UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
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# Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion

## Ice Exercise 2024 Arctic

**NMFS Consultation Number: AKRO-2023-02122**

**DOI: https://doi.org/10.25923/xnj0-5580**

**Action Agencies:** U.S. Department of Navy
NMFS Office of Protected Resources, Permits, and Conservation Division

**Affected Species and Determinations:**

| ESA-Listed Species | Status | Is the Action Likely to Adversely Affect Species? | Is the Action Likely to Adversely Affect Critical Habitat? | Is the Action Likely To Jeopardize the Species? | Is the Action Likely To Destroy or Adversely Modify Critical Habitat? |
|---|---|---|---|---|---|
| Ringed Seal, Arctic Subspecies (*Phoca (Pusa) hispida*) | Threatened | Yes | No | No | No |

**Consultation Conducted By:** National Marine Fisheries Service, Alaska Region

**Issued By**: ______________________
Jonathan M. Kurland
Regional Administrator

**Date**: January 11, 2024

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**TERMS AND ABBREVIATIONS**

| | |
|---|---|
| μPa | Micro Pascal |
| 2D | Two-Dimensional |
| 3D | Three-Dimensional |
| Ac | Acre |
| AKR | Alaska Region |
| Bbbl | Billion Barrels |
| BE | Biological Evaluation |
| BOEM | Bureau of Ocean Energy Management |
| BSEE | Bureau of Safety and Environmental Enforcement |
| CMTS | U.S. Committee on the Marine Transportation System |
| CWA | Clean Water Act |
| dB re 1μPa | Decibel referenced 1 microPascal |
| dBA | A-weighted decibels |
| DEC | Department of Environmental Conservation |
| EAOEA | Environmental Assessment/Overseas Environmental Assessment |
| EEZ | Exclusive Economic Zone |
| EPA | Environmental Protection Agency |
| ESA | Endangered Species Act |
| °F | Fahrenheit |
| FAA | Federal Aviation Administration |
| FR | Federal Register |
| ft | Feet |
| gal | Gallons |
| Hz | Hertz |
| ICEX | Ice Exercise |
| ICEX 2024 | Ice Exercise 2024 |
| IHA | Incidental Harassment Authorization |
| IPCC | Intergovernmental Panel on Climate Change |
| ITA | Incidental Take Authorization |
| ITS | Incidental Take Statement |
| kHz | Kilohertz |
| kg | Kilograms |

| | |
|---|---|
| km | Kilometers |
| $km^2$ | Square kilometers |
| kn | Knots |
| L | Liter |
| L/day | Liters/day |
| m | Meter |
| mi | Mile |
| MMPA | Marine Mammal Protection Act |
| ms | Milliseconds |
| µPa | Micro Pascal |
| MT | Metric tons |
| NAEMO | The Navy Acoustic Effects Model |
| Navy | United States Department of the Navy |
| nm | Nautical mile |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NPDES | National Pollution Discharge Elimination System |
| NRC | National Research Council |
| OCS | Outer Continental Shelf |
| Opinion | Biological Opinion |
| Pa | Pascals |
| PDV | Phocine distemper virus |
| PAM | Passive acoustic monitoring |
| PTS | Permanent Threshold Shift |
| RPA | Reasonable and Prudent Alternative |
| SEL | Sound exposure level |
| SPL | Sound pressure level |
| s | Second |
| TTS | Temporary Threshold Shift |
| UME | Unusual Mortality Event |
| U.S. | United States |
| U.S.C. | United States Code |
| USFWS | United States Fish and Wildlife Services |
| VLOS | Very Large Oil Spill |

# 1 INTRODUCTION

Section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. § 1536(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 protected species, that agency is required to consult with the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), depending upon the endangered species, threatened species, or designated critical habitat that may be affected by the action (50 CFR § 402.14(a)). Federal agencies may fulfill this general requirement informally if they conclude that an action may affect, but "is not likely to adversely affect" endangered species, threatened species, or designated critical habitat, and NMFS or the USFWS concurs with that conclusion (50 CFR § 402.14(b)).

Section 7(b)(3) of the ESA requires that at the conclusion of consultation, NMFS and/or USFWS provide an opinion stating how the Federal agency's action is likely to affect ESA-listed species and their critical habitat. If incidental take is reasonably certain to occur, section 7(b)(4) requires the consulting agency to provide an incidental take statement (ITS) that specifies the impact of any incidental taking, specifies those reasonable and prudent measures necessary or appropriate to minimize such impact, and sets forth terms and conditions to implement those measures.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019 Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. On November 14, 2022, the Northern District of California issued an order granting the government's request for voluntary remand without vacating the 2019 regulations. The District Court issued a slightly amended order two days later on November 16, 2022. As a result, the 2019 regulations remain in effect, and we are applying the 2019 regulations here. For purposes of this consultation and in an abundance of caution, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different. New proposed rules were published in the Federal Register on June 22, 2023 (88 FR 40753).

In this document, the action agencies are the United States Navy (Navy), which proposes to conduct military exercises in the Arctic, and the NMFS Office of Protected Resources, Permits and Conservation Division (hereafter referred to as "the Permits Division"), which plans to issue an incidental harassment authorization (IHA) pursuant to section 101(a)(5)(D) of the Marine Mammal Protection Act of 1972, as amended (MMPA; 16 U.S.C. § 1361 et seq.), to the Navy for harassment of marine mammals incidental to the proposed activities (88 FR 85244, December 7, 2023). When issued, the IHA will be valid from February 1, 2024 to April 30, 2024, and will authorize the incidental harassment of the threatened Arctic ringed seal. The consulting agency for this proposal is NMFS's Alaska Region (AKR). This document represents NMFS's biological opinion (opinion) on the effects of this proposal on endangered and threatened species and designated critical habitat.

The opinion and ITS were prepared by NMFS Alaska Region in accordance with section 7(b) of the ESA (16 U.S.C. § 1536(b)), and implementing regulations at 50 CFR part 402.

The opinion and ITS are in compliance with the Data Quality Act (44 U.S.C. § 3504(d)(1)) and underwent pre-dissemination review.

## 1.1 Background

This opinion is based on information provided in the July 2023 and revised October 2023 Biological Evaluation (BE) for the project, the October 2023 Revised Request for an Incidental Harassment Authorization (IHA), and the September 2023 Draft Supplemental Environmental Assessment/Overseas Environmental Assessment (EAOEA) for the Ice Exercise Program. Other sources of information relied upon include clarifying emails between NMFS and Navy staff, stock assessment reports, monitoring reports, and relevant peer reviewed literature. A complete record of this consultation is on file at NMFS's Juneau, Alaska office.

The proposed action involves the establishment of a temporary base camp on Arctic ice in the Beaufort Sea approximately 100–200 nautical miles (nm) north of Prudhoe Bay, Alaska (Figure 1). The base camp will support submarine training and testing under Arctic conditions, test emerging technologies and their capabilities in the Arctic, and gather data on Arctic environmental conditions. The proposed construction, use, and demobilization of the camp will occur over a six-week period from February to April 2024.

This opinion considers the effects of the Navy's Ice Exercise (ICEX 2024) in the winter/spring of 2024. These actions have the potential to affect the threatened Arctic subspecies of ringed seal (*Phoca (Pusa) hispida*) but will have no effect to critical habitat. Critical habitat only overlaps with the flight corridor. Physical and biological features that are necessary to conserve the Arctic subspecies of ringed seals included sea ice habitat and primary prey needed to maintain ringed seal energy budgets. Critical habitat is not expected to be altered by periodic overflight of aircraft. Therefore, effects to critical habitat are not considered in this Opinion. The bowhead whale (*Balaena mysticetus*) was not included in the IHA application because bowhead whales migrate to the west and south in the winter and will not be present in the action area. Likewise, the bearded seal (*Erignathus barbatus nauticus*) is not expected to be within the vicinity of the action area. Therefore, neither bowhead whales nor bearded seals are considered in this Opinion.

