Final Environmental Assessment
For the Issuance of an Incidental Harassment Authorization for the Take of Marine Mammals by Harassment Incidental to Anchor Retrieval Activities in the Chukchi and Beaufort Seas

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LOCATION:	U.S. Beaufort and Chukchi Seas
ABSTRACT:	National Marine Fisheries Service proposes to issue an Incidental Harassment Authorization (IHA) to Fairweather, LLC (Fairweather) for the take of marine mammals incidental to conducting an anchor retrieval program in the U.S. Beaufort and Chukchi seas in 2016.

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Chapter 1 INTRODUCTION AND PURPOSE AND NEED

1.1 Background

The Marine Mammal Protection Act of 1972, as amended (MMPA; 16 U.S.C. 1631 et seq.) prohibits the incidental taking of marine mammals. The incidental take of a marine mammal falls under three categories: mortality, serious injury or harassment (i.e., injury and behavioral effects). Harassment[1] is any act of pursuit, torment or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild (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 (Level B harassment). Disruption of behavioral patterns includes, but is not limited to, migration, breathing, nursing, breeding, feeding or sheltering. However, there are exceptions to the prohibition on take in Section 101(a)(5)(D) of the MMPA that gives the National Marine Fisheries Service (NMFS) the authority to authorize the incidental but not intentional take of small numbers of marine mammals by harassment provided certain determinations are made and statutory and regulatory procedures are met. Refer to Chapter 2 for details regarding this exception and NMFS' incidental harassment authorization (IHA) criteria.

NMFS also promulgated regulations to implement the provisions of the MMPA governing the taking and importing of marine mammals, 50 Code of Federal Regulations (CFR) Part 216 and produced Office of Management and Budget (OMB)-approved application instructions (OMB Number 0648-0151) that prescribe the procedures necessary to apply for permits. All applicants must comply with these regulations and application instructions in addition to the provisions of the MMPA.

1.1.1 Applicant's Incidental Take Authorization Request

On February 2, 2016, NMFS received an application from Fairweather for the taking of marine mammals incidental to conducting anchor retrieval activities in the U.S. Chukchi and Beaufort seas. After receiving NMFS' comments, Fairweather made revisions and updated its IHA application and marine mammal mitigation and monitoring plan on February 8, 2016.

Fairweather proposes to retrieve anchor equipment left by Shell Offshore, Inc. (Shell) during its 2012 and 2015 exploration drilling programs in the U.S. Chukchi and Beaufort seas. The proposed activity would occur between July 1 and October 31, 2016. Noise generated from anchor handling activities and the vessel's dynamic positioning thrusters could impact marine mammals in the vicinity of the activities. Incidental take, by Level B harassment, of individuals of 11 species of marine mammals is anticipated to result from the specified activity.

1.1.2Marine Mammals in the Action Area

Fairweather has requested an authorization to take 11 marine mammal species by Level B harassment. These species are: beluga whale (*Delphinapterus leucas*), bowhead whale (*Balaena mysticetus*), gray whale (*Eschrichtius robustus*), humpback whale (*Megaptera novaeangliae*),

[1] As defined in the MMPA for non-military readiness activities (Section 3 (18)(A)).

minke whale (*Balaenoptera acutorostrata*), fin whale (*B. physalus*), killer whale (*Orcinus orca*), harbor porpoise (*Phocoena phocoena*), bearded seal (*Erignathus barbatus*), ringed seal (*Phoca hispida*), and spotted seal (*P. largha*).

1.2 Purpose and Need

1.2.1 Description of the Proposed Action

NMFS proposes to issue an IHA to Fairweather pursuant to Section 101(a)(5)(A) of the MMPA and 50 CFR Part 216. The IHA will be valid from July 1 – October 31, 2016, and authorizes takes, by Level B harassment, of marine mammals incidental to the anchor retrieval activities. The impact of the underwater noise associated with the anchor handling and vessel's dynamic positioning thrusters have the potential to cause marine mammals within or near the proposed retrieval sites to be behaviorally disturbed, thus warrant an IHA from NMFS. NMFS proposed action is a direct outcome of Fairweather's request for an IHA to take marine mammals.

1.2.2 Purpose

The purpose of our proposed action is to authorize take of marine mammals incidental to Fairweather's proposed anchor retrieval activities in the Chukchi and Beaufort seas during the 2016 Arctic open-water season. The IHA, if issued, would provide an exception to Fairweather from the take prohibitions contained in the MMPA. To authorize the incidental take of small numbers of marine mammals, NMFS evaluates the best available scientific information to determine whether the take would have a negligible impact on marine mammals or stocks and whether the activity would have an unmitigable impact on the availability of affected marine mammal species for subsistence use. NMFS cannot issue this IHA if it cannot make those findings in the affirmative. In addition, we must prescribe the permissible methods of taking and other means of effecting the least practicable impact on the species or stocks of marine mammals and their habitat, paying particular attention to rookeries, mating grounds, and other areas of similar significance. If appropriate, we must prescribe means of effecting the least practicable impact on the availability of the species or stocks of marine mammals for subsistence uses. IHAs must also include requirements or conditions pertaining to the monitoring and reporting.

1.2.3 Need

U.S. citizens seeking to obtain authorization for the incidental take of marine mammals under NMFS jurisdiction must submit such a request (in the form of an application). On February 8, 2016, Fairweather submitted an adequate and complete application demonstrating both the need and potential eligibility for an IHA under the MMPA. NMFS now has a corresponding duty to determine whether and how to authorize take of marine mammals incidental to the activities described Fairweather's application. NMFS' responsibilities under section 101(a)(5)(D) of the MMPA and its implementing regulations establish and frame NMFS' proposed action.

Any alternatives considered under NEPA must meet the agency's statutory and regulatory requirements. Our described purpose and need guide us in developing reasonable alternatives for consideration, including alternative means of mitigating potential adverse effects.

1.3 Environmental Review Process

In accordance with the Council on Environmental Quality (CEQ) Regulations for implementing the National Environmental Policy Act (NEPA), NMFS, to the fullest extent possible, integrates the requirements of NEPA with other regulatory processes required by law or by agency practice so that all procedures run concurrently, rather than consecutively. This includes coordination within National Oceanic Atmospheric Administration (NOAA), (e.g., the Office of the National Marine Sanctuaries) and with other regulatory agencies (e.g., the U.S. Fish and Wildlife Service), as appropriate, during NEPA reviews prior to implementation of a proposed action to ensure that requirements are met. Regarding the issuance of IHAs, we rely substantially on the public process required by the MMPA for proposed IHAs to develop and evaluate relevant environmental information and provide a meaningful opportunity for public participation when we prepare corresponding NEPA documents. We fully consider public comments received in response to the publication of proposed IHAs during the corresponding NEPA review process.

1.3.1 National Environmental Policy Act

NEPA requires federal agencies to examine the environmental impacts of their proposed actions within the United States and its territories. A NEPA analysis is a public document that provides an assessment of the potential effects a major federal action may have on the human environment, which includes the natural and physical environment. Major federal actions include activities that federal agencies fully or partially fund, regulate, conduct or approve. Because our issuance of an Authorization would allow for the taking of marine mammals, consistent with provisions under the MMPA and incidental to the applicant's activities, we consider this as a major federal action subject to NEPA; therefore, NMFS analyzes the environmental effects associated with authorizing incidental takes of protected species and prepares the appropriate NEPA documentation.

1.3.2 Scoping and Public Involvement

The NEPA process is intended to enable NMFS to make decisions based on an understanding of the environmental consequences and take actions to protect, restore, and enhance the environment. An integral part of the NEPA process is public involvement. Public involvement facilitates the development of an EA and informs the scope of issues to be addressed in the EA. Although agency procedures do not require public involvement prior to finalizing an EA, NMFS determined that the publication of the draft EA along with the proposed IHA was the appropriate step to involve the public in order to understand the public concerns for the proposed action, identify significant issues related to the proposed action and obtain the necessary information to complete an analysis.

On May 19, 2016 we published the proposed IHA in the Federal Register (81 FR 31594) with our preliminary determinations. The notice included a detailed description of the proposed action resulting from the MMPA consultation process; consideration of environmental issues and impacts of relevance related to the proposed issuance of the IHA; and potential mitigation and monitoring measures to avoid and minimize potential adverse impacts to marine mammals and their habitat. The notice of the proposed IHA and the corresponding public comment period were instrumental in providing the public with information on relevant environmental issues and

offering the public a meaningful opportunity to provide comments for our consideration in both the MMPA and NEPA decision-making processes.

The public comment period for the proposed IHA ended on June 20, 2016. During the 30-day public comment period, NMFS received comments from the Marine Mammal Commission (Commission). No other public comments were received during the comment period. All relevant comments will be addressed in the *Federal Register* notice when NMFS makes a determination whether to issue an IHA.

1.4 Other Environmental Laws or Consultations

NMFS must comply with all applicable federal environmental laws, regulations, and Executive Orders (EO) necessary to implement a proposed action. NMFS evaluation of and compliance with environmental laws, regulations and EOs is based on the nature and location of the applicants proposed activities and NMFS proposed action. Therefore, this section only summarizes environmental laws and consultations applicable to NMFS issuance of an IHA to Fairweather. There are no other environmental laws, regulations, EOs, consultations, federal permits or licenses applicable NMFS issuance of an IHA to Fairweather.

1.4.1 Endangered Species Act

The Endangered Species Act (ESA) established protection over and conservation of threatened and endangered species (T&E) and the ecosystems upon which they depend. An endangered species is a species in danger of extinction throughout all or a significant portion of its range. A threatened species is one that is likely to become endangered within the near future throughout all or in a significant portion of its range. The U.S. Fish and Wildlife Service (USFWS) and NMFS jointly administer the ESA and are responsible for the listing of species (designating a species as either threatened or endangered) and designating geographic areas as critical habitat for (T&E) species. The ESA generally prohibits the "take" of an ESA-listed species unless an exception or exemption applies. The term "take" as defined in section 3 of the ESA means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Section 7(a)(2) requires each federal agency to ensure that any action it authorizes, funds or carries 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 of such species. When a federal agency's action may affect a listed species, that agency is required to consult with NMFS and/or the USFWS under procedures set out in 50 CFR Part 402. NMFS and USFWS can also be action agencies under section 7. Informal consultation is sufficient for species the action agency determines are not likely to be adversely affected if NMFS or USFWS concurs with the action agency's findings, including any additional measures mutually agreed upon as necessary and sufficient to avoid adverse impacts to listed species and/or designated critical habitat.

The bowhead, humpback, and fin whales are the only marine mammal species currently listed under the ESA that could occur in the vicinity of Fairweather's proposed anchor retrieval activity. NMFS' Permits and Conservation Division has consulted with NMFS' Alaska Regional Protected Resources Division (AKRO) under section 7 of the ESA on the issuance of the IHA to

Fairweather under section 101(a)(5)(D) of the MMPA for this activity. In a biological opinion dated June 18, 2016, NMFS' Alaska Regional Office concluded that the issuance of the IHA is: (1) not likely to jeopardize the continued existence of the ESA-listed bowhead whales; and (2) not likely to adversely modify or destroy critical habitat, as the proposed anchor retrieval areas are neither within nor nearby designated critical habitat for ESA-listed species.

1.42 Magnuson-Stevens Fishery Conservation and Management Act

Under the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), "Essential Fish Habitat" (EFH) is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. § 1802(10)). The EFH provisions of the MSFCMA offer resource managers means to accomplish the goal of giving heightened consideration to fish habitat in resource management.

