitigation during site clearance and geotechnical surveys by Statoil USA E&P Inc. in the Chukchi Sea, August–October 2011: 90-day report. LGL Report P1193. Final report prepared by LGL Alaska Research Associates Inc., Anchorage, Alaska, USA, and JASCO Applied Sciences Ltd., Victoria, British Columbia, Canada, for Statoil USA E&P Inc., Anchorage, Alaska, USA, Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland, USA, and Marine Mammal Management, U.S. Fish and Wildlife Service, U.S. Department of the Interior, Anchorage, Alaska, USA.

Wartzok, D., W. A. Watkins, B. Würsig, and C. I. Malme. 1989. Movements and behaviors of bowhead whales in response to repeated exposures to noises associated with industrial activities in the Beaufort Sea. AMOCO Production Co., Anchorage, Alaska.

Watkins, W. A. 1981. Activities and underwater sounds of fin whales. Scientific Reports of the Whales Research Institute 33:83-117.

Watkins, W. A., P. Tyack, K. E. Moore, and J. E. Bird. 1987. The 20-Hz signals of finback whales (*Balaenoptera physalus*). Journal of the Acoustical Society of America 82:1901-1912.

Wiig, Ø., L. Bachmann, N. Øien, K. M. Kovacs, and C. Lydersen. 2009. Observations of bowhead whales (*Balaena mysticetus*) in the Svalbard area 1940-2008. International Whaling Commission Scientific Committee, Madeira, Portugal.

Wiig, Ø., M. P. Heide-Jørgensen, C. Lindqvist, K. L. Laidre, L. D. Postma, L. Dueck, P. J. Palsbøll, and L. Bachmann. 2011. Recaptures of genotyped bowhead whales *Balaena mysticetus* in eastern Canada and West Greenland. Endangered Species Research 14:235-242.

Winn, H. E., P. J. Perkins, and T. C. Poulter. 1970. Sounds of the humpback whale. Pages 39-52 Seventh Annual Conference on Biological Sonar and Diving Mammals, Stanford Research Institute, Menlo Park, California.

Winn, H. E., and N. E. Reichley. 1985. Humpback whale, *Megaptera novaeangliae* (Borowski, 1781). Pages 241-274 *in* S. H. Ridgway and S. R. Harrison, editors. Handbook of Marine Mammals. Academic Press, London, England.