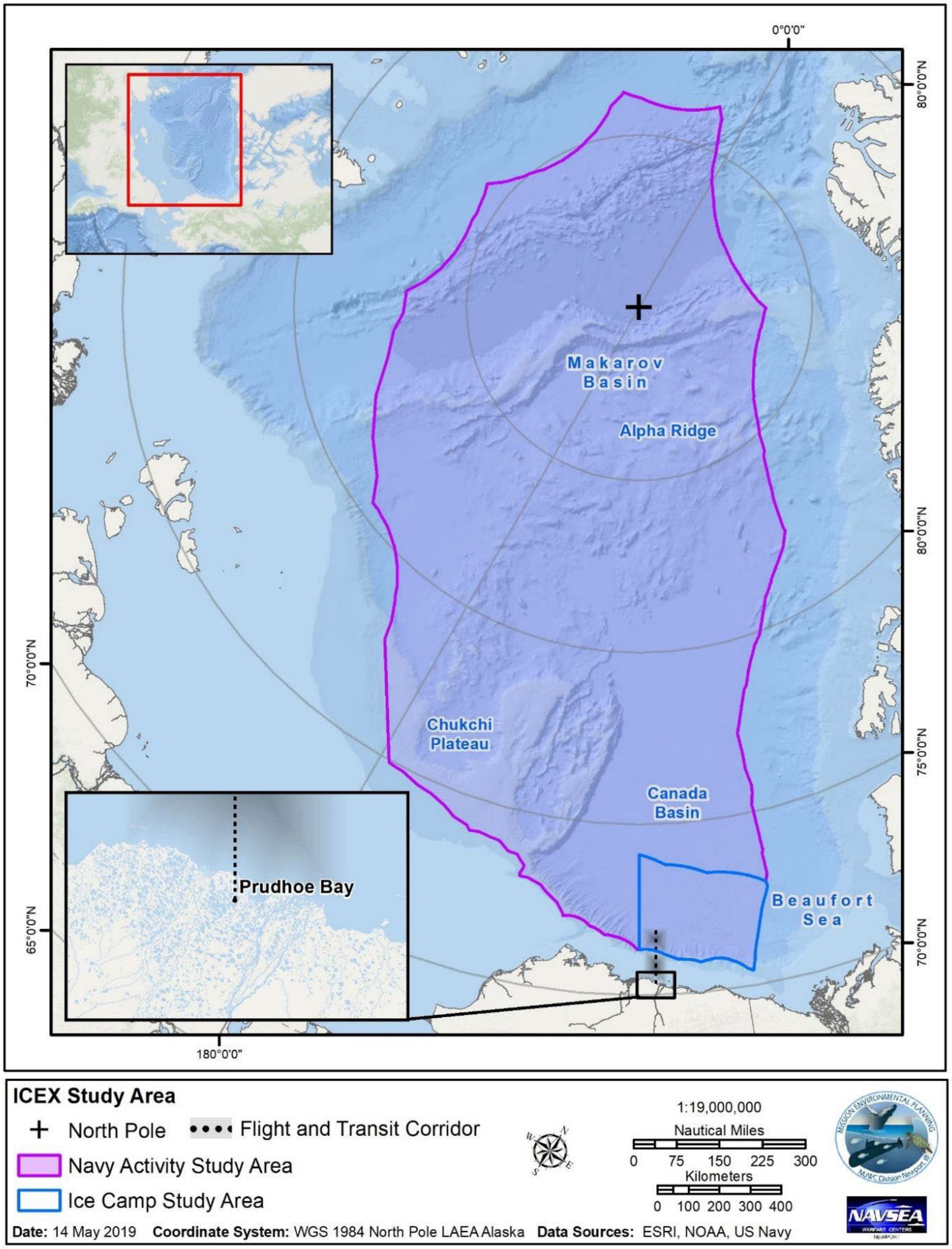


**Figure 1. Navy Activity Study Area for ICEX 2024.**

## 1.2 Consultation History

June 12, 2023: The Permits Division receives a request from the U.S. Navy for an Incidental Take Authorization (ITA) to take marine mammals, by Level B harassment incidental to ice exercises in the Arctic Ocean starting February 2024.

August 9, 2023: AKR receives transmittal letter requesting initiation of consultation and the Biological Evaluation (BE) from the Navy for ICEX 2024.

August 15, 2023: AKR asks the Navy questions about how seal density is calculated.

August 19, 2023: AKR request more information to clarify points in the BE.

August 29, 2023: Early Review Team (ERT) meets for coordination between AKR and the Permits Division on the project. The Permits Division sends out a summary of notes.

August 30, 2023: Consultation initiated with the Navy.

August 31, 2023: AKR asks the Permits Division follow-up questions about the ERT summary notes.

August 31, 2023: Navy responds with information requested about ice thickness at the ice camp location.

September 2023: Coordination and communication with the Permits Division and the Navy.

September 22, 2023: Navy sends 2023 Draft Supplemental Environmental Assessment/Overseas Environmental Assessment (EAOEA).

October 13, 2023: The Navy sends a revised IHA application to the Permits Division and AKR.

October 25, 2023: The Navy sends a revised BE to AKR, which includes the updated occupancy method for calculating exposures due to submarine activities.

November 6, 2023: AKR requests the Navy to review mitigation measures.

November 15, 2023: The Navy agrees to mitigation measures.

December 7, 2023: The proposed IHA was published in the Federal Register (88 FR 85244).

# 2 DESCRIPTION OF THE PROPOSED ACTION AND ACTION AREA

## 2.1 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas. 50 C.F.R. § 402.02.

The proposed action is to conduct submarine training and testing activities, which includes establishing a tracking range and temporary ice camp, and if resources are available, the proposed action also will include conducting research in an Arctic environment (Figure 1). The primary purpose of the proposed action is to evaluate the ice camp, the equipment, systems, and the employment and tactics of submarine operability in Arctic conditions. The proposed action will also evaluate emerging technologies, assess capabilities in the Arctic environment, and gather data on Arctic environmental conditions. The need for the proposed action is to prepare forces capable of extended operations and warfighting in the Arctic in accordance with Title 10 United States Code (U.S.C.) § 8062 and the strategies outlined in A Blue Arctic (a document that provides direction to the Navy to enhance the Navy's ability to operate in the Arctic region) (U.S. Department of the Navy 2021). The vast majority of submarine training and testing would occur near the ice camp. Some submarine training and testing may occur throughout the deep Arctic Ocean basin near the North Pole, within the ICEX 2024 Study Area (Figure 1).

The proposed action, including the construction and demobilization of the ice camp, will occur over approximately a six-week period from February through April. The submarine training and testing and the research activities will occur over approximately four weeks during the six-week period. The camp should be fully functional within five days after initial flights have dropped off equipment.

### 2.1.1 Proposed Activities

#### 2.1.1.1 Ice Camp

The ice camp will be established approximately 100 to 200 nm north of Prudhoe Bay, Alaska; the exact location cannot be identified in advance, as many of the required conditions (e.g., ice cover, avoidance of pressure ridges and snow drifts that could contain ringed seal lairs) cannot be forecasted until around the time when the exercises are expected to commence. The vast majority of submarine training and testing will occur near the ice camp; however, some submarine training and testing may occur throughout the deep Arctic Ocean basin near the North Pole, within the study area (Figure 1). Though the study area is large, the area where the proposed ice camp will be located (Figure 1) will be smaller, no more than 1.6 kilometers (km) in diameter, approximately 2 $km^2$ in area. Prior to the set-up of the ice camp, reconnaissance flights will be conducted to locate suitable ice conditions required for the location of the ice camp. The reconnaissance flights will occur over an area of approximately 70,374 $km^2$.

The ice camp will consist of a command hut, dining tent, sleeping quarters, an outhouse, a powerhouse, a runway (and a back-up runway for use in case of emergency), and a helipad (Figure 2). The number of structures/tents will range from 15 to 20, and are typically 2 to 6 meters (m) by 6 to 10 m in size. Berthing tents will contain bunk beds, a heating unit, and a circulation fan. The completed ice camp, including runway, will be approximately 1.6 km in diameter. Support equipment for the ice camp includes snow machines, snow blowers, gas powered augers and saws (for boring holes through the ice), two reverse osmosis units, and diesel generators.

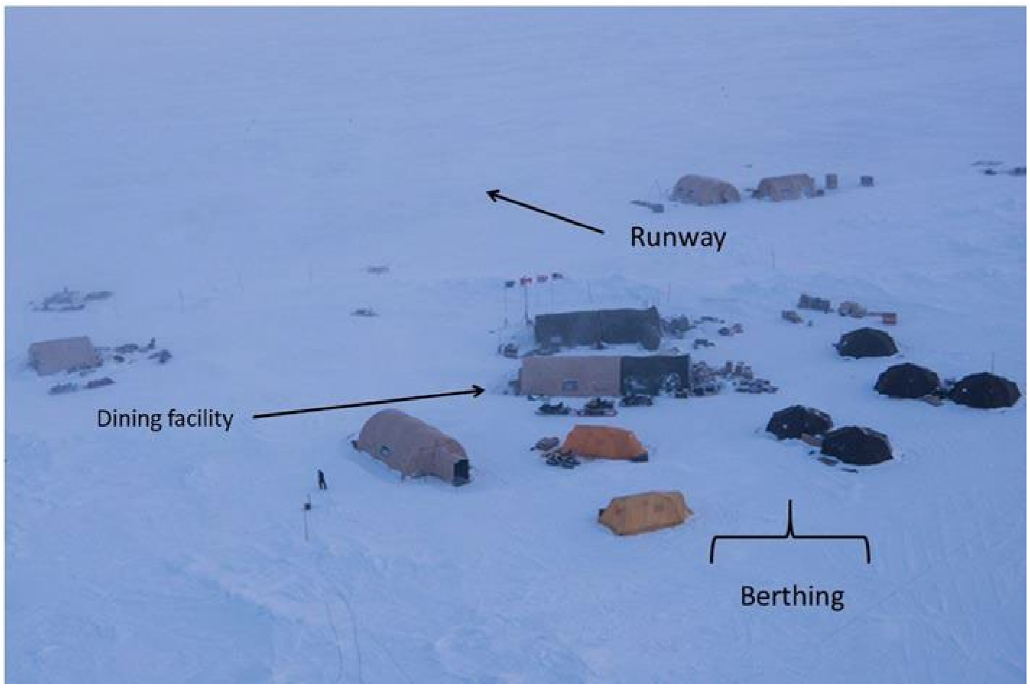


**Figure 2. Example Ice Camp**

All ice camp materials, fuel, and food will be transported from Prudhoe Bay, Alaska, and will either be air-dropped from military transport aircraft (e.g., C-17 and C-130), or arrive via a small twin-engine aircraft and military and commercial helicopters at the ice camp runway. Aircraft will be used to transport personnel and equipment from the ice camp to Prudhoe Bay. Up to nine round trips could occur daily during ice camp build-up and demobilization, and one to three round trips could occur daily during ice camp operation. At the completion of ICEX 2024, the ice camp will be demobilized, and all personnel and materials will be removed from the ice floe. All shelters, solid waste, hazardous waste, and sanitary waste will be removed and disposed of in accordance with applicable laws and regulations.