Federal agencies are required to consult with the Secretary of Commerce with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency which may adversely affect essential fish habitat (EFH) identified under the MSA.

1.4.3 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) encourages coastal states to develop comprehensive programs to manage and balance competing uses of and impacts to coastal resources. The CZMA emphasizes the primacy of state decision-making regarding the coastal zone. Section 307 of the CZMA (16 U.S.C. § 1456), called the Federal consistency provision, is a major incentive for states to join the national coastal management program and is a powerful tool that states use to manage coastal uses and resources and to facilitate cooperation and coordination with Federal agencies.

Federal consistency is the CZMA requirement where federal agency activities that have reasonably foreseeable effects on any land or water use or natural resource of the coastal zone (also referred to as coastal uses or resources and coastal effects) must be consistent to the maximum extent practicable with the enforceable policies of a coastal state's federally-approved coastal management program. On July 1, 2011, the federally-approved Alaska Coastal Management Program expired, resulting in a withdrawal by Alaska from participation in CZMA's National Coastal Management Program. The federal CZMA consistency provision in section 307 no longer applies in Alaska.

1.5 Scope of Environmental Analysis

This EA was prepared in accordance with NEPA (42 USC 4321, et seq.) and CEQ Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500-1508). The analysis in this EA addresses potential impacts to the human environment and natural resources, specifically marine mammals and their habitat, resulting from NMFS' proposed action to authorize incidental takes associated with the Fairweather project. We analyze direct, indirect, and cumulative impacts related to authorizing incidental take of marine mammals under the MMPA. The scope of our analysis is limited to the decision for which we are responsible (i.e. whether or not to issue the IHA). This EA is intended to provide focused information on the primary issues and impacts of environmental concern, which is our issuance of the IHA authorizing the take of marine mammals incidental Fairweather's activity, and the mitigation and monitoring measures to

minimize the effects of that take. For these reasons, this EA does not provide a detailed evaluation of the effects to the elements of the human environment listed in Table 1 below.

In summary, the analysis herein supports our conclusion that, with the incorporation of the proposed monitoring and mitigation measures, the issuance of the IHA to Fairweather for the anchor retrieval activities would not result in any significant direct, indirect, or cumulative impacts. Based on our MMPA analysis, the limited harassment from the proposed anchor retrieval activities would allow adequate time for the marine mammals to recover from potentially adverse effects. Furthermore, the analysis concluded that the cumulative effects of the project on its own or in combination with other activities are not expected to occur.

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Table 1. Components of the human environment not affected by our issuance of an IHA.

Biological	Physical	Socioeconomic / Cultural
Lower trophic organisms	Air Quality	Commercial Fishing
Fish	Essential Fish Habitat	Military Activities
Mammal species not under NMFS jurisdiction	Geography	Recreational Fishing
Seabirds	Oceanography	Shipping and Boating
		National Historic Preservation Sites
		Low Income Populations
		Minority Populations
		Indigenous Cultural Resources
		Public Health and Safety
		Historic and Cultural Resources

Chapter 2 ALTERNATIVES

2.1 Introduction

As described in Chapter 1, the National Marine Fisheries Service (NMFS) Proposed Action is to issue an Incidental Harassment Authorization (IHA) to authorize the take of small numbers of marine mammals incidental to Fairweather's proposed anchor retrieval activities. NMFS Proposed Action is triggered by Fairweather's request for an IHA per the Marine Mammal Protection Act of 1972, as amended (MMPA; 16 U.S.C. 1361 *et seq.*). In accordance with the National Environmental Policy Act (NEPA) and the Council on Environmental Quality (CEQ) Regulations, NMFS is required to consider alternatives to the Proposed Action. This includes the no action and other reasonable course of action associated with authorizing incidental take of protected species. The evaluation of alternatives under NEPA assists NMFS with ensuring that any unnecessary impacts are avoided through an assessment of alternative ways to achieve the purpose and need for our Proposed Action that may result in less environmental harm. To warrant detailed evaluation under NEPA, an alternative must be reasonable along with meeting the stated purpose and need for the proposed action. For the purposes of this EA, an alternative will only meet the purpose and need if it satisfies the requirements under section 101(a)(5)(D) the MMPA. Therefore, NMFS applied the following screening criteria to the alternatives to identify which alternatives to carry forward for analysis. Accordingly, an alternative must meet the following criteria to be considered "reasonable".

As described in Section 1.2, the MMPA requires that we must prescribe the means of effecting the least practicable impact on the species or stocks of marine mammals and their habitat. In order to do so, we must consider Fairweather's proposed mitigation measures, as well as other potential measures, and assess how such measures could minimize impacts on the affected species or stocks and their habitat. Our evaluation of potential measures includes consideration of the following factors in relation to one another: (1) the manner in which, and the degree to which, we expect the successful implementation of the measure to minimize adverse impacts to marine mammals; (2) the proven or likely efficacy of the specific measure to minimize adverse impacts as planned; and (3) the practicability of the measure for applicant implementation.

Any additional mitigation measure proposed by us beyond what the applicant proposes should be able to or have a reasonable likelihood of accomplishing or contributing to the accomplishment of one or more of the following goals:

- Avoidance or minimization of marine mammal injury, serious injury, or death, wherever possible;
- A reduction in the numbers of marine mammals taken (total number or number at biologically important time or location);
- A reduction in the number of times the activity takes individual marine mammals (total number or number at biologically important time or location);
- A reduction in the intensity of the anticipated takes (either total number or number at biologically important time or location);

- Avoidance or minimization of adverse effects to marine mammal habitat, paying special attention to the food base; activities that block or limit passage to or from biologically important areas; permanent destruction of habitat; or temporary destruction/disturbance of habitat during a biologically important time; and
- For monitoring directly related to mitigation, an increase in the probability of detecting marine mammals, thus allowing for more effective implementation of the mitigation.

Alternative 1 (the Preferred Alternative) includes a suite of mitigation measures intended to minimize potentially adverse interactions with marine mammals.

2.2 Description of Fairweather's Proposed Activities

Fairweather plans to conduct anchor retrieval activity during the 2016 Arctic open-water season in the Chukchi and Beaufort seas.

2.2.1 Dates and Duration

Fairweather's proposed anchor retrieval activity is planned for the 2016 open-water season (July through October, 2016). Vessels will mobilize from Dutch Harbor in late June to arrive in Kotzebue area by early July to start the anchor retrieval program. Fairweather anticipates operations to be complete by late August with all vessels out of the theater, with the exception of the *Norseman II*, which would remain in the area for final data collection until October.

At each site, active anchor retrieval activities with the use of thrusters are expected to occur in two to seven days with the thrusters operating only part of the time; unseating typically takes less than half an hour for each anchor. Additionally, the sonar surveys are expected to take one to three days at each site before and after anchor retrieval. Therefore, operations that may result in incidental harassment to marine mammals would occur over approximately 10 days total on each site throughout the season with the noise sources operating only part of the time over those days.

2.2.2 Specific Geographic Region

Fairweather will retrieve mooring systems that were left as part of Shell's exploration program at five locations (Figure 1): 1) Good Hope Bay in Kotzebue Sound, 2) Burger A site in the Chukchi Sea, 3) Burger V site in the Chukchi Sea, 4) Kakapo in the Chukchi Sea, and 5) Sivulliq site in the Beaufort Sea. Using specialized Anchor Handling Towing Supply Vessels (AHTSVs, Table 2), the mooring systems are scheduled for retrieval in the open water season of 2016 (July through September). Vessels will mobilize from Dutch Harbor in late June to arrive in Kotzebue area by early July. Multiple retrieval scenarios have been developed to retrieve all of the systems within one season; actual timing of retrieval at each of the sites will depend on vessel configuration, ice, weather, and timing of subsistence activities in Kotzebue and Beaufort Sea.

The Kotzebue location is approximately 20 kilometers (km, 12 miles [mi]) offshore of the village of Kotzebue, on the northwest coast of Alaska. The average depth in the Kotzebue project area is approximately 9 meters (m, 29 feet [ft]). The Burger A and Burger V locations are approximately 100 km (64 mi) offshore and approximately 126 km (78 mi) northwest of the closest village of Wainwright. Water depths in the Burger prospect area average 40-48 m (130-157 ft). The Kakapo location is approximately 110 km (68 mi) offshore to the northwest of the

village of Point Lay, also on the northwest coast of Alaska. Water depths in the Kakapo area are similar to Burger, averaging 40 m (130 ft). The Sivulliq location is approximately 25 km (15 mi) offshore of the North Slope of Alaska in between Prudhoe Bay to the west and Kaktovik to the east. The average water depth at the Sivulliq project area is approximately 30-35 m (98-115 ft).

2.2.3 Detailed Description of the Activity

I. Anchor Retrieval

The goal of the retrieval program will be to complete operations efficiently and safely within one season, taking into consideration ice, weather, and subsistence harvest activities. Preliminary calculations indicate the vessels will have sufficient fuel onboard to have endurance to remain offshore with minimal fuel transfers at sea. The number of crew changes and vessel resupply will depend on the progress of the retrieval program, but, if necessary, will take place in Kotzebue, Wainwright, or Prudhoe Bay. Through the Olgoonik Fairweather, LLC joint venture, Fairweather has provided crew change and logistic support for multiple vessels in all three locations since 2008. A small, flat-bottom crew change vessel is available at each location to transfer personnel, equipment, and groceries from shore to the AHTSV. Helicopters will not be used in this program, unless in an emergency situation.

Vessels will mobilize from Dutch Harbor in late June to arrive in Kotzebue area by early July. Delmar (the owners of some of the mooring systems and onboard anchor handling technicians) and Fairweather have developed multiple scenarios to retrieve all of the systems within one season. Each AHTSV vessel is a different size and each will hold different amounts of equipment depending on deck space, storage reel space, chain locker space, storage location, and equipment type to meet stability requirements. If subsistence harvest activities are taking place, Fairweather will not retrieve anchors until cleared (by the communities) to do so. The vessels will move into the Chukchi Sea to retrieve the Burger and Kakapo anchors, depending on ice presence. As soon as the passage to Barrow around Point Barrow is ice free and safe for passage to the Beaufort Sea, two of the four vessels will immediately transit to the Sivulliq site. Typically, this occurs in late July/early August. Retrieval operations will be completed and vessels out of the Beaufort prior to the August 25th commencement for the Nuiqsut/Kaktovik bowhead whale harvest. Once the Sivulliq anchors are retrieved, the two vessels will return to the Chukchi Sea to complete any remaining operations.

Once on site, the retrieval of each anchor and associated mooring system typically takes approximately four hours to complete. There is typically one to two vessels onsite, only one of which will be retrieving an anchor. Depending on weather and number of the mooring lines/anchors, one site is expected be completed between two and seven days. Anchors will be retrieved in one of two ways. The first is by locating the float rope connected to each of the mooring systems with the remotely operated vehicle (ROV) and retrieving the anchor from the opposite side of the anchor, working towards the anchor itself. The second method will be employed if the float rope cannot be located, or the vessel retrieving does not have an ROV. A grappling hook will be deployed and to grasp the mooring chain along the anchoring system. From that point, the anchor system will be pulled on the back deck with retrieval on the non-anchor side first, then the anchor side, and all the way to the anchor.