A portable tracking range for submarine training and testing will be installed in the vicinity of the ice camp during ICEX 2024; hydrophones will be deployed on the ice and extending to approximately 30 m below the ice. Hydrophones will be approximately 11.8 centimeters (cm) in length and have 610 m in associated cables. The associated cable will be Kevlar reinforced with a long-life polyurethane jacket for durability. The hydrophones will be deployed by drilling/melting holes in the ice and lowering the cable down into the water column. Hydrophones will be linked remotely to the command hut via cables (Figure 3).

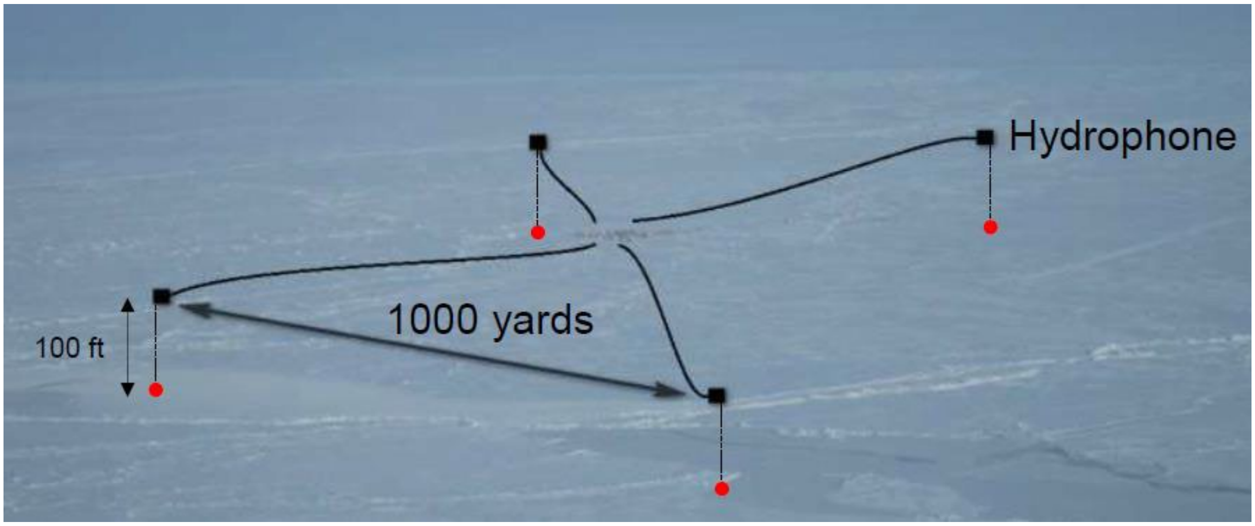


**Figure 3. Schematic of the Underwater Tracking Range**

Additionally, tracking pingers will be configured aboard each submarine to continuously monitor the location of the submarines. Acoustic communications with the submarines will be used to coordinate the training and research schedule with the submarines; an underwater telephone will be used as a backup to the acoustic communications. Recovery of the hydrophones is planned; however, if emergency demobilization is required, or the hydrophones are frozen in place and are unrecoverable, they will be left in place.

Freshwater will only be made available in the camp's dining facility. This water will be available for limited food preparation, dishwashing, and human consumption. Additionally, a hygiene station will be available at the ice camp for hand washing. The hygiene station will be located in the dining facility and consist of a gravity fed container that will provide water for hand sanitizing and/or face washing if needed. The hygiene station will utilize the same drain as the kitchen sink for gray water discharge. No shower facilities will be available at the camp.

Dishwashing and a hygiene station will use biodegradable, chlorine- and phosphate-free detergent that meets the U.S. Environmental Protection Agency's (EPA) Safer Choice standards. Prior to use, dishwashing water will be heated using an on-demand propane water heater. Wastewater generated during food preparation and dishwashing will be discharged to the Beaufort Sea via a single drain in the camp's dining facility. The drain will consist of a corrugated pipe, wrapped in electric heat tape to prevent the pipe from freezing, which will be placed through a hole drilled/melted into the ice. The drain will utilize a removable metal screen to capture solid debris (i.e., food particles) in the wastewater prior to discharge. The metal screen will have a mesh size of no greater than 0.16 cm. Solids captured in the screen will be disposed of via the camp's solid waste containers and brought back to Prudhoe Bay, Alaska, for disposal.

Freeze-dried, camping style meals will be the primary form of meals, supplemented with fresh fruit, energy bars, etc. The camp will have an average discharge rate of 379 liters per day (L/day), with a maximum discharge rate of 587 L/day during the two weeks of peak camp operations. The estimated total discharge from the ice camp's dining facility is 11,072 liters (L) over the duration of ICEX 2024.

Most freshwater for drinking and meal preparation will be produced by reverse osmosis through desalination. However, the camp also may use mining and melting of multi-year ice. The operation of a reverse osmosis system results in "reject water," or water that is of higher salinity (approximately three times the salinity) than the initial seawater input. This reject water will be discharged at the camp via a single drain (corrugated pipe placed through a hole in the ice) co-located with the portable system. The average reject water production is expected to be 545 L/day. This amount is based on the unit not being operated continuously due to downtime associated with system maintenance and adjustments for flow rate. The maximum reject water production will be up to 2,271 L/day. The extreme conditions of the ice camp will influence both the system's efficiency and ability to operate, which is why the output from the system will be variable. Assuming continuous operation (24 hours per day) for the four weeks of camp operations (excluding a week each for construction and demobilization), a maximum total discharge of reject water from the ice camp will be 30,526 L.

Sanitary/human waste generated at the camp will be collected in zero-discharge sanitary facilities (e.g., barrels lined with plastic bags), which will be containerized and flown back to Prudhoe Bay, Alaska, for disposal at appropriate facilities.

In addition to the main ice camp, two smaller, adjacent berthing areas are proposed for ICEX 2024. These areas (used for expeditionary forces) will leverage the facilities provided by the main camp (e.g., sanitary facilities) while verifying these groups could function independently if necessary. All materials from these adjacent areas will be removed from the ice upon completion of the activities.

#### 2.1.1.2 On-Ice Vehicles

Snow machines will be used to transport personnel and equipment on the ice. Additionally, snow machines will support research activities that require data collection from multiple locations. These research trips will travel no more than 3.2 km from the camp and could occur once per day. Four to six snow machines will be used during ICEX 2024. Two types of snow machines are typically used at the ice camp (Figure 4). Heavyweight snow machines have a single steering track and a very large drive track. These machines are slow with limited maneuverability, and they are used to pull sleds and sledges to move equipment around camp. Lightweight snow machines have dual steering tracks and a single drive track, are faster and more maneuverable, and are used to transport personnel.

**Figure 4. Typical on-ice vehicles used during ICEX.**

In addition to the typical snow machines, two types of all-terrain vehicles, one equipped with four wheels and one equipped with six or eight wheels, that can be used in open water (referenced herein as all-terrain vehicle; Figure 5) may be air-dropped to support runway construction and expeditionary forces. The all-terrain vehicle has a low ground pressure of 0.11 kilograms per square centimeter and is used in sensitive habitats. The all-terrain vehicle is capable of traversing in all terrains (Ontario Drive and Gear Ltd.).

**Figure 5. All-Terrain Vehicle**

Expeditionary forces may use an all-terrain vehicle. The all-terrain vehicles have a load capacity of up to 544 kilograms (kg), depending on the model. They are capable of floating in open water if necessary. All-terrain vehicles have two engine types, typically gasoline or diesel. Both engines are approximately 30 horsepower (https://argoatv.com/). The all-terrain vehicle will be used to transport expeditionary forces to and from the main camp.

### 2.1.1.3 Aircraft

Flights to and from Prudhoe Bay will use Deadhorse Airport, a public airport located next to Prudhoe Bay (see Figure 1). Up to nine round trips could occur daily during ice camp build-up and demobilization; one to three round trips could occur daily during ice camp operations. These flights will be in addition to the usual flight traffic that occurs at the airport (average of 58 flights per day; FAA 2023). All flights will leave from Deadhorse Airport and fly directly to the ice camp. The flight and transit corridor (Figure 1) is approximately 40 km wide and is the most direct route to the camp.

Various fixed-wing and rotary-wing (i.e., helicopters) aircraft may be used in the conduct of ICEX 2024 (Figure 6). Shelters, personnel, and equipment will be transported to and from the ice camp via these aircraft. These aircraft also support many of the research activities.

**Figure 6. Typical aircraft used during ICEX.**

In addition to the typical commercial aircraft, military aircraft may be used depending on their availability. Examples of military aircraft that may be used include C-130, V-22, and C-17 transport aircraft (as well as the LC-130, which is a modified C-130 suited to land on the ice) and CH-47 Chinook heavy-lift helicopters (Figure 7). These aircraft are much larger than the small, fixed-wing aircraft typically used (up to 53 m in length for the C-17 compared to 8 and 24 m in length for a Cessna 185 and Casa, respectively) and will allow for more efficient transport of supplies (i.e., fewer trips). Equipment and material may be dropped by parachute from these military aircraft. The LC-130 will conduct up to four round trip flights to the ice camp over the course of the proposed action; these are included within the maximum number of daily flights to the ice camp. The V-22 will land and take off from the ice camp only one time. The V-22 Osprey has several modes of operation associated with it, which include a vertical take-off, similar to a helicopter, as well as a traditional take off, similar to other fixed-wing aircraft. The V-22 generates a large amount of heat from its engines. However, due to the low ambient temperature of the Arctic and ice thickness required to support aircraft, temporary melting of the runway may occur, but it will re-freeze after the aircraft has departed the ice. The aircraft will not remain long enough to alter the runway to make it inoperable for the remainder of the aircraft operations that will need to occur.