Over this period, the anchor winch and thrusters will be used to pull to unseat and retrieve anchors from the seafloor. Depending on water depth and anchors depth, this typically takes 15-20 minutes per anchor. Thruster usage while maintaining station using Dynamic Positioning (DP) will vary depending on weather and sea conditions. Thruster percentages are automatically increased and decreased based on the sea state and weather. If weather conditions are poor, the thrusters will need to work harder to maintain position. Anchors at Burger A and Kakapo locations are wet stored (they were not seated deeply in place) and will not require unseating.

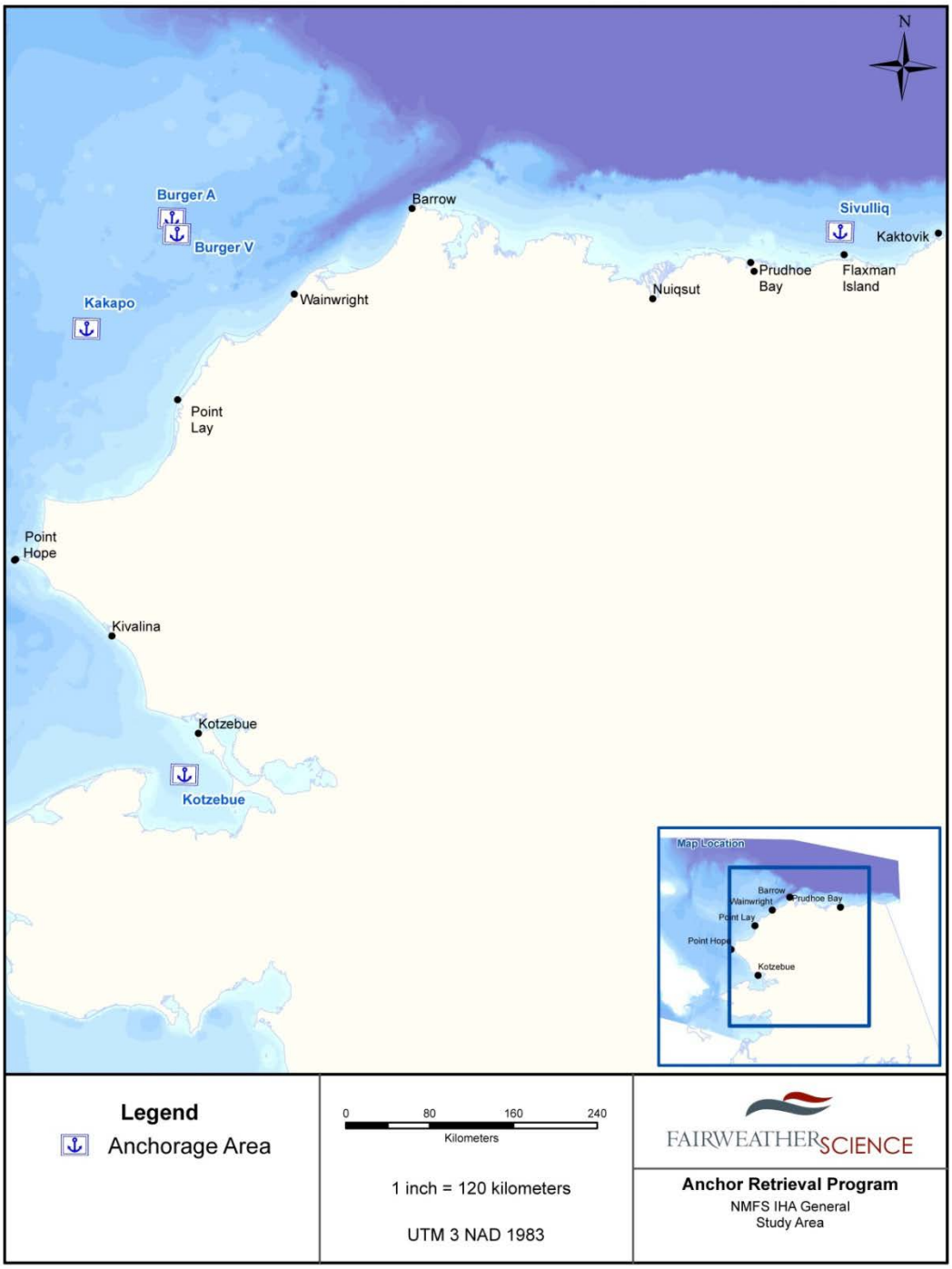

Figure 1. Fairweather proposed anchor retrieval locations.

During the 2012 exploratory program for Shell, detailed sound level measurements were performed of all the various activities and vessels, including anchor handling. Detailed descriptions of the sound measurements and analysis methods are provided in the Shell 2012 90-day report (Austin et al. 2013) and in the Comprehensive Joint Monitoring Report (LGL et al. 2014). Anchor handling activities were found to be the loudest of the activities due to the thrusters working at their highest power during the seating of the anchors. Received levels were measured at 143 dB at 860 m. Thrusters will only be needed when on site with the anchor being removed.

Table 2. A list of proposed anchor retrieval vessels.

Vessel Name	Specification	Length	Width	Draft	Maximum Speed	Available Fuel Storage
M/V *Aiviq*	Anchor handling Ice Classed* Refueling Support	360 feet	80 feet	28 feet	15 knots	527,073 gallons
M/V *Ross Chouest*	Anchor handling	256 feet	54 feet	18 feet	12 knots	149,157 gallons
M/V *Nanuq*	Anchor handling Ice Classed* Refueling Support	301 feet	60 feet	21 feet	15 knots	323,065 gallons
M/V *Dino Chouest*	Anchor handling ROV	348 feet	72 feet	24.9 feet	15 knots	508,337 gallons

* To the extent necessary, operated vessels may contact small ice floes (that do not have marine mammals visibly on them) in order to maximize survey efficiency. In other words, these vessels (M/V *Aiviq* and M/V *Nanuq*) do not need to avoid ice for safety reasons.

II. Use of Sonar Equipment

If necessary, Fairweather proposes to use a geo-referenced interferometric sonar or multi-beam sonar with magnetometer to provide accurate imagery of the anchors and associated gear prior to retrieval and after the retrieval to confirm removal of anchor equipment. The device is mounted in a towfish towed by the Norseman II (just below the sea surface, or deep-towed). The sound frequencies used in sonar usually range from 100 to 500 kiloHertz (kHz); higher frequencies yield better resolution but less range. The actual device has not been decided, but the following systems would be representative of what would be used:

- A multi-beam echosounder operates at an rms source level of a maximum of 220 dB re 1 µPa @1m. The multi beam echosounder emits high frequency (240 kHz) energy in a fan-shaped pattern of equidistant or equiangular beam spacing. The beam width of the emitted sound energy in the along-track direction is 1.5 degrees, while the across track beam width is 1.8 degrees. (Teledyne Benthos Geophysical 2008; Konsberg 2014)

- A single-beam echosounder operates at an rms source level of approximately 220 dB re 1 µPa @1m. The transducer selected uses a frequency of 210 kHz. The transducer's beam width is approximately 3 degrees. (Teledyne Benthos Geophysical 2008; Konsberg 2014)

- A dual frequency sonar system will operate at about 400 kHz and 900 kHz. The rms source level is 215 dB re 1µPa @ 1m. The sound energy is emitted in a narrow fan-shaped pattern, with a horizontal beam width of 0.45 degrees for 400 kHz and 0.25 degrees at 900 kHz, with a vertical beam width of 50 degrees. (Teledyne Benthos Geophysical 2008; Konsberg 2014)

In the 2013 Shell 90-day report (Bisson et al., 2013), JASCO (a contractor hired by Shell on acoustic modeling and measuring) measured all the various sources associated with the seismic survey program, including sonar. They measured the distance to the 160 dB threshold to be 130 m, resulting in an ensonified area of 0.053 km^2.

2.3 Description of Alternatives

2.3.1 Alternative 1 – Issuance of an Authorization with Mitigation Measures (Preferred Alternative)

Under this alternative, NMFS would issue an IHA under section 101(a)(5)(D) of the MMPA to Fairweather, allowing the take, by Level B harassments, of small numbers of marine mammal species incidental to its anchor retrieval activity in the Chukchi and Beaufort seas during the 2016 open-water season. In order to reduce the incidental harassment of marine mammals to the lowest level practicable, Fairweather would be required to implement the mitigation, monitoring, and reporting measures described below.

2.3.1.1 Proposed Mitigation Measures

In the marine mammal monitoring and mitigation plan (4MP), Fairweather proposed a suite of mitigation measures to minimize any adverse impacts associated with the anchor retrieval operation in the Chukchi and Beaufort seas. These include: (1) establishing and monitoring safety zones for anchor retrieval and exclusion zones for sonar operations; and (2) vessel movement to minimize potential marine mammal impacts. The following is a summary of mitigation measures proposed for Fairweather:

(a) Establishing Zone of Influence (ZOI)

- (i) Establish a ZOI where the received level is 160 dB zone as a safety zone (although Level A takes are not expected when a marine mammal occurs in this zone).

(b) Clearing Marine Mammals for Safety Zone before Anchor Retrieval and Ice Management Activities:

- (i) When the vessel is positioned on-site, the protected species observers (PSOs) will 'clear' the area by observing the 160 dB safety zone (100 m from the source) for 30 minutes; if no marine mammals are observed within those 30 minutes, anchor retrieval or ice management will commence.
- (ii) If a marine mammal(s) is observed within the 160 dB safety zone (100 m from the source) during the clearing, the PSO will continue to watch until the animal(s) is gone and has not returned for 15 minutes if the sighting was a pinniped, or 30 minutes if it was a cetacean.
- (iii) Once the PSO has cleared the area, anchor retrieval or ice management operations may commence.
- (iv) Should a marine mammal(s) be observed within the 100 m safety zone during the retrieval operations, the PSO will monitor and carefully record any reactions observed. PSOs will also collect behavioral information on marine mammals beyond the safety zone.

(c) Safety Zones Related to Sonar Operations

- (i) Prior to starting the sonar activity, the PSO will 'clear' the area by observing the 180 dB exclusion zone (100 m) for 30 minutes; if no marine mammals are observed within those 30 minutes, sonar activity will commence.

(ii) If a marine mammal(s) is observed within the 180 dB exclusion zone during the clearing, the PSO will continue to watch until the animal(s) is gone and has not returned for 15 minutes if the sighting was a pinniped, or 30 minutes if it was a cetacean.

(iii) Once the PSO has cleared the area, sonar activity may commence.

(iv) If an animal enters the 180 dB exclusion zone, sonar will be shut down immediately. Sonar activity will not resume until the marine mammal has cleared the exclusion zone. PSOs will also collect behavioral information on marine mammals beyond the exclusion zone.

(d) Vessel Speed and Course Alteration

(i) If a marine mammal is detected outside the 160 dB safety zone for anchor handling or the 180 dB exclusion zone for sonar activities (100 m) and, based on its position and the relative motion, is likely to enter those zones, the vessel's speed and/or direct course may, when practical and safe, be changed.

(ii) The marine mammal activities and movements relative to the vessels will be closely monitored to ensure that the marine mammal does not approach within either zone. If the mammal appears likely to enter the respective zone, further mitigative actions will be taken, i.e., either further course alterations or shut down in the case of the sonar.