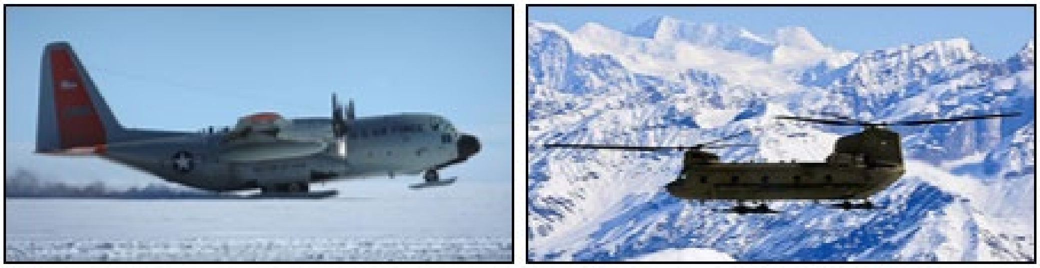

**Figure 7. Examples of military fixed-wing aircraft (left panel; C-130) and rotary-wing aircraft (right panel; CH-47) that may be used during ICEX 2024.**

### 2.1.1.4 Unmanned vehicles and systems

Unmanned underwater vehicles will either maneuver autonomously or be tethered to a command center (Figure 8). Unmanned underwater vehicles are typically slow moving (less than 5 knots), and they range in size from approximately 52 cm in length and width to 493 cm in length and 53 cm in diameter. Some unmanned underwater vehicles will have *de minimis* acoustic sources used and deployed throughout ICEX 2024. *De minimis* sources, as applied in these circumstances, have the following parameters: low source levels, narrow beams, downward directed transmission, short pulse lengths, frequencies above (outside) known marine mammal hearing ranges, or some combination of these factors (U.S. Department of the Navy 2018).

**Figure 8. Examples of Unmanned Underwater Vehicles. Top panel is a Remote Environmental Monitoring Unit System 100; bottom left is a 21" Bluefin; bottom center is a Little Benthic Vehicle (LBV) 300; bottom right is the tether associated with the LBV300, resulting in a Tethered, Hovering Autonomous Underwater System.**

Various unmanned aerial systems are proposed for testing. Systems used may be either fixed-wing (Figure 9) or rotary-wing (Figure 10). Fixed-wing systems vary in their wingspans, up to approximately 457 cm, and fly at speeds of about 25 to 80 knots. Rotary-wing systems are typically smaller, approximately 51 cm in length and width, and they fly at speeds of about 30 knots.

**Figure 9. Example Fixed-wing Unmanned Aerial System (Left panel is launch; center panel is in flight; right panel is recovery).**

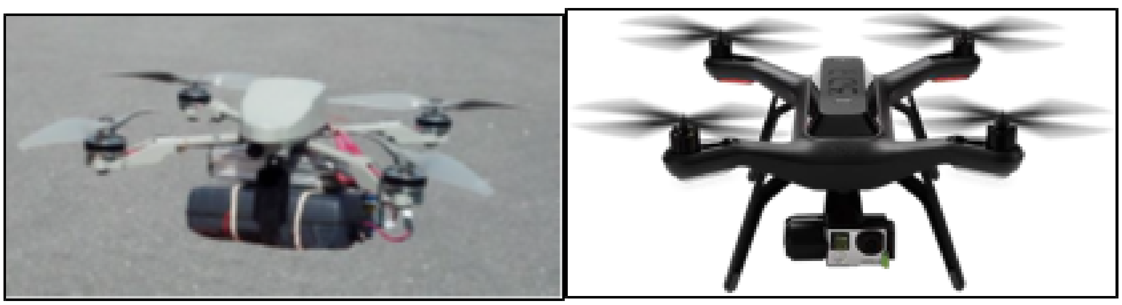

**Figure 10. Example Rotary-wing Unmanned Aerial Systems**

### 2.1.1.5 Scientific Devices

Various passive and active acoustic devices will be used for data collection, including a vertical array and buoys.

#### 2.1.1.5.1 Passive Devices

A vertical line array will be deployed through the ice to measure ambient underwater sound and sound propagation through Arctic waters. A tow body consisting of plate weights suspended from a line will be deployed through the ice to disturb the fine-scale ocean "staircase" structure at 200 to 300 m. A line array of oceanographic sensors will measure any noticeable difference in the ambient area from the deployment of this tow body line. This array will contain a series of acoustic recorders located at depths from the surface to 200 m. Other various scientific devices (typically less than 1 m in diameter) will be deployed throughout ICEX 2024, including approximately four EMATTS (Expendable Mobile Anti-Submarine Warfare Training Targets), which will transmit in specific patterns within the mixed Arctic water layer, for the vertical line arrays to receive. EMATTS will scuttle and will not be retrieved. To support submarine self-tracking, an acoustic buoy will be deployed and will emit a homing signal so that the submarines can determine their location relative to the ice camp. This buoy will be retrieved at the completion of the exercise. The remaining devices will be deployed as part of the research activities and will collect data on the under-ice topography and environmental conditions (Figure 11).

**Figure 11. Example Passive Devices, Buoys (Left panel is an Ocean Flux Buoy; Center and Right panels are Ice Tethered Profilers).**

### 2.1.1.5.2 Active Acoustic Devices

Information regarding the majority of the active acoustics associated with ICEX 2024 is classified. One unmanned underwater vehicle will be deployed under the ice to test the communication and range of the vehicle and to conduct under-ice and in-water column sampling. Several other acoustic sources (i.e., echosounder, transducers) will be deployed under the ice, or in the water column, to determine systems signal recognition capabilities. Acoustic parameters for these active sources are in Table 1.

**Table 1. Parameters of scientific devices with active acoustics.**

| ***Research Institution*** | ***Source Name*** | ***Frequency Range (kHz)*** | ***Source Level (dB)*** | ***Pulse Length*** | ***Source Type*** |
|---|---|---|---|---|---|
| Woods Hole Oceanic Institute | LRAUV+ | 10 and 25 | 185 or less | 14 and 3000 ms | Unmanned Underwater Vehicle |
| Naval Postgraduate School | Echosounder[1] | 38 to 200 | 221 | 0.5 ms | Sonar |
| Massachusetts Institute of Technology Lincoln Lab | Echosounder[1] | 115 and 200 | 227 or less | 1 ms | Sonar |

| *Research Institution* | *Source Name* | *Frequency Range (kHz)* | *Source Level (dB)* | *Pulse Length* | *Source Type* |
|---|---|---|---|---|---|
| Naval Postgraduate School | Geospectrum M72, Geospectrum M71, ITC 1007 | 0.13, 0.8, and 5 | 190 or less | maximum length sequence of 20 min on and 40 min off | Transducer |

dB = decibels; kHz = kilohertz; LRAUV+ = Long Range Autonomous Underwater Vehicle Plus; min = minutes; ms = millisecond(s); [1] Echosounders are a type of sonar. Echosounders have transducers that send sound pulses (i.e., sonar signals) into the water. The signal is reflected, and the transducer receives the returning echo (DOSITS 2023, retrieved from https://dosits.org/ accessed on Nov. 21, 2023).

#### 2.1.1.5.3 Submarine Training and Testing

Submarine activities associated with ICEX 2024 are classified, but they generally entail safety maneuvers and active sonar use similar to submarine activities conducted in other undersea environments. These maneuvers and sonar use will be conducted in the Arctic to test their performance in a cold environment. Classified descriptions of submarine training and testing activities planned for ICEX 2024 can be provided to authorized individuals upon request. Submarine training and testing involves active acoustic transmissions.

#### 2.1.1.5.4 Research Activities

Personnel and equipment proficiency testing and multiple research and development activities will be conducted during ICEX 2024 (Table 2). Each type of activity scheduled for ICEX 2024 has been reviewed and placed into general categories of actions (Table 2). Due to the uncertainty of extreme cold, some scheduled activities may not be able to be conducted. All researcher personnel traveling to the ice camp will be berthed at the established ice camp facilities.

**Table 2. Summary of training and testing, and research activities.**

| *Activity Type* | *Category of Action* | *Project* | *Description* |
|---|---|---|---|
| Submarine Training and Testing | Logistics | Ice Camp Operations | A camp is constructed and an associated underwater tracking range is deployed to support submarine training and testing. |
| | Submarine Training and Testing | Submarine Training and Testing | Submarines conduct various training and testing events |
| Research Activities | On-Ice Data Collection | Ice Cores/Snow Samples | Collection of ice cores and/or snow to obtain abiotic (e.g., snow depth, thermal properties) and/or biotic (e.g., eDNA, microbial communities) information. |
| | | Sensors | Use of sensors to measure ice thickness. |
| | In-water Device Data Collection | Buoys | Deployment of buoys to collect abiotic measurements (e.g., climate data, light transmission) and biotic measurements (e.g., phytoplankton blooms). |

| Activity Type | Category of Action | Project | Description |
|---|---|---|---|
| Research Activities | Personnel/ Equipment Proficiency | Sensors | Deployment of various remote sensor nodes to collect measurements on photosynthetic light levels, speed of different sounds, conductivity, temperature, and depth. |
| | | Unmanned Underwater Vehicle | Deployment of autonomous and tethered unmanned underwater vehicle to measure sea-ice ocean interactions, such as exchanges of heat, salt, and momentum with sea-ice. |
| | | Water Samples | Collection of water samples under the ice for environmental deoxyribonucleic acid (eDNA) analysis. |
| | | Training and Support | Personnel conduct various activities in extreme cold, including, but not limited to, combat casualty care protocols, expeditionary ice diving operations, expeditionary camp construction operations support/maintenance, infiltration, special operations, and exfiltration. |
| | Underwater Equipment Testing | Acoustics/ Communication | Various communication systems and/or acoustic sources deployed under the ice, or in the water column, to determine system signal recognition capabilities. |
| | | Unmanned Underwater Vehicle | Autonomous unmanned underwater vehicle deployed to test communication and range of vehicle along with the vehicles' ability to sample under-ice and in the open Arctic Ocean. |
| | Aerial System Testing | Unmanned Fixed-Wing | Fixed-wing unmanned aerial systems launched by hand or by pneumatic catapult. Fixed-wing systems may have up to 457 cm wingspan, fly at speeds of about 25 to 80 knots, and up to a 6.5 hour endurance. |
| | Unmanned On-Ice System Testing | Unmanned On-Ice Vehicle | Autonomous unmanned electric snow machine deployed to test real-time ice detection, navigation, and provide various real-time monitoring data (e.g., meteorological data, ice thickness). |

### 2.1.2 Standard Operating Procedures and Mitigation Measures

Standard operating procedures and mitigation measures will be implemented during the proposed action. Standard operating procedures serve primarily to provide safety and mission success and are implemented regardless of their secondary benefits (e.g., to a resource). Mitigation measures are used to avoid or reduce potential impacts. The standard operating procedures and mitigation measures that are applicable to the proposed action are provided below.

#### 2.1.2.1 Standard Operating Procedures

***Camp Operations***

1. The Navy will comply with National Pollution Discharge Elimination System (NPDES) permit requirements for all authorized wastewater discharges from the camp.
2. Wastewater generated during food preparation and dishwashing will be discharged to the

Beaufort Sea via a single drain in the camp's dining facility. The drain will consist of a corrugated pipe, wrapped in electric heat tape to prevent the pipe from freezing, which will be placed through a hole drilled/melted into the ice. The drain will use a removable metal screen to capture solid debris (i.e., food particles) in the wastewater prior to discharge. The metal screen will have a mesh size of no greater than 0.16 cm. Solids captured in the screen will be disposed of via the camp's solid waste containers and brought back to Prudhoe Bay, Alaska, for disposal.

3. Most freshwater for drinking and meal preparation will be produced by reverse osmosis through desalination. However, the camp also may use mining and melting of multi-year ice. The operation of a reverse osmosis system results in "reject water," or water that is of higher salinity (approximately three times the salinity) than the initial seawater input. This reject water will be discharged at the camp via a single drain (corrugated pipe placed through a hole in the ice) co-located with the portable system. The average reject water production is expected to be 545 L/day. This amount is based on the unit not being operated continuously due to downtime associated with system maintenance and adjustments for flow rate. The maximum reject water production will be up to 2,271 L/day. The extreme conditions of the ice camp will influence both the system's efficiency and ability to operate, which is why the output from the system will be variable. Assuming continuous operation (24 hours per day) for the four weeks of camp operations (excluding a week each for construction and demobilization), a maximum total discharge of reject water from the ice camp will be 30,526 L.
4. Dishwashing and a hygiene station will use biodegradable, chlorine- and phosphate-free detergent that meets the U.S. Environmental Protection Agency's (EPA) Safer Choice standards (U.S. Environmental Protection Agency 2015).
5. Dish and hand soap will be selected from the U.S. EPA's "Safer Choice" list.
6. All cooking and food consumption will occur within designated facilities to minimize attraction of nearby animals.
7. Sanitary/human waste generated at the camp will be collected in zero-discharge sanitary facilities (e.g., barrels lined with plastic bags), which will be containerized and flown back to Prudhoe Bay, Alaska, for disposal at appropriate facilities.
8. All material (e.g., shelters, unused food, excess fuel) and wastes (e.g., solid waste, hazardous waste) will be removed from the ice floe upon completion of ICEX 2024 events.
9. All personnel will be required to complete environmental compliance training, including environmental health and safety procedures.
10. Personnel will be trained in the proper handling of fuels, containment procedures, and clean up procedures. Necessary equipment (spill kits, secondary containment) will be provided and accessible.
11. Ice camp activities and personnel movement within the camp will occur during daylight hours as much as possible.

***Air Transportation***

12. Safety permitting, as aircraft approach the camp, aircraft crew will ensure that the landing zone is clear of any animals and will report the presence and behavior of any seal(s) observed on the ice.
13. Aircraft pilots will make every attempt to avoid large flocks of birds (which are unlikely) in order to reduce the safety risk involved with a potential bird strike.
14. The location for any air-dropped equipment and material will be visually surveyed prior to release of the equipment/material to ensure the landing zone is clear. Equipment and materials will not be released if any animal were observed within the landing zone.
15. Spill response kits/material will be on-site prior to the air-drop of any hazardous material (e.g. fuel).
16. Air drop bundles will be packed within a plywood structure with honeycomb insulation to protect the material from damage.

**2.1.2.2 Mitigation Measures**

Appropriate personnel (including civilian personnel) involved in mitigation and training or testing activity reporting under the specified activities must complete Arctic Environmental and Safety Awareness Training. Modules include: Arctic Species Awareness and Mitigations, Environmental Considerations, Hazardous Materials Management, and General Safety.

***Aircraft Activities***

1. Unmanned Aircraft Systems will maintain a minimum altitude of at least 15.2 m above the ice except during take-off and landing. They will not be used to track or follow marine mammals.
2. Fixed wing aircraft must operate at the highest altitude practicable taking into account safety of personnel, meteorological conditions, and need to support safe operations of a drifting ice camp. Aircraft must not reduce altitude if a seal is observed on the ice. In general, cruising elevation must be 457 m or higher (to align with polar bear mitigation measures in the U.S. Fish and Wildlife ESA section 7 consultation on this action).
3. Helicopter flights will use prescribed transit corridors when traveling to/from Prudhoe Bay and the ice camp. Helicopters will not hover or circle above or within 457 m of marine mammals.
4. Aircraft will maintain a minimum separation distance of 1.6 km from groups of five or more seals.
5. Aircraft will not land on ice within 800 m of hauled-out seals.

***On-ice Activities***

6. Ice camp reconnaissance and deployment will begin within 5 days of February 22, 2024 and be gradual, with activity increasing over the first five days. Camp deployment must be completed by March 15, 2024. This allows ringed seals to avoid the camp area prior to pupping, further reducing potential effects.
7. The ice camp and runway must be established on first-year or multi-year ice without pressure ridges.
8. Personnel operating on-ice vehicles will avoid pressure ridges by 0.8 km and will avoid areas of snow drifts >0.5 m in depth (often near pressure ridges), which are preferred areas for ringed seal subnivean lairs.
9. Snow machines must follow established routes, when available. On-ice vehicles must not be used to follow any animal, with the exception of actively deterring polar bears (*Ursus maritimus*) if the situation requires.
10. Personnel must maintain 100 m avoidance distance from all observed marine mammals.
11. A dedicated observer (not the vehicle operator) will be on each snow machine, or there will be at least one observer for each expeditionary team. Observers for ice trail activities need not be trained protected species observers, but they must be capable of observing and recording marine mammal presence and behaviors, and accurately and completely record data. When traveling, observers will have no other primary duty than to watch for and report observations related to marine mammals and human/seal interactions.
12. Observer will have sufficient equipment (binoculars/monocular, GPS, ability to record information) to aid in observing marine mammals, determining the location of observed marine mammals, and recording observations.
13. Observer will record the date, time, species, number, and geographic coordinates of all seals observed within 150 m of the main camp.
14. Observer will provide an account of interactions, or lack of apparent interaction, between humans (including human operated equipment) and seals or seal lairs that are within 150 m of camps or snow machine trails.
15. Observers or other designated personnel will submit to NMFS a monitoring report in digital format that can be queried. Reporting will occur within 90 days of the cessation of ICEX 2024 and will provide details about marine mammal observations and interactions that occurred during the exercise.
16. Observers will provide a record of all monitoring efforts, including date, time, duration of observation efforts, duration of time during which seals or seal lairs were known to be present within 150 m of human activities, and the behaviors exhibited by the seals during those observation periods.
17. Observers will record the minimum distance between human activities and seals or seal lairs.

18. If seal lairs are located within 150 m of camps or ice trails, observers will provide an account of the status of lairs through time.
19. If a seal lair or hauled-out seal is disrupted, the disruption will be documented, and details reported to NMFS in the monitoring report.