(e) Mitigation Measures for the North Pacific Right Whal:

(i) Fairweather shall avoid transits within designated North Pacific right whale critical habitat. If transit within North Pacific right whale critical habitat cannot be avoided, vessel operators are requested to exercise extreme caution and observe the of 10 kt (18.52 km/h) vessel speed restriction while within North Pacific right whale critical habitat.

(ii) Within the North Pacific right whale critical habitat, all vessels shall keep 2,625 ft (800 m) away from any observed North Pacific right whales and avoid approaching whales head-on consistent with vessel safety.

2.3.1.2 Proposed Monitoring Measures

(1) Vessel-based Marine Mammal Monitoring

Vessel-based NMFS-approved PSOs will monitor for marine mammals during vessel operations (including anchor handling) during all daytime hours.

Each of the vessels will be staffed with a minimum of two PSOs. PSOs will be on watch during all daylight periods.

The observer(s) will watch for marine mammals from the best available vantage point on vessel.

The PSOs will scan systematically with the naked eye and 7 x 50 reticle binoculars.

When a mammal sighting is made, the following information about the sighting will be carefully and accurately recorded:

- Species, group size, age/size/sex categories (if determinable), behavior when first sighted and after initial sighting, heading (if consistent), bearing and distance from the PSO, apparent reaction to activities (e.g., none, avoidance, approach, paralleling, etc.), closest point of approach, and behavioral pace.
- Time, location, speed, activity of the vessel, sea state, ice cover, visibility, and sun glare.
- The positions of other vessel(s) in the vicinity of the PSO *location*.
- The vessel's position, speed, water depth, sea state, ice cover, visibility, and sun glare will also be recorded at the start and end of each observation watch, every 30 minutes during a watch, and whenever there is a change in any of those variables.

Distances to nearby marine mammals will be estimated with binoculars (Fujinon 7x50 binoculars) containing a reticle to measure the vertical angle of the line of sight to the animal relative to the horizon.

Personnel on the bridge will also assist the PSOs in watching for marine mammals.

An electronic database will be used to record and collate data obtained from visual observations. The PSOs will enter the data into the data entry program installed on field laptops. The program automates the data entry process, reduces data entry errors, and maximizes PSO time spent looking at the water.

(2) Protected Species Observers (PSOs)

A sufficient number of PSOs will be onboard to meet the following criteria

- 100 percent monitoring coverage during all periods of exploration drilling operations in daylight.
- Maximum of four consecutive hours on watch per PSO.
- Maximum of approximately 12 hours on watch per day per PSO.

PSO teams will consist of trained field biologist and Alaska Natives observers. An experienced field crew leader will be on every PSO team aboard each anchor handling vessel during the program. PSOs will help ensure that the vessel communicates with the Communications and Call Centers (Com Centers) in Native villages along the Chukchi Sea coast.

Crew leaders serving as PSOs will have experience from one or more projects with operators in Alaska or the Canadian Beaufort. Biologist-observers will have previous PSO experience, and crew leaders will be highly experienced with previous vessel-based marine mammal monitoring projects. All PSOs will be trained and familiar with the marine mammals of the area. All observers will also complete a training session on marine mammal monitoring, to be conducted shortly before the anticipated start of the season. The training sessions will be conducted by marine mammalogists with extensive crew leader experience from previous vessel-based monitoring programs in the Arctic.

Monitoring Plan Peer Review
The MMPA requires that monitoring plans be independently peer reviewed "where the proposed activity may affect the availability of a species or stock for taking for subsistence uses" (16 U.S.C. 1371(a)(5)(D)(ii)(III)). Regarding this requirement, NMFS' implementing regulations state, "Upon receipt of a complete monitoring plan, and at its discretion, [NMFS] will either submit the plan to members of a peer review panel for review or within 60 days of receipt of the proposed monitoring plan, schedule a workshop to review the plan" (50 CFR 216.108(d)).

NMFS has established an independent peer review panel to review Fairweather's 4MPs for its proposed open-water anchor retrieval activities. The panel is scheduled to meet in early March 2016, and will provide comments to NMFS shortly after it meets. After completion of the peer review, NMFS will consider all recommendations made by the panel, incorporate appropriate changes into the monitoring requirements of the IHA (if issued), and publish the panel's findings and recommendations in the final IHA notices of issuance or denial document.

Reporting Measures

(1) Final Report
The results of Fairweather's anchor retrieval activities monitoring reports would be presented in the "90-day" final reports, as required by NMFS under the proposed IHA. The initial final reports are due to NMFS within 90 days after the expiration of the IHA (if issued). The reports will include:

- Summaries of monitoring effort (e.g., total hours, total distances, and marine mammal distribution through the study period, accounting for sea state and other factors affecting visibility and detectability of marine mammals);

- 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;

- Analyses of the effects of various factors influencing detectability of marine mammals (e.g., sea state, number of observers, and fog/glare);

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

- 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;

- A clear comparison of authorized takes and the level of actual estimated takes; and

- A complete characterization of the acoustic footprint resulting from various activity states.

The "90-day" reports will be subject to review and comment by NMFS. Any recommendations made by NMFS must be addressed in the final report prior to acceptance by NMFS.

(2) Notification of Injured or Dead Marine Mammals
Fairweather will be required to notify NMFS' Office of Protected Resources and NMFS' Stranding Network of any sighting of an injured or dead marine mammal. Based on different circumstances, Fairweather may or may not be required to stop operations upon such a sighting. Fairweather would provide NMFS with the species or description of the animal(s), the condition of the animal(s) (including carcass condition if the animal is dead), location, time of first discovery, observed behaviors (if alive), and photo or video (if available). The specific language describing what Fairweather must do upon sighting a dead or injured marine mammal can be found in the "Proposed Incidental Harassment Authorization" section of their specific proposed IHA.

2.3.2 Alternative 2 – No Action Alternative

For NMFS, denial of an MMPA authorization constitutes the NMFS No Action Alternative, which is consistent with our statutory obligation under the MMPA to grant or deny permit applications and to prescribe mitigation, monitoring and reporting with any authorizations. Under the NMFS No Action Alternative, there are two potential outcome scenarios. One is that the anchor retrieval operations in the Chukchi and Beaufort seas occur in the absence of an MMPA authorization. In this that case, (1) Fairweather would be in violation of the MMPA if takes occur; (2) mitigation, monitoring and reporting would not be prescribed by NMFS; and 3) mitigation measures might not be performed voluntarily by the applicant. Another outcome scenario is Fairweather could choose would not to proceed with their proposed activities.

By undertaking prescribing measures to protect minimize impacts on marine mammals species or stocks from incidental take through the authorization program, we can potentially lessen the impacts of these activities on the marine environment. While NMFS does not authorize the anchor retrieval operations, NMFS does authorize the unintentional, incidental unintentional take of marine mammals (under its jurisdiction) in connection with these activities and prescribes, where applicable, the methods of taking and other means of effecting the least practicable impact on the species and stocks and their habitats. Although the No Action Alternative would not meet the purpose and need to allow incidental takes of marine mammals under certain conditions, the CEQ's regulations require consideration and analysis of a No Action Alternative for the purposes of presenting a comparative analysis to the action alternatives.

2.3.5 Alternatives Considered but Rejected from Further Consideration

NMFS considered whether other alternatives could meet the purpose and need and support Fairweather's proposed activities.

Issuance of IHA with No Required Mitigation, Monitoring, or Reporting Measures
An alternative that would allow for the issuance of IHA with no required mitigation or monitoring was considered but eliminated from consideration, as it would not be in compliance

with the MMPA and therefore would not meet the purpose and need. For that reason, this alternative is not analyzed further in this document.

Use of Alternative Technologies

An alternative that would require Fairweather to use alternative technologies to conduct anchor retrieval activity in the Chukchi and Beaufort seas was considered but eliminated from further consideration. NMFS did a search on the technologies that are potential available for anchor retrieval operations that would generate less underwater noise or afford less impacts. However, NMFS is unaware of any alternative techniques currently available that would allow Fairweather to conduct the proposed anchor retrieval activities in the Arctic Ocean.

Chapter 3 AFFECTED ENVIRONMENT

The National Marine Fisheries Service (NMFS) reviewed all possible environmental, cultural, historical, social, and economic resources based on the geographic location associated with NMFS proposed action and alternatives and Fairweather's request for an IHA. Based on this review, this section describes the affected environment and existing (baseline) conditions for select resource categories. Chapter 4 provides an analysis and description of environmental impacts associated with the affected environment.

3.1 Physical Environment

As explained in Chapter 1, certain resource categories are not affected by NMFS proposed action and alternatives and were not carried forward for detailed evaluation in this EA (see Section 1.5, Table 1). Therefore, the physical components of the environment are summarized in the following subsections.

3.1.1 Marine Mammal Habitat

The Proposed Action areas in the Chukchi and Beaufort seas cover a large continental shelf adjacent to the Arctic Ocean. Water depths within the proposed anchor retrieval operation in the Chukchi and Beaufort seas are less than 200 m.

3.2 Biological Environment

The primary component of the biological environment that would be impacted by the proposed action and alternatives would be marine mammals, which would be directly impacted by the authorization of incidental take. We briefly summarize this component of the biological environment here.

3.2.1 Marine Mammals

The Chukchi and Beaufort seas support a diverse assemblage of marine mammals, including: bowhead, gray, beluga, killer, minke, humpback, and fin whales; harbor porpoise; ringed, spotted, and bearded seals; polar bears; and walruses. Both the walrus and the polar bear are managed by the U.S. Fish and Wildlife Service (USFWS) and are not considered further in this proposed IHA notice.

The bowhead, humpback, and fin whales are listed as "endangered" under the Endangered Species Act (ESA) and as depleted under the MMPA. The ringed and bearded seals are listed as "threatened" under the ESA. Certain stocks or populations of gray, beluga, and spotted seals are listed as endangered under the ESA; however, none of those stocks or populations occur in the proposed activity area.

Fairweather's IHA application contains information on the status, distribution, seasonal distribution, abundance, and life history of each of the species under NMFS jurisdiction mentioned in this document. When reviewing the application, NMFS determined that the species descriptions provided by Fairweather correctly characterized the status, distribution, seasonal distribution, and abundance of each species. Please refer to the applications for that

information. Additional information can also be found in the NMFS Stock Assessment Reports (SAR) (Allen and Angliss, 2015). The Alaska 2014 SAR is available at: http://www.nmfs.noaa.gov/pr/sars/pdf/alaska2014_final.pdf.

Table 5 lists the seven marine mammal species under NMFS jurisdiction with confirmed or possible occurrence in the proposed project area.

Table 5. Marine mammal species and stocks that could be affected by Fairweather's anchor retrieval activities in the Beaufort Sea.