***In-water Activities***

20. Personnel must begin passive acoustic monitoring (PAM) for vocalizing marine mammals 15 minutes prior to the start of training or testing activities involving active acoustic transmissions from submarines.
21. Personnel must delay active acoustic transmissions if a marine mammal is detected during pre-activity PAM and must shutdown active acoustic transmissions if a marine mammal is detected during acoustic transmissions.
22. Personnel must not restart acoustic transmissions until 15 minutes have passed with no marine mammal detections.
23. The Navy must analyze any declassified underwater recordings collected during ICEX24 for marine mammal vocalizations and report that information to NMFS, including the types and natures of sounds heard (e.g., clicks, whistles, creaks, burst pulses, continuous, sporadic, strength of signal) and the species or taxonomic group (if determinable). This information must be submitted to NMFS with the 2025 annual Atlantic Fleet Training and Testing (AFTT) declassified monitoring report.

***Data Collection and Reporting Requirements***

24. The Navy must provide data regarding sonar use and the number of and date and time of any shutdowns during ICEX24 activities in the AFTT Letter of Authorization 2025 annual classified report.
25. The results of the Navy marine mammal monitoring program, including estimates of “take by harassment” and “take by mortality,” will be presented in a technical report, with observer data submitted to NMFS in a digital spreadsheet format that can be queried. The technical report(s) will include:
    a. Summaries of monitoring effort: total hours, total distances, and distribution of marine mammals through the study period accounting for weather and other factors affecting visibility and detectability of marine mammals
    b. Species composition, occurrence, and distribution of marine mammal sightings including date, water depth, numbers, age/size/gender categories, group sizes, and ice cover
    c. Observed behaviors and types of movements versus exercise activity
    d. If no seals are seen or detected, that information will also be reported
26. Report injured or dead marine mammals unrelated to project activities to the Stranding

Hotline (Table 3).

27. In the unexpected event that the specified activity causes the take of a marine mammal in a manner prohibited by the IHA, such as an injury (Level A harassment), serious injury, or mortality, or if personnel discover an injured or deal marine mammal, the Navy shall report the incident to the Office of Protected Resources, NMFS and the Permits Division. Contact information is in Table 3. The following information will be included:
    i. Time, date, and location of the incident;
    ii. Species identification (if known) or description of the animal(s) involved;
    iii. Condition of the animal(s) (including carcass condition if the animal is dead);
    iv. Observed behaviors of the animal(s), if alive;
    v. If available, photographs or video footage of the animal(s); and
    vi. General circumstances under which the animal(s) was observed (e.g., during snow machine transit, on-ice experiment, or recon flight).
28. Monitoring reports will be provided to NMFS Permits and Conservation Division, Leah Davis (leah.davis@noaa.gov), pr.itp.monitoringreports@noaa.gov, and the Alaska Region, Kim Raum-Suryan (kim.raum-suryan@noaa.gov), and AKR.section7@noaa.gov.

**Table 3. Summary of Agency Contact Information**

| **Reason for Contact** | **Contact Information** |
|---|---|
| Consultation Questions & Unauthorized Take | AKR.prd.section7@noaa.gov<br>Kim Raum-Suryan: kim.raum-suryan@noaa.gov<br>Leah Davis: Leah.davis@noaa.gov |
| Reports & Data Submittal | AKR.section7@noaa.gov (please include NMFS consultation number AKRO 2023-02122) |
| Stranded, Injured, or Dead Marine Mammal *(not related to project activities)* | Stranding Hotline (24/7 coverage) 877-925-7773 |
| Oil Spill & Hazardous Materials Response | U.S. Coast Guard National Response Center: 1-800-424-8802 and NMFS AKR Protected Resources Oil Spill Response Coordinator AKRNMFSSpillResponse@noaa.gov |
| Illegal Activities<br>*(not related to project activities; e.g., feeding, unauthorized harassment, or disturbance to marine mammals)* | NMFS Office of Law Enforcement (AK Hotline): 1-800-853-1964 |

| Reason for Contact | Contact Information |
|---|---|
| In the event that this contact information becomes obsolete | NMFS Anchorage Main Office: 907-271-5006<br>Or NMFS Juneau Main Office: 907-586-7236 |

## 2.2 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR § 402.02). For this reason, the action area is typically larger than the project area and extends out to a point where no measurable effects from the proposed action occur.

The action area for this biological opinion includes the aircraft flight and transit corridor (approximately 40 km wide and most direct route) between Prudhoe Bay and the ice camp (the ice camp will be established approximately 100 to 200 nm north of Prudhoe Bay, Alaska; the precise location for the ice camp, which requires both multi-year and first-year ice, cannot be predicted due to the uncertainty of spring ice conditions); the reconnaissance flights conducted over an area of approximately 70,374 $km^2$ to locate suitable ice conditions for the location of the ice camp; the approximately 2 $km^2$ ice camp, and a much larger area (see Figure 1) that will be used for submarine training and testing. The vast majority of training and research objectives will occur at or near the ice camp, although portions of the submarine training and testing may occur throughout the deep Arctic Ocean basin. The whole study area is 2,874,520 square kilometers, which also accounts for submarine maneuvers (Figure 1). The Action Area includes the whole study area in addition to the flight and transit corridor. The whole study area will be referred to as the "study area" in this document.

# 3 APPROACH TO THE ASSESSMENT

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

To jeopardize the continued existence of a listed species means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR § 402.02). As NMFS explained when it promulgated this definition, NMFS considers the likely impacts to a species' survival as well as likely impacts to its recovery. Further, it is possible that in certain, exceptional circumstances, injury to recovery alone may result in a jeopardy biological opinion (51 FR 19926, 19934; June 3, 1986).

Under NMFS's regulations, the destruction or adverse modification of critical habitat means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species (50 CFR § 402.02).

We use the following approach to determine whether the proposed action described in Section 2 of this opinion is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Identify those aspects (or stressors) of the proposed action that are likely to have effects on listed species or critical habitat. As part of this step, we identify the action area – the spatial and temporal extent of these effects.

- Identify the range-wide status of the species and critical habitat likely to be adversely affected by the proposed action. This section describes the current status of each listed species and its critical habitat relative to the conditions needed for recovery. We determine the range-wide status of critical habitat by examining the condition of its PBFs - which were identified when the critical habitat was designated. Species and critical habitat status are discussed in Section 4 of this opinion.

- Describe the environmental baseline including: past and present impacts of Federal, state, or private actions and other human activities *in the action area*; anticipated impacts of proposed Federal projects that have already undergone formal or early section 7 consultation, and the impacts of state or private actions that are contemporaneous with the consultation in process. The environmental baseline is discussed in Section 5 of this opinion.

- Analyze the effects of the proposed action. Identify the listed species that are likely to co-occur with these effects in space and time and the nature of that co-occurrence (these represent our *exposure analyses*). In this step of our analyses, we try to identify the number, age (or life stage), and gender of the individuals that are likely to be exposed to stressors and the populations or subpopulations those individuals represent. NMFS also evaluates the proposed action's effects on critical habitat PBFs. The effects of the action are described in Section 6 of this opinion with the exposure analysis described in Section 6.2 of this opinion.

- Once we identify which listed species are likely to be exposed to an action's effects and the nature of that exposure, we examine the scientific and commercial data available to determine whether and how those listed species are likely to respond given their exposure (these represent our *response analyses*). Response analysis is considered in Section 6.3 of this opinion.

- Describe any cumulative effects. Cumulative effects, as defined in NMFS's implementing regulations (50 CFR § 402.02), are the effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area. Future Federal actions that are unrelated to the proposed action are not considered because they require separate section 7 consultation. Cumulative effects are considered in Section 7 of this opinion.

- Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat. In this step, NMFS adds the effects of the action (Section 6) to the environmental baseline (Section 5) and the cumulative effects (Section 7) to assess whether the action could reasonably be expected to: (1) appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species and critical habitat (Section 4). Integration and synthesis with risk analyses occurs in Section 8 of this opinion.

- Reach jeopardy and adverse modification conclusions. Conclusions regarding jeopardy and the destruction or adverse modification of critical habitat are presented in Section 9. These conclusions flow from the logic and rationale presented in the Integration and Synthesis Section 8.

- If necessary, define a reasonable and prudent alternative to the proposed action. If, in completing the last step in the analysis, NMFS determines that the action under consultation is likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat, NMFS must identify a reasonable and prudent alternative (RPA) to the action.

# 4 RANGEWIDE STATUS OF THE SPECIES AND CRITICAL HABITAT

This opinion considers the effects of the proposed action on the species specified in Table 4.

**Table 4. Listing status and critical habitat designation for species considered in this opinion.**

| Species | Status | Listing | Critical Habitat |
|---|---|---|---|
| Ringed Seal, Arctic Subspecies (*Phoca hispida hispida*) | Threatened | NMFS 2012, 77 FR 76706 | NMFS 2022, 87 FR 19232 |

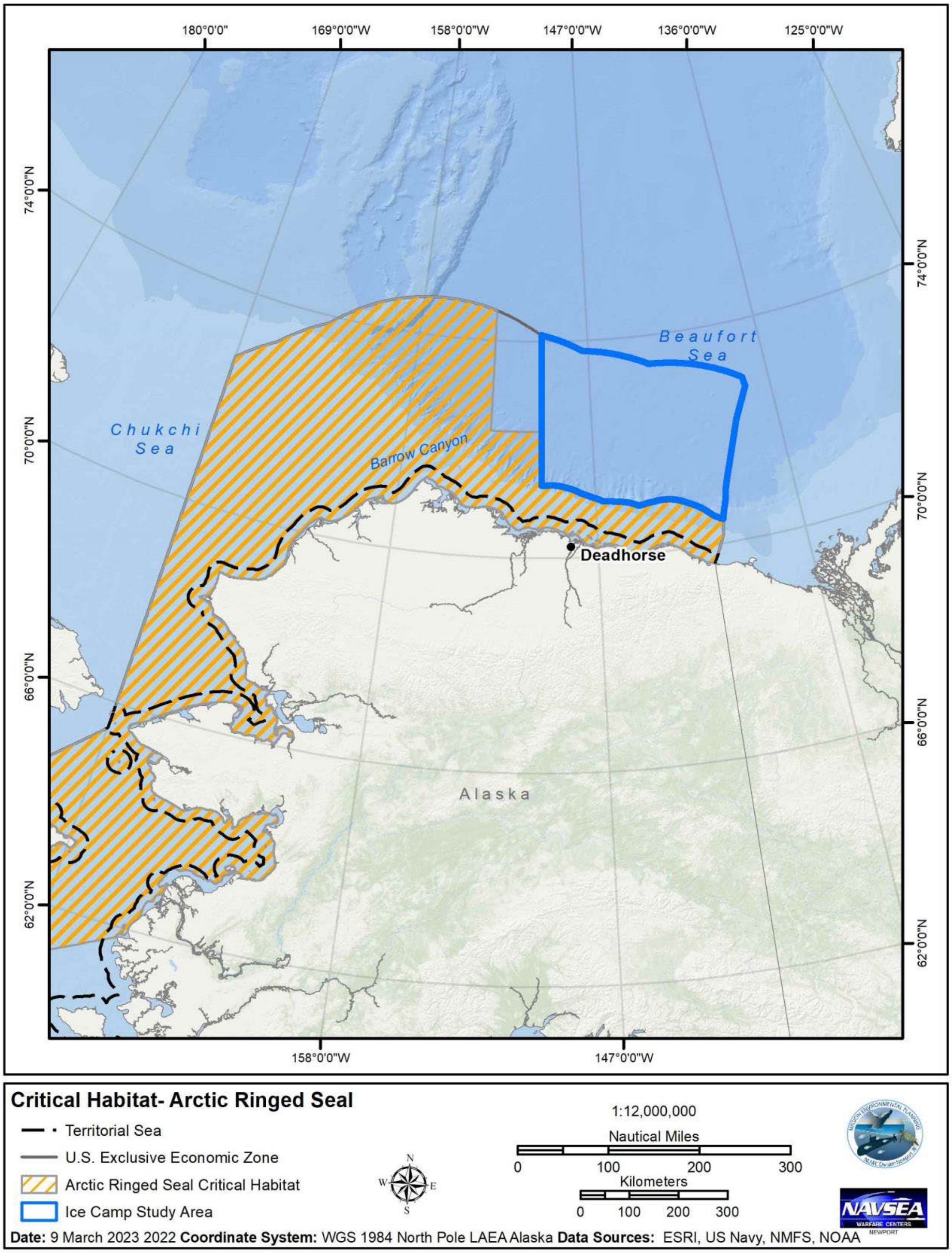


**Figure 12. Designated critical habitat for ringed seals.**

## 4.1 Climate Change

We present an overview of this shared threat here. A vast amount of literature is available on climate change and for more detailed information we refer the reader to these websites, which provide the latest data and links to the current state of knowledge on the topic in general, and in the Arctic specifically:

https://www.ipcc.ch/reports/

https://climate.nasa.gov/evidence/

http://nsidc.org/arcticseaicenews/

https://arctic.noaa.gov/Report-Card

The listed marine mammals we consider in this opinion live in the ocean and depend on the ocean for nearly every aspect of their life history. Factors that affect the ocean, like temperature and pH, can have direct and indirect impacts on marine mammals and the resources they depend upon. Global climate change may affect the species we consider in this opinion. First, we provide background on the physical effects climate change has caused on a broad scale; then we focus on changes that have occurred in Alaska. Finally, we provide an overview of how these physical changes translate to biological effects.

### 4.1.1 Physical Effects

#### 4.1.1.1 Air Temperature

There is consensus throughout the scientific community that atmospheric temperatures are increasing, and will continue to increase, for at least the next several decades (Watson and Albritton 2001; Oreskes 2004). The Intergovernmental Panel on Climate Change (IPCC) estimated that since the mid-1800s, average global land and sea surface temperature has increased by 0.85°C (±0.2°C), with most of the change occurring since 1976 (IPCC 2019). This temperature increase is greater than what would be expected given the range of natural climatic variability recorded over the past 1,000 years (Crowley 2000).

Continued emission of greenhouse gases is expected to cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems (IPCC 2019). The decadal global land and ocean surface average temperature anomaly for 2011–2020 indicates that it was the warmest decade on record for the globe, with a surface global temperature of +0.82°C (+1.48°F) above the 20th century average[1]. This surpassed the previous decadal record (2001–2010) value of +0.62°C (+1.12°F)[2]. The 2020 Northern Hemisphere land and ocean surface temperature was the highest in the 141-year record at +1.28°C (+2.30°F) above average. This was 0.06°C (0.11°F)

[1] https://www.ncdc.noaa.gov/sotc/global/202013 viewed on 5/31/2021
[2] https://www.ncdc.noaa.gov/sotc/global/202013 viewed on 5/31/2021

higher than the previous record set in 2016[2].

The impacts of climate change are especially pronounced at high latitudes. Since 2000, the Arctic (latitudes between 60ºN and 90ºN) has been warming at more than two times the rate of lower latitudes because of "Arctic amplification," a characteristic of the global climate system influenced by changes in sea ice extent, atmospheric and oceanic heat transports, cloud cover, albedo, black carbon, and many other factors[3] (Serreze and Barry 2011; Overland et al. 2017). Across Alaska, average air temperatures have been increasing, and the average annual temperature is now 1.65-2.2°C warmer than during the early and mid-century (Thoman and Walsh 2019). Winter temperatures have increased by 3.3°C (Chapin et al. 2014) and the snow season is shortening. Some of the most pronounced effects of climate change in Alaska include disappearing sea ice, shrinking glaciers, thawing permafrost, and changing ocean temperatures and chemistry (Chapin et al. 2014). Thoman and Walsh (2019) reported that late winter ice coverage in 2018 and 2019 in the Alaska waters of the Bering Sea was far lower than any winter in the past 170 years. Climate models project that before 2050 Arctic waters will be virtually ice-free by late summer[4]. The Arctic continues to warm more than twice as fast as the rest of the globe (Druckenmiller et al. 2022).

#### 4.1.1.2 Ocean Heat

Higher air temperatures have led to higher ocean temperatures. More than 90 percent of the excess heat created by global climate change is stored in the world's oceans, causing increases in ocean temperature (IPCC 2019; Cheng et al. 2020). The upper ocean heat content, which measures the amount of heat stored in the upper 2,000 m of the ocean, was the highest on record in 2019 by a wide margin, and is the warmest in recorded human history (Cheng et al. 2020). The seas surrounding Alaska have been unusually warm in recent years, with unprecedented warmth in some cases (Thoman and Walsh 2019). This effect can be seen throughout the Alaska region, including the Bering, Chukchi, and Beaufort seas (Figure 13) (Thoman and Walsh 2019).

Warmer ocean water affects sea ice formation and melt. In the first decade of the 21st century, Arctic sea ice thickness and annual minimum sea ice extent (i.e., September sea ice extent) declined at a considerably accelerated rate and continues to decline (Stroeve et al. 2007; Stroeve and Notz 2018) (Figure 14). Approximately three-quarters of summer Arctic sea ice volume has been lost since the 1980s (IPCC 2013). In addition, old ice (> 4 years old), which is thicker and more resilient to melting than young ice, constituted 33 percent of the ice pack in 1985, but by March 2019, it represented only 1.2 percent of the ice pack in the Arctic Ocean (Perovich et al. 2019; Meier et al. 2021). Based on data available since 1985, multiyear ice in 2021 reached its second lowest level by the end of summer and ice volume was at a record low (at least since 2010) in April 2021 (Meier et al. 2021) (Figure 14). Overland (2020) suggests that the loss of the thicker older ice makes the Arctic ecosystem less resilient. Both the maximum sea ice extent (March) and the minimum (September) have consistently been decreasing, although the summer minimums are more pronounced (Perovich et al. 2019) (Figure 15). In the 45 year satellite record

[3] NASA webpage. State of the Climate: How the World Warmed in 2019. Available at https://www.carbonbrief.org/state-of-the-climate-how-the-world-warmed-in-2019, accessed January 20, 2020.
[4] https://statesummaries.ncics.org/chapter/ak/, viewed on 12/19/23

of Arctic sea ice extent, 17 of the lowest minimums have all occurred in the last 17 years[5].