Species	Conservation Status	Habitat	Minimum Population Estimate[1]
Beluga whale (*Delphinapterus leucas*) – Eastern Chukchi Stock	ESA – Not Listed	Offshore, coastal, ice edges	3,710
Beluga whale (*Delphinapterus leucas*) – Beaufort Stock	ESA – Not Listed	Offshore, coastal, ice edges	32,453
Killer whale (*Orcinus orca*)	ESA – Not Listed	Widely distributed	2,084
Harbor porpoise (*Phocoena phocoena*) – Bering Sea Stock[4]	ESA – Not Listed	Coastal, inland waters, shallow offshore waters	48,215
Bowhead whale (*Balaena mysticetus*) – Western Arctic Stock	ESA – Endangered	Pack ice, coastal	19,534
Gray whale (*Eschrichtius robustus*) – Eastern Pacific Stock	ESA – Not Listed	Coastal, lagoons, shallow offshore waters	19,126
Minke whale (*Balaenoptera acutorostrata*)	ESA – Not Listed	Shelf, coastal	810
Humpback whale (*Megaptera novaeangliae*) – Western North Pacific Stock	ESA – Endangered	Shelf slope, mostly pelagic	6,000-14,000
Fin whale (*Balaenoptera physalus*) – Northeast Pacific Stock	ESA – Endangered	Shelf, coastal	1,368
Bearded seal (*Erignathus barbatus*)	ESA – Not listed	Pack ice, shallow offshore waters	155,000
Spotted seal (*Phoca largha*)	ESA – (Arctic DPS Not Listed)	Pack ice, coastal haul outs, offshore	391,000
Ringed seal (*Pusa hispida*)	ESA – Threatened	Land-fast & pack ice, offshore	300,000

3.3 Socioeconomic Environment

3.3.1 Subsistence

Subsistence hunting continues to be an essential aspect of Inupiat Native life, especially in rural coastal villages. The Inupiat participate in subsistence hunting activities in and around the Chukchi and Beaufort seas. The animals taken for subsistence provide a significant portion of the food that will last the community through the year. Marine mammals represent on the order

of 60-80% of the total subsistence harvest. Along with the nourishment necessary for survival, the subsistence activities strengthen bonds within the culture, provide a means for educating the younger generation, provide supplies for artistic expression, and allow for important celebratory events.

The main species that are hunted include bowhead and beluga whales; ringed, spotted, and bearded seals; walruses; and polar bears. (As mentioned previously in this document, both the walrus and the polar bear are under the USFWS' jurisdiction.) The importance of each of these species varies among the communities and is largely based on availability.

Chapter 4 ENVIRONMENTAL CONSEQUENCES

This chapter of the EA analyzes the impacts of the two alternatives and addresses the potential direct, indirect, and cumulative impacts of our issuance of an IHA. Fairweather's IHA application and other related environmental analyses identified previously facilitate this analysis.

Under the MMPA, we have evaluated the potential impacts of Fairweather's anchor retrieval activity in order to determine whether to authorize incidental take of marine mammals. Under NEPA, we have determined that an EA is appropriate to evaluate the potential significance of environmental impacts resulting from the issuance of the IHA.

4.1 Effects of Alternative 1— Issuance of an IHA with Mitigation Measures

Under this alternative, NMFS would issue an IHA to Fairweather for the proposed anchor retrieval activity in the Chukchi and Beaufort seas during the 2016 Artic open-water season, with required mitigation, monitoring, and reporting requirements as discussed in Chapter 2 of this EA. As part of NMFS' action, the mitigation and monitoring would be undertaken as required by the MMPA, and, as a result, no injury or mortality of marine mammals is expected and correspondingly no impact on the reproductive or survival ability of affected species would occur. These analyses are provided in details in the proposed IHA for the issuance of the IHA to Fairweather. Potentially affected marine mammal species under NMFS' jurisdiction include: bowhead, humpback, fin, gray, beluga, and killer whales harborpor porpoise, and bearded, spotted, ribbon, and ringed seals. Five of these species (i.e., bowhead, humpback, and fin whales, and ringed and bearded seals) are listed under the ESA.

4.1.1 Effects on Marine Mammals

Acoustic Impacts

When considering the influence of various kinds of sound on the marine environment, it is necessary to understand that different kinds of marine life are sensitive to different frequencies of sound. Based on available behavioral data, audiograms have been derived using auditory evoked potentials, anatomical modeling, and other data. Southall *et al.* (2007) designate "functional hearing groups" for marine mammals and estimate the lower and upper frequencies of functional hearing of the groups. The functional groups and the associated frequencies are indicated below (though animals are less sensitive to sounds at the outer edge of their functional range and most sensitive to sounds of frequencies within a smaller range somewhere in the middle of their functional hearing range):

- Low frequency cetaceans (13 species of mysticetes): functional hearing is estimated to occur between approximately 7 Hz and 25 kHz;

- Mid-frequency cetaceans (32 species of dolphins, six species of larger toothed whales, and 19 species of beaked and bottlenose whales): functional hearing is estimated to occur between approximately 150 Hz and 160 kHz;

- High frequency cetaceans (eight species of true porpoises, six species of river dolphins, Kogia, the franciscana, and four species of cephalorhynchids): functional hearing is

estimated to occur between approximately 200 Hz and 180 kHz;

- Phocid pinnipeds in Water: functional hearing is estimated to occur between approximately 75 Hz and 100 kHz; and

- Otariid pinnipeds in Water: functional hearing is estimated to occur between approximately 100 Hz and 40 kHz.

As mentioned previously in this document, six marine mammal species (three cetaceans and three phocid pinnipeds) may occur in the proposed seismic survey area. Of the five cetacean species likely to occur in the proposed project area and for which take is requested, two are classified as low-frequency cetaceans (i.e., bowhead and gray whales), two are classified as mid-frequency cetaceans (i.e., killer and beluga whales), and one is classified as a high-frequency cetacean (i.e., harbor porpoise) (Southall *et al.*, 2007). A species functional hearing group is a consideration when we analyze the effects of exposure to sound on marine mammals.

The proposed Fairweather anchor retrieval activity could adversely affect marine mammal species and stocks by exposing them to elevated noise levels in the vicinity of the activity area. Marine mammals exposed to high intensity sound repeatedly or for prolonged periods can experience hearing threshold shift (TS), which is the loss of hearing sensitivity at certain frequency ranges (Kastak et al. 1999; Schlundt et al. 2000; Finneran et al. 2002; 2005). TS can be permanent (PTS), in which case the loss of hearing sensitivity is unrecoverable, or temporary (TTS), in which case the animal's hearing threshold will recover over time (Southall et al. 2007). Since marine mammals depend on acoustic cues for vital biological functions, such as orientation, communication, finding prey, and avoiding predators, marine mammals that suffer from PTS or TTS will have reduced fitness in survival and reproduction, either permanently or temporarily. Repeated noise exposure that leads to TTS could cause PTS.

In addition, chronic exposure to excessive, though not high-intensity, noise could cause masking at particular frequencies for marine mammals that utilize sound for vital biological functions (Clark et al. 2009). Acoustic masking can interfere with detection of acoustic signals such as communication calls, echolocation sounds, and environmental sounds important to marine mammals. Therefore, under certain circumstances, marine mammals whose acoustical sensors or environment are being severely masked could also be impaired from maximizing their performance fitness in survival and reproduction.

Masking occurs at the frequency band which the animals utilize. Therefore, since noise generated from dynamic positioning (DP) using thrusters and mechanic noise from anchor retrieval activities are mostly concentrated at low frequency ranges, they may have less effect on high frequency echolocation sounds by odontocetes (toothed whales). However, lower frequency man-made noises are more likely to affect detection of communication calls and other potentially important natural sounds such as surf and prey noise. It may also affect communication signals when they occur near the noise band and thus reduce the communication space of animals (e.g., Clark et al. 2009) and cause increased stress levels (e.g., Foote et al. 2004; Holt et al. 2009).

Unlike TS, masking can potentially affect the species at population, community, or even ecosystem levels, as well as individual levels. Masking affects both senders and receivers of the signals and could have long-term chronic effects on marine mammal species and populations. Recent science suggests that low frequency ambient sound levels have increased by as much as 20 dB (more than 3 times in terms of sound pressure level (SPL)) in the world's ocean from pre-industrial periods, and most of these increases are from distant shipping (Hildebrand 2009). All anthropogenic noise sources, such as those from vessel traffic and anchor retrieval activity while operating DP thrusters contribute to the elevated ambient noise levels, thus increasing potential for or severity of masking.

Finally, exposure of marine mammals to certain sounds could lead to behavioral disturbance (Richardson et al. 1995), such as: changing durations of surfacing and dives, number of blows per surfacing, or moving direction and/or speed; reduced/increased vocal activities; changing/cessation of certain behavioral activities (such as socializing or feeding); visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping); avoidance of areas where noise sources are located; and/or flight responses (e.g., pinnipeds flushing into water from haulouts or rookeries).

The biological significance of many of these behavioral disturbances is difficult to predict, especially if the detected disturbances appear minor. However, the consequences of behavioral modification are expected to be biologically significant if the change affects growth, survival, and/or reproduction.

The onset of behavioral disturbance from anthropogenic noise depends on both external factors (characteristics of noise sources and their paths) and the receiving animals (hearing, motivation, experience, demography) and is also difficult to predict (Southall et al. 2007). Currently NMFS uses 160 dB re 1 μPa (rms) at received level for impulse noises (such as impact pile driving) as the onset of marine mammal behavioral harassment, and 120 dB re 1 μPa (rms) for non-impulse noises (such as operating DP thrusters). No impulse noise is expected from the Fairweather's anchor retrieval activity. For the Fairweather's anchor retrieval operation, only the 120 dB re 1 μPa (rms) threshold is considered because only non-impulse noise sources would be generated.

4.1.2 Effects on Marine Mammals Habitat

Project activities that could potentially impact marine mammal habitats include acoustical injury of prey resources and temporarily disturbing bethic habitat on sea bottom during anchor retrieval. Regarding the former, however, acoustical injury from thruster and anchor retrieval noises are unlikely. Previous noise studies (e.g., Greenlaw et al. 1988, Davis et al. 1998, Christian et al. 2004) with cod, crab, and schooling fish found little or no injury to adults, larvae, or eggs when exposed to impulsive noises exceeding 220 dB. Continuous noise levels from ship thrusters are generally below 180 dB, and do not create great enough pressures to cause tissue or organ injury.

The anchor handling area covers a small percentage of the potentially available habitat used by marine mammals in the Arctic allowing marine mammals to move away from any generated sounds to feed, rest, migrate, or conduct other elements of their life history. Thus, the proposed activity is not expected to have any habitat-related effects that could cause significant or long-

term consequences for individual marine mammals or their populations, since operations will be limited in duration, location, timing, and intensity.

4.1.3 Effects on Subsistence

4.1.3.1 Subsistence Activities in the Action Area

NMFS has defined "unmitigable adverse impact" in 50 CFR 216.103 as: "an impact resulting from the specified activity: (1) That is likely to reduce the availability of the species to a level insufficient for a harvest to meet subsistence needs by: (i) Causing the marine mammals to abandon or avoid hunting areas; (ii) Directly displacing subsistence users; or (iii) Placing physical barriers between the marine mammals and the subsistence hunters; and (2) That cannot be sufficiently mitigated by other measures to increase the availability of marine mammals to allow subsistence needs to be met.

Noise and general activity during Fairweather's proposed anchor retrieval operation has the potential to impact marine mammals hunted by Native Alaskans. In the case of cetaceans, the most common reaction to anthropogenic sounds (as noted previously) is avoidance of the ensonified area. In the case of bowhead whales, this often means that the animals divert from their normal migratory path by several kilometers. Additionally, general vessel presence in the vicinity of traditional hunting areas could negatively impact a hunt. Native knowledge indicates that bowhead whales become increasingly "skittish" in the presence of anthropogenic noise. Whales are more wary around the hunters and tend to expose a much smaller portion of their back when surfacing, which makes harvesting more difficult. Additionally, natives report that bowheads exhibit angry behaviors, such as tail-slapping, in the presence of seismic activity, which translate to danger for nearby subsistence harvesters.

Anchor handling-related vessel traffic may traverse some areas used during bowhead harvests by Chukchi and Beaufort villages. Bowhead hunts by residents of Wainwright, Point Hope, and Point Lay take place almost exclusively in the spring prior to the date on which the vessels would commence the proposed anchor handling program. From 1984 through 2009, all bowhead harvests by these Chukchi Sea villages occurred only between April 14 and June 24 (George and Tarpley 1986; George et al. 1987, 1988, 1990, 1992, 1995, 1998, 1999, 2000; Philo et al. 1994; Suydam et al. 1995a,b, 1996, 1997, 2001a,b, 2002, 2003, 2004, 2005a,b, 2006, 2007, 2008, 2009, 2010), while vessels will not enter the Bering Sea (northbound) prior to July 1. However, fall whaling by some of these Chukchi Sea villages has occurred since 2010 and is likely to occur in the future, particularly if bowhead quotas are not completely filled during the spring hunt, and fall weather is accommodating. A Wainwright whaling crew harvested the first fall bowhead for these villages in 90 years or more on October 7, 2010, and another in October of 2011 (Suydam et al. 2011, 2012, 2013). No bowhead whales were harvested during fall in 2012, but 3 were harvested by Wainwright in fall 2013.

Barrow crews have traditionally hunted bowheads during both spring and fall; however, spring whaling by Barrow crews is normally finished before the date on which anchor handling operations would commence. From 1984 through 2011 whales were harvested in the spring by Barrow crews only between April 23 and June 15 (George and Tarpley 1986; George et al. 1987, 1988, 1990, 1992, 1995, 1998, 1999, 2000; Philo et al. 1994; Suydam et al. 1995 a, b, 1996,

1997, 2001a, 2002, 2003, 2004, 2005a, b, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013). Fall whaling by Barrow crews does take place during the time period when anchor handling activities would be completed, with vessels out of the Chukchi Sea by the end of August. From 1984 through 2011, whales were harvested in the fall by Barrow crews between August 31 and October 30, indicating that there is potential for vessel traffic to affect these hunts. Most fall whaling by Barrow crews, however, takes place east of Barrow along the Beaufort Sea coast therefore providing little opportunity for the anchor handling program to affect them. For example, Suydam et al. (2008) reported that in the previous 35 years, Barrow whaling crews harvested almost all their whales in the Beaufort Sea to the east of Point Barrow. As all anchor sites are over 100 miles from Barrow, we do not anticipate any conflict with Barrow harvest. In the event the sonar survey for Sivulliq is taking place as Barrow is harvesting, the Norseman II will traverse 50 mi offshore around Barrow, as we have for the last eight years.

Nuiqsut and Kaktovik crews traditionally hunt during the fall, harvesting in late August through September. The Alaska Eskimo Whaling Commission (AEWC) requires that all industry activities cease working east of 150° W by August 25th for the start of whaling for those communities. The anchor handling vessels will enter the Beaufort Sea as soon as ice at Point Barrow allows for safe passage and will complete the Sivulliq anchor retrieval well before August 25th. If a sonar survey is required on this site, it will take place after the completion of the fall hunt and has been cleared by both communities.

Beluga whales typically do not represent a large proportion of the subsistence harvests by weight in the communities of Wainwright and Barrow, the nearest communities to the planned anchor handling project area. Barrow residents hunt beluga in the spring (normally after the bowhead hunt) in leads between Point Barrow and Skull Cliffs in the Chukchi Sea, primarily in April-June and later in the summer (July-August) on both sides of the barrier island in Elson Lagoon/Beaufort Sea (Minerals Management Service [MMS] 2008), but harvest rates indicate the hunts are not frequent. Wainwright residents hunt beluga in April-June in the spring lead system, but this hunt typically occurs only if there are no bowheads in the area. Communal hunts for beluga are conducted along the coastal lagoon system later in July-August.

Belugas typically represent a much greater proportion of the subsistence harvest in Kotzebue, Point Lay, and Point Hope. Point Lay's primary beluga hunt occurs from mid-June through mid-July, but can sometimes continue into August if early success is not sufficient. Point Hope residents hunt beluga primarily in the lead system during the spring (late March to early June), but also in open water along the coastline in July and August. Belugas are harvested in spring mid-June through mid-July in Kotzebue, but the timing can vary based on beluga movement. Belugas are harvested in coastal waters near these villages, generally within a few miles from shore. In the Chukchi, the anchor retrieval sites are located more than 60 mi (97 km) offshore, therefore proposed anchor handling in the project area would have no or minimal impacts on beluga hunts.

The retrieval of anchors around Kotzebue is located nearshore and has the most potential for disturbance to beluga harvest. Communications with the Kotzebue Whaling Commission, AEWC, and Com Center (if established) will be imperative during operations in this area to

avoid any conflict. Vessels will move offshore if Fairweather is not cleared by subsistence users to conduct activities.

Disturbance associated with vessel traffic could potentially affect beluga hunts. However, all of the beluga hunt by Barrow residents in the Chukchi Sea, and much of the hunt by Wainwright residents would likely be completed before anchor handling activities would commence. Additionally, vessel traffic associated with the anchor handling program will be restricted under normal conditions to designated corridors that remain onshore or proceed directly offshore thereby minimizing the amount of traffic in coastal waters where beluga hunts take place. The designated vessel traffic corridors do not traverse areas indicated in recent mapping as utilized by Point Lay or Point Hope for beluga hunts, and avoids important beluga hunting areas in Kasegaluk Lagoon that are used by Wainwright.

Seals are an important subsistence resource and ringed seals make up the bulk of the seal harvest. Most ringed and bearded seals are harvested in the winter or in the spring before the anchor handling program would commence, but some harvest continues during open water and could possibly be affected by the planned activities. Spotted seals are also harvested during the summer. Most seals are harvested in coastal waters, with available maps of recent and past subsistence use areas indicating seal harvests have occurred only within 48-64 km (30-40 mi) of the coastline. The anchor handling retrieval sites are located more than 103 km (64 mi) offshore, so activities are thought to possibly have an impact on subsistence hunting for seals. Since most seal hunting is done during the winter and spring when the anchor handling program is not operational, potential effects to seal species are thought to be negligible.

Fairweather's mitigation measures, which include a system of PSOs and communication with Com Centers in the respective region, will be implemented to avoid any effects from vessel traffic on fall whaling and other subsistence activities. Vessel movements are adjusted as needed and planned in a manner that avoids potential impacts to bowhead whale hunts and other subsistence activities. With these mitigation measures and the nature of Fairweather's proposed action, it is expected that any harassment of marine mammals resulting from the 2016 anchor handling program will not have an unmitigable adverse impact on the availability of marine mammals to be taken for subsistence uses.

4.2 Effects of Alternative 2—No Action Alternative

Under the No Action Alternative, NMFS would not issue IHA to Fairweather for the proposed anchor retrieval activities in the Bering, Chukchi, and Beaufort seas. Therefore, the No Action Alternative would effectively preclude Fairweather from engaging in these activities in the Chukchi and Beaufort seas during the 2016 Arctic open-water season, as any takes of marine mammals under such activities would be violations of the MMPA. If this alternative were selected, the impact on the environment from not conducting the proposed anchor retrieval activities in the 2016 open-water season mean that:

1) Adverse impacts on marine mammals would not be expected as the associated noise generated from these activities would not exist; and

2) Adverse impacts on the Inupiat subsistence hunts would not occur as marine mammals would not be affected and would not have cause to temporarily vacate the area due to underwater noises from the anchor retrieval operation.

4.3 Estimation of Takes

For purposes of evaluating the potential significance of the "takes" by harassment, estimations of the number of potential takes are discussed in terms of the populations present. The specific number of takes considered for the authorizations is developed via the MMPA process, and the analysis in this EA provides a summary of the anticipated numbers that would be authorized to give a relative sense of the nature of impact of NMFS' proposed action. The methods to estimate take by harassment and present estimates of the numbers of marine mammals that might be affected during Fairweather's proposed anchor retrieval activities are described in detail in the applicants' IHA applications and the *Federal Register* notices of proposed IHA, which can be accessed at NMFS website at: http://www.nmfs.noaa.gov/pr/permits/incidental/research.htm.

Table 6. Summary of Number of Marine Mammals Potentially Exposed to Level B Harassment.

Species	**Chukchi Sea**	**Beaufort Sea**	**Abundance**	**Total**	**% of stock or population**
Bowhead whale	37.41	620.51	19,534	658	3.37%
Gray whale	197.41	0	20,990	197	0.94%
Beluga whale (E. Chukchi stock)	33.55	19.98	3,710	54	1.47%
Beluga whale (Beaufort stock)	356.56	212.38	39,258	569	1.45%
Fin whale	3.68	0	10,103	4	0.04%
Humpback whale	3.68	0.86	1,652	4	0.27%
Minke whale	5.52	1.29	1,233	7	0.55%
Harbor porpoise	40.46	9.48	48,215	50	0.10%
Killer whale	3.68	0.86	2,347	4	0.19%
Ringed seal	5,586.67	1,308.58	249,000	6,895	2.77%
Bearded seal	186.68	43.73	155,000	230	0.15%
Spotted seal	112.19	26.28	460,268	138	0.03%

Estimates of the takes of marine mammals by Level B harassment from Fairweather's proposed anchor retrieval operation are presented in Table 6. Detailed descriptions of take estimates are presented in the *Federal Register* notices for the proposed IHA for the proposed action.

4.4 Cumulative Effects

Cumulative effect is defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such other actions" (40 CFR §1508.7). Cumulative impacts may occur when there is a relationship between a proposed action and other actions expected to occur in a similar location or during a similar time period, or when past or future actions may result in impacts that would additively or

synergistically affect a resource of concern. In other words, the analysis takes into account the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions (40 CFR §1508.7). These relationships may or may not be obvious. Actions overlapping within close proximity to the proposed action can reasonably be expected to have more potential for cumulative effects on "shared resources" than actions that may be geographically separated. Similarly, actions that coincide temporally will tend to offer a higher potential for cumulative effects.

Actions that might permanently remove a resource would be expected to have a potential to act additively or synergistically if they affected the same population, even if the effects were separated geographically or temporally. Note that the proposed action considered here would not be expected to result in the removal of individual cetaceans or pinnipeds from the population or to result in harassment levels that might cause animals to permanently abandon preferred feeding areas or other habitat locations, so concerns related to removal of viable members of the populations are not implicated by the proposed action. This cumulative effects analysis considers these potential impacts, but more appropriately focuses on those activities that may temporally or geographically overlap with the proposed activity such that repeat harassment effects warrant consideration for potential cumulative impacts to the potentially affected 11 marine mammal species and their habitats.

Cumulative effects may result in significant effects even when the Federal action under review is insignificant when considered by itself. The CEQ guidelines recognize that it is not practical to analyze the cumulative effects of an action on the universe but to focus on those effects that are truly meaningful. This section analyzes the addition of the effects of the proposed action (i.e., the issuance of IHA to Fairweather for the take of marine mammals incidental to anchor retrieval activities in the Chukchi and Beaufort seas) to the potential direct and indirect effects of other factors that may, in combination with the proposed action, result in greater effects on the environment than those resulting solely from the proposed action. Cumulative effects on affected resources that may result from the following activities—seismic survey activities, vessel and air traffic, oil and gas exploration and development in Federal and state waters, subsistence harvest activities, military activities, industrial development, community development, and climate change—within the proposed project area are discussed in the following subsections.

4.6.1 Past Commercial Whaling

Commercial hunting between 1848 and 1915 caused severe depletion of the bowhead population(s) that inhabits the Bering, Chukchi, and Beaufort (BCB) Seas. This hunting is no longer occurring and is not expected to occur again. Woodby and Botkin (1993) estimated that the historic abundance of bowheads in this population was between 10,400 and 23,000 whales in 1848, before the advent of commercial whaling. Woodby and Botkin (1993) estimated between 1,000 and 3,000 animals remained in 1914, near the end of the commercial-whaling period. Data indicate that what is currently referred to as the BCB Seas stock of bowheads is increasing in abundance.

Similar to bowhead whales, most stocks of fin whales were depleted by commercial whaling (Reeves et al., 1998) beginning in the second half of the mid-1800s (Schmitt et al., 1980; Reeves and Barto, 1985). In the 1900s, hunting for fin whales continued in all oceans for about 75 years

(Reeves et al., 1998) until it was legally ended in the North Pacific in 1976. Commercial hunting for humpback whales resulted in the depletion and endangerment of this species. Prior to commercial hunting, humpback whales in the North Pacific may have numbered approximately 15,000 individuals (Rice, 1978). Unregulated hunting legally ended in the North Pacific in 1966.

The end of commercial whaling has seen the increase in whale numbers in the Arctic, particularly for bowhead and gray whales, despite increased industrial and commercial activities in the region. Since the proposed anchor retrieval activity will not have lethal takes of marine mammals, there is no potential additive or cumulative effects on marine mammal population level with the proposed action.

4.6.2 Subsistence Hunting

4.6.2.1 Bowhead Whales

Indigenous peoples of the Arctic and Subarctic have been hunting bowhead whales for at least 2,000 years (Stoker and Krupnik, 1993). Thus, subsistence hunting is not a new contributor to cumulative effects on this population. There is no indication that, prior to commercial whaling, subsistence whaling caused significant adverse effects at the population level. However, recent agreement has changed the potential for any lethal hunting of this whale to cause population-level adverse effects if unregulated. Under the authority of the IWC, the subsistence take from this population has been regulated by a quota system since 1977. Federal authority for cooperative management of the Eskimo subsistence hunt is shared with the AEWC through a cooperative agreement between the AEWC and NMFS.

The sustainable take of bowhead whales by indigenous hunters represents the largest known human-related cause of mortality in this population at the present time. Available information suggests that it is likely to remain so for the foreseeable future. While other potential effectors primarily have the potential to cause, or to be related to, behavioral or sublethal adverse effects to this population, or to cause the deaths of a small number of individuals, little or no evidence exists of other common human-related causes of mortality. Subsistence take, which all available evidence indicates is sustainable, is monitored, managed, and regulated, and helps to determine the resilience of the population to other actions that could potentially cause lethal takes. The sustained growth of the BCB Seas bowhead population indicates that the level of subsistence take has been sustainable. Because the quota for the hunt is tied to the population size and population parameters (IWC, 2003; NMFS, 2003), it is unlikely this source of mortality will contribute to a significant adverse effect on the recovery and long-term viability of this population.

Currently, Native Alaskan hunters from 11 communities harvest bowheads for subsistence and cultural purposes under a quota authorized by the IWC. Chukotkan Native whalers from Russia also are authorized to harvest bowhead whales under the same authorized quota. Bowheads are hunted at Gambell and Savoonga on St. Lawrence Island, and along the Chukotkan coast. On the northward spring migration, harvests may occur by the villages of Wales, Little Diomede, Kivalina, Point Lay, Point Hope, Wainwright, and Barrow. During their westward migration in autumn, whales are harvested by Kaktovik, Nuiqsut, and Barrow. At St. Lawrence Island, fall

migrants can be hunted as late as December (IWC, 2004). The status of the population is closely monitored, and these activities are closely regulated.

There are adverse impacts of the hunting to bowhead whales in addition to the death of animals that are successfully hunted and the serious injury of animals that are struck but not immediately killed. Available evidence indicates that subsistence hunting causes disturbance to the other whales, changes in their behavior, and sometimes temporary effects on habitat use, including migration paths. Modern subsistence hunting represents a source of noise and disturbance to the whales during the following periods and in the following areas: during their northward spring migration in the Bering Sea, the Chukchi Sea in the spring lead system, and in the Beaufort Sea spring lead system near Barrow; their fall westward migration in subsistence hunting areas associated with hunting from Kaktovik, Cross Island, and Barrow; hunting along the Chukotka coast; and hunting in wintering areas near St. Lawrence Island. Lowry et al. (2004) reported that indigenous hunters in the Beaufort Sea sometimes hunt in areas where whales are aggregated for feeding. When a subsistence hunt is successful, it results in the death of a bowhead. Data on strike and harvested levels indicate that whales are not always immediately killed when struck, and some whales are struck but cannot be harvested. Whales in the vicinity of the struck whale could be disturbed by the sound of the explosive harpoon used in the hunt, the boat motors, and any sounds made by the injured whale.

Noise and disturbance from subsistence hunting serves as a seasonally and geographically predictable source of noise and disturbance to which other noise and disturbance sources, such as shipping and oil and gas-related activities, add additional stressors to marine mammals. To the extent such activities occur in the same habitats during the period of whale migration, even if the activities (for example, hunting and shipping) themselves do not occur simultaneously, cumulative effects from all noise and disturbance could affect whale habitat use. Subsistence hunting attaches a strong adverse association to human noise for any whale that has been in the vicinity when other whales were struck.

4.6.2.2 Beluga Whales

The subsistence take of beluga whales within U.S. waters is reported by the Alaska Beluga Whale Committee (ABWC). The annual subsistence take of the Beaufort Sea stock of beluga whales by Alaska Natives averaged 25 belugas during the 5-year period from 2002-2006 (Allen and Angliss, 2011). The annual subsistence take of Eastern Chukchi Sea stock of beluga whales by Alaska Natives averaged 59 belugas landed during the 5-year period 2002-2006 based on reports from ABWC representatives and on-site harvest monitoring. Data on beluga that were struck and lost have not been quantified and are not included in these estimates (Allen and Angliss, 2011). As with bowhead whale subsistence hunts, noise during the hunts may disturb other animals not struck and taken for subsistence purposes. Again, the disturbance occurs during specific time periods in specific locations to which other activities could add. To the extent such activities occur in the same habitats during the period of whale migration, even if the activities (for example, hunting and shipping) themselves do not occur simultaneously, cumulative effects from all noise and disturbance could affect whale habitat use. Subsistence hunting attaches a strong adverse association to human noise for any whale that has been in the vicinity when other whales were struck.

4.6.2.3 Ice Seals

The Division of Subsistence, Alaska Department of Fish and Game (ADF&G) maintains a database that provides additional information on the subsistence harvest of ice seals in different regions of Alaska (ADF&G 2000a,b). Information on subsistence harvest of bearded seals has been compiled for 129 villages from reports from the Division of Subsistence and a report from the Eskimo Walrus Commission (Sherrod, 1982). Data were lacking for 22 villages; their harvests were estimated using the annual per capita rates of subsistence harvest from a nearby village. As of August 2000, the subsistence harvest database indicated that the estimated number of bearded, ribbon, ringed, and spotted seals harvested for subsistence use per year are 6,788, 193, 9,567, and 244, respectively (Allen and Angliss, 2011).

At this time, there are no efforts to quantify the current level of harvest of bearded seals by all Alaska communities. However, the Fairweather collects information on the level of ice seal harvest in five villages during their Walrus Harvest Monitoring Program. Results from this program indicate that an average of 239 bearded seals were harvested annually in Little Diomede, Gambell, Savoonga, Shishmaref, and Wales from 2000 to 2004, 13 ribbon seals from 1999 to 2003, and 47 ringed seals from 1998 to 2003 (Allen and Angliss, 2010). Since 2005, harvest data are only available from St. Lawrence Island (Gambell and Savoonga) due to lack of walrus harvest monitoring in areas previously monitored. There were 21 bearded seals harvested during the walrus harvest monitoring period on St. Lawrence Island in 2005, 41 in 2006, and 82 in 2007. There were no ringed seals harvested on St. Lawrence Island in 2005, 1 in 2006, and 1 in 2007. The mean annual subsistence harvest of spotted seals in north Bristol Bay from this stock over the 5-year period from 2002 through 2006 was 166 seals per year. No ribbon seal was harvested between 2005 and 2007 (Allen and Angliss, 2010).

4.6.2.4 Contributions of the Alternatives to Cumulative Effects of Subsistence Hunting

Alternative 2 would not contribute any additional effects beyond those already analyzed to the cumulative effects from subsistence hunting, as the IHA would not be issued. Alternative 1 would allow for the issuance of an IHA for the take of marine mammals incidental to conducting anchor retrieval activities in the Beaufort Sea during the open-water season. However, the proposed action is not anticipated to result in serious injury or mortality of any marine mammals; therefore, there would not be additional deaths beyond those from subsistence hunting activities. While both activities (i.e., the proposed surveys and subsistence hunting) can disturb marine mammals, NMFS considers the contribution of such disturbance to overall cumulative effects to be minimal because of the mitigation measures that would be required under the IHA, which are included to reduce impacts to the lowest level practicable.

4.6.3 Climate Change

Section 3.1.4.4 in NMFS' Draft EIS on the Effects of Oil and Gas Activities in the Arctic Ocean (NMFS, 2011) describes changes to climate in the Arctic environment. That information is summarized here and incorporated herein by reference. Evidence of climate change in the Arctic has been identified and appears to generally agree with climate modeling scenarios of greenhouse gas warming. Such evidence suggests (NSIDC, 2011a):

- Air temperatures in the Arctic are increasing at an accelerated rate;
- Year-round sea ice extent and thickness has continually decreased over the past three decades;
- Water temperatures in the Arctic Ocean have increased;
- Changes have occurred to the salinity in the Arctic Ocean;
- Rising sea levels;
- Retreating glaciers;
- Increases in terrestrial precipitation;
- Warming permafrost in Alaska; and
- Northward migration of the treeline.

Concurrent with climate change is a change in ocean chemistry known as ocean acidification. This phenomenon is described in the IPCC Fourth Assessment Report (IPCC, 2007a), a 2005 synthesis report by members of the Royal Society of London (Raven et al., 2005), and an ongoing BOEM-funded study (Mathis, 2011). The greatest degree of ocean acidification worldwide is predicted to occur in the Arctic Ocean. This amplified scenario in the Arctic is due to the effects of increased freshwater input from melting snow and ice and from increased CO_2 uptake by the sea as a result of ice retreat (Fabry et al., 2009). Measurements in the Canada Basin of the Arctic Ocean demonstrate that over 11 years, melting sea ice forced changes in pH and the inorganic carbon equilibrium, resulting in decreased saturation of calcium carbonate in the seawater. At this time, we do not know the precise timeframe, or the series of events that would need to occur before an adverse population level effect on the marine mammals or other resources in the Arctic would be realized. This information is unobtainable at this time due to the fact that such conditions do not exist to conduct studies.

Bowhead and other Arctic whales are associated with and well adapted to ice-covered seas with leads, polynyas, open water areas, or thin ice that the whales can break through to breathe. Arctic coastal peoples have hunted bowheads for thousands of years, but the distribution of bowheads in relation to climate change and sea ice cover in the distant past is not known. It has been suggested that a cold period 500 years ago resulted in less ice-free water near Greenland, forcing bowheads to abandon the range, and that this in turn led to the disappearance of the Thule culture. However, it is not clear if larger expanses and longer periods of ice-free water would be beneficial to bowheads. The effect of warmer ocean temperatures on bowheads may depend more on how such climate changes affect the abundance and distribution of their planktonic prey rather than the bowheads' need for ice habitat itself.

Climate change associated with Arctic warming may also result in regime change of the Arctic Ocean ecosystem. Sighting of humpback whales in the Chukchi Sea during the 2007 Shell seismic surveys (Funk et al., 2008), 2009 COMIDA aerial survey (Clarke et al., 2011c), and south of Point Hope in 2009 while transiting to Nome (Brueggeman, 2010) may indicate the expansion of habitat by this species as a result of ecosystem regime shift in the Arctic. These species, in addition to minke and killer whales, and four pinniped species (harp, hooded, ribbon, and spotted seals) that seasonally occupy Arctic and subarctic habitats may be poised to encroach into more northern latitudes and to remain there longer, thereby competing with extant Arctic species (Moore and Huntington, 2008).

In the past decade, geographic displacement of marine mammal population distributions has coincided with a reduction in sea ice and an increase in air and ocean temperatures in the Bering Sea. Continued warming is likely to increase the occurrence and resident times of subarctic species such as spotted seals and bearded seals in the Beaufort Sea. The result of global warming would significantly reduce the extent of sea ice in at least some regions of the Arctic (ACIA, 2004).

Ringed seals, which are true Arctic species, depend on sea ice for their life functions, and give birth to and care for their pups on stable shorefast ice. The reductions in the extent and persistence of ice in the Beaufort Sea almost certainly could reduce their productivity (NRC, 2003b). Ongoing and projected changes in sea ice habitat pose significant threats to the Alaska ringed seal stock. In addition, spotted seals and bearded seals would also be vulnerable to reductions in sea ice, although insufficient data exist to make reliable predictions of the effects of Arctic climate change on these two species (Allen and Angliss, 2010).

The implications of the trends of a changing climate for bowheads and other Arctic cetaceans are uncertain, but they may be beneficial, in contrast to affects on ice-obligate species such as ice seals, polar bears, and walrus (ACIA, 2004). There will be more open water and longer ice-free seasons in the arctic seas, which may allow them to expand their range as the population continues to recover from commercial whaling. However, this potential for beneficial effects on bowheads and other whales will depend on their ability to locate sufficient concentrations of planktonic crustaceans to allow efficient foraging. Since phytoplankton blooms may occur earlier or at different times of the season, or in different locations, the timing of zooplankton availability may also change from past patterns. Hence, the ability of bowheads to use these food sources may depend on their flexibility to adjust the timing of their own movements and to find food sources in different places (ACIA, 2004). In addition, it is hypothesized that some of the indirect effects of climate change on marine mammal health would likely include alterations in pathogen transmission due to a variety of factors, effects on body condition due to shifts in the prey base/food web, changes in toxicant exposures, and factors associated with increased human habitation in the Arctic.

With the large uncertainty of the degree of impact of climate change to Arctic marine mammals, NMFS recognizes that warming of this region which results in the diminishing of ice could be a concern to ice dependent seals, walrus, and polar bears. Nonetheless, NMFS considers the effects of the proposed action and the specified activity proposed by Fairweather during 2016 on climate change to be too remote and speculative at this time to conclude definitively that the issuance of an MMPA IHA for the 2016 open-water anchor retrieval activities would contribute to climate change, and therefore a reduction in Arctic sea ice coverage. More research is needed to determine the magnitude of the impact, if any, of global warming to marine mammal species in the Arctic and subarctic regions.

4.6.4 Oil and Gas Exploration and Development

4.6.4.1 Marine and Seismic Surveys

BOEM-permitted seismic surveys have been conducted in the Federal waters of the Beaufort Sea since the late 1960's/early 1970's (MMS 2007a). For activities since July 2010, NMFS issued

an IHA to Shell to take 8 species of marine mammals by Level B behavioral harassment incidental to conducting site clearance and shallow hazards surveys in the Beaufort and Chukchi Seas on August 6, 2010 (75 FR 49710; August 13, 2010). No seismic surveys were conducted in the Beaufort Sea in 2011. In 2012, NMFS issued an IHA to BP Exploration (Alaska), Inc. (BPXI) and ION Geophysical (ION) to take small numbers of marine mammals by harassment incidental to conducting open-water 3D OBC seismic surveys in the Simpson Lagoon of the Beaufort Sea (77 FR 40007; July 6, 2012) and in-ice 2D seismic surveys in the Beaufort and Chukchi Seas (77 FR 65060; October 24, 2012), respectively. In 2013, NMFS issued an IHA to Shell for its open-water marine surveys in the Chukchi Sea (78 FR 47496; August 5, 2013), and to ION for its 2D seismic survey in the Chukchi Seas (78 FR 51147; August 20, 2013). In 2014, NMFS issued an IHA to BP for its 3D seismic survey in the Beaufort Sea (79 FR 36730; June 30, 2014) and its geohazard survey in the Beaufort Sea (79 FR 36769; June 30, 2014), and to SAE for its marine seismic survey in the Beaufort Sea (79 FR 51963; September 2, 2014). In 2015, NMF issued an IHA to SAE for its marine seismic survey in the Beaufort Sea (80 FR 40016; July 13, 2015), and to Hilcorp for its geohazard survey in the Beaufort Sea (80 FR 39062; July 8, 2015).

However, the proposed anchor retrieval operation by Fairweather would not generate as intense underwater noise as those from marine seismic and shallow hazard surveys.

4.6.4.2 Oil and Gas Development and Production

Oil and gas exploration and production activities have occurred on the North Slope since the early 1900's, and production has occurred for more than 50 years. Since the discovery and development of the Prudhoe Bay and Kuparuk oil field, more recent fields generally have been developed not in the nearshore environment, but on land in areas adjacent to existing producing areas. Pioneer Natural Resources Co. is developing its North Slope Oooguruk field, which is in the shallow waters of the Beaufort Sea approximately 8 mi northwest of the Kuparuk River unit.

BPXA is currently producing oil from an offshore development in the Northstar Unit, which is located between 3.2 and 12.9 km (2 and 8 mi) offshore from Point Storkersen in the Beaufort Sea. This development is the first in the Beaufort Sea that makes use of a subsea pipeline to transport oil to shore and then into the Trans-Alaska Pipeline System. The Northstar facility was built in State of Alaska waters on the remnants of Seal Island ~9.5 km (6 mi) offshore from Point Storkersen, northwest of the Prudhoe Bay industrial complex, and 5 km (3 mi) seaward of the closest barrier island. The unit is adjacent to Prudhoe Bay, and is approximately 87 km (54 mi) northeast of Nuiqsut, an Inupiat community. To date, it is the only offshore oil production facility north of the barrier islands in the Beaufort Sea.

On November 6, 2009, BPXI submitted an application requesting NMFS issue regulations and subsequent LOAs governing the taking of marine mammals, by both Level B harassment and serious injury and mortality, incidental to operation of the Northstar development in the Beaufort Sea, Alaska. Construction of Northstar was completed in 2001. The activities for 2012-2017 include a continuation of drilling, production, and emergency training operations but no construction or activities of similar intensity to those conducted between 1999 and 2001. NMFS published a notice of proposed rulemaking in the *Federal Register* on July 6, 2011, requesting comments and information from the public (76 FR 39706). NMFS is currently working on the

final rulemaking governing BPXA's marine mammal take authorizations for operating its Northstar facility.

In addition, Shell conducted two exploratory drilling activities at exploration wells in the Beaufort (77 FR 27284; May 9, 2012) and Chukchi (77 FR 27322; May 9, 2012) Seas, Alaska, during the 2012 Arctic open-water season (July through October). In December 2012, Shell submitted two additional IHA applications to take marine mammals incidental to its proposed exploratory drilling in Beaufort and Chukchi Seas during the 2013 open-water season. However, Shell withdrew its application in February 2013. In 2015, NMFS issued an IHA to Shell for its exploration drilling in the Chukchi Sea (80 FR 35744; June 22, 2015).

4.6.4.3 Vessel Traffic

Vessel traffic in the Alaskan Arctic generally occurs within 12.4 mi (20 km) of the coast and usually is associated with fishing, hunting, cruise ships, icebreakers, Coast Guard activities, and supply ships and barges. No extensive maritime industry exists for transporting goods. Traffic in the Beaufort and Chukchi Seas, at present, is limited primarily to late spring, summer, and early autumn.

For cetaceans, the main potential for effects from vessel traffic is through vessel strikes and acoustic disturbance. Regarding sound produced from vessels, it is generally expected to be less in shallow waters (i.e., background noise up to 6.2 mi [10 km] away from vessel) and greater in deeper waters (traffic noise up to 2,480 mi [4,000 km] away may contribute to background noise levels) (Richardson et al., 1995). Aside from the drillships and other vessels associated with the drilling programs, seismic-survey vessels, barging associated with activities such as onshore and limited offshore oil and gas activities, fuel and supply shipments, and other activities contribute to overall ambient noise levels in some regions of the Beaufort and Chukchi Seas. Whaling boats (usually aluminum skiffs with outboard motors) contribute noise during the fall whaling periods in the Alaskan Beaufort Sea. Fishing boats in coastal regions also contribute sound to the overall ambient noise. Sound produced by these smaller boats typically is at a higher frequency, around 300 Hz (Richardson et al., 1995a).

In 2016, Quintillion Subsea Operations, LLC submitted an IHA application to take marine mammals incidental to subsea cable-laying activity in the Bering, Chukchi, and Beaufort seas (Owl Ridge, 2016). The proposed operation would involve 2 cable vessels and several support vessels to deploy subsea fiber optical cable in the Arctic Ocean. NMFS issued an IHA to Quintillion on June 1, 2016. The IHA is valid until October 31, 2016.

Overall, the level of vessel traffic in the Alaskan Arctic, either from oil and gas-related activities or other industrial, military, or subsistence activities, is expected to be greater than in the recent past. With increased ship traffic, there could potentially be deep water port construction in the region.

Ships using the newly opened waters in the Arctic likely will use leads and polynyas to avoid icebreaking and to reduce transit time. Leads and polynyas are important habitat for polar bears

and belugas, especially during winter and spring, and heavy shipping traffic could disturb polar bears and belugas during these times.

The anchor retrieval activities proposed by Fairweather would involve only a few vessels in limited geographic regions. Therefore, these activities would not contribute to a noticeable increase in the total number of vessels already operating in the Arctic Ocean.

4.7.6 Conclusion

Based on the analyses provided in this section, NMFS has determined that Fairweather's proposed anchor retrieval activities in the Chukchi and Beaufort seas during the 2016 Arctic open-water season would not be expected to add significant impacts to overall cumulative effects on marine mammals from past, present, and future activities. The potential impacts to marine mammals and their habitat are expected to be minimal based on the limited noise footprint, and temporal or spatial separation from the activities analyzed above. In addition, mitigation and monitoring measures described in Chapter 2 are expected to further reduce any potential adverse effects.

Chapter 5 List of Preparers and Agencies Consulted

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Agencies Consulted
NMFS Office of Protected Resources consulted with NMFS Alaska Regional Office on potential effects on species listed under the Endangered Species Act.

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