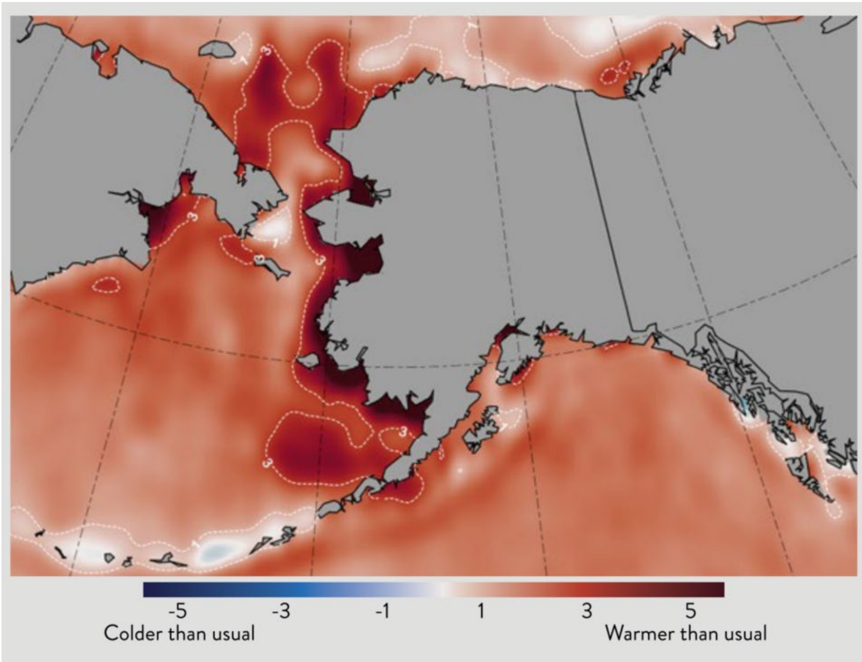


**Figure 13. Arctic summer sea surface temperatures, 2019 (Thoman and Walsh 2019).**

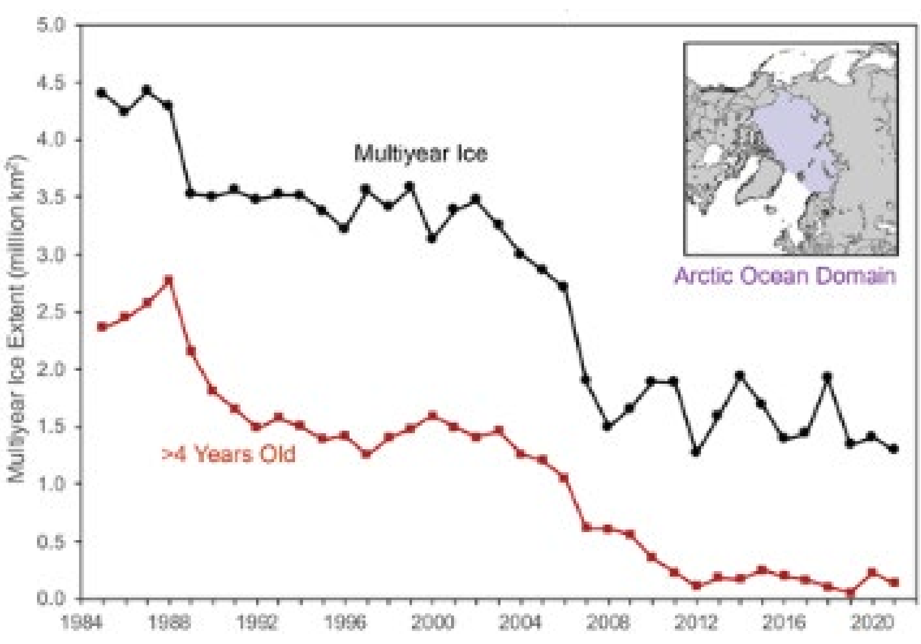


**Figure 14. Extent of multiyear ice (black) and ice greater than four years old (within the Arctic Ocean for the week of the minimum total extent (Figure from Meier et al. (2021)).**

[5] seaicenews/2023/09/arctic-sea-ice-minimum-at-sixth/, viewed on 11/22/2023

Wang and Overland (2009) estimated that the Arctic will become essentially ice-free (i.e., sea ice extent will be less than 1 million $km^2$) during the summer between the years 2021 and 2043 and modeling with the new generation climate models provides independent support of an ice-free Arctic in mid-century or earlier (Notz and Stroeve 2016; Guarino et al. 2020; SIMIP Community 2020). Once the entire Arctic Ocean becomes a seasonal ice zone, its ecosystem will change fundamentally as sea ice is the key forcing factor in polar oceans (Wassmann et al. 2011).

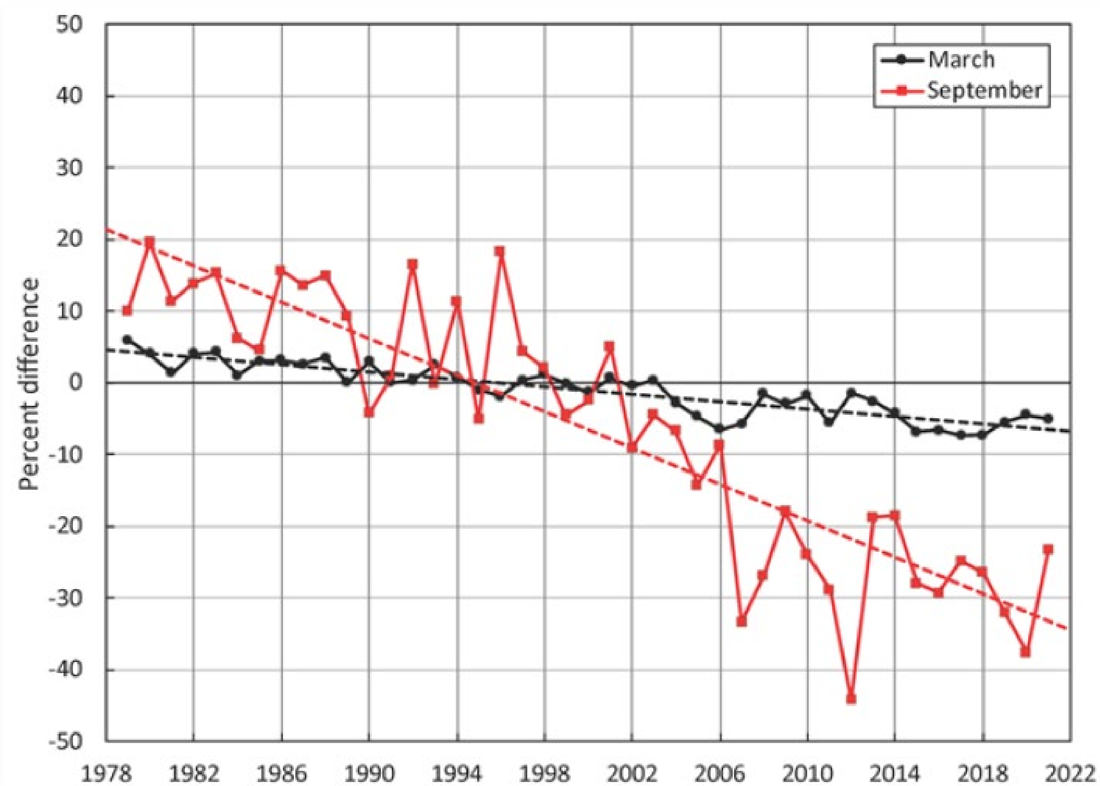


**Figure 15. Arctic ice extent declines in September (red) and in March (black). The value for each year is the difference in percent in ice extent relative to the mean values for 1981-2010. Both trends are significant at the 99 percent confidence level. The slopes of the lines indicate losses of -2.7 for the maximum ice extent and -13.0 percent for the minimum ice extent, per decade (Meier et al. 2021).**

Related to the loss of sea ice is the northward shift and near loss of the cold-water pool in the eastern Bering Sea. Winter sea ice creates a pool of cold (<2ºC) bottom water that is protected from summer mixing by a thermocline (Mueter and Litzow 2008). With the reduction in winter sea ice, the cold-water pool has shrunk (Figure 16). Many temperate species, especially groundfish, are intolerant of the low temperatures so the extent of sea ice determines the boundary between arctic and subarctic seafloor communities and demersal vs pelagic fish communities (Grebmeier et al. 2006). In the Pacific Arctic, large scale, northward movements of commercial stocks are underway as previously cold-dominated ecosystems warm, and fish move northward to higher latitude, relatively cooler environments (Grebmeier et al. 2006; Eisner et al.

2020). Not only fish, but plankton, crabs and ultimately, sessile invertebrates like clams are affected by these changes in water temperature (Grebmeier et al. 2006; Fedewa et al. 2020).

Another ocean water anomaly is described as a marine heat wave. Marine heat waves are described as a coherent area of extreme warm temperature at the sea surface that persists (Frölicher et al. 2018). Marine heatwaves are a key ecosystem driver and there has been an increase from 30 percent in 2012 to nearly 70 percent of global oceans in 2016 experiencing strong or severe heatwaves (Suryan et al. 2021). The largest recorded marine heat wave occurred in the northeast Pacific Ocean from 2013-2015 (Frölicher et al. 2018). Initially called “the blob” the northeast Pacific marine heatwave (PMH) first appeared off the coast of Alaska in the winter of 2013-2014 and by the end of 2015 it stretched from Alaska to Baja California. In mid-2016, the PMH began to dissipate, based on sea surface temperature data but warming re-intensified in late-2018 and persisted into fall 2019 (Suryan et al. 2021). Consequences of this event included an unprecedented harmful algal bloom that extended from the Aleutian Islands to southern California, mass strandings of marine mammals, shifts in the distribution of invertebrates and fish, and shifts in abundance of several fish species (Cavole et al. 2016). Cetaceans, forage fish (capelin and herring), Steller sea lions (*Eumetopias jubatus*), adult cod (*Gadus sp.*), Chinook (*Oncorhynchus tshawytscha*) and sockeye (*Oncorhynchus nerka)* salmon in the Gulf of Alaska were all impacted by the PMH (Bond et al. 2015; Peterson et al. 2016; Sweeney et al. 2018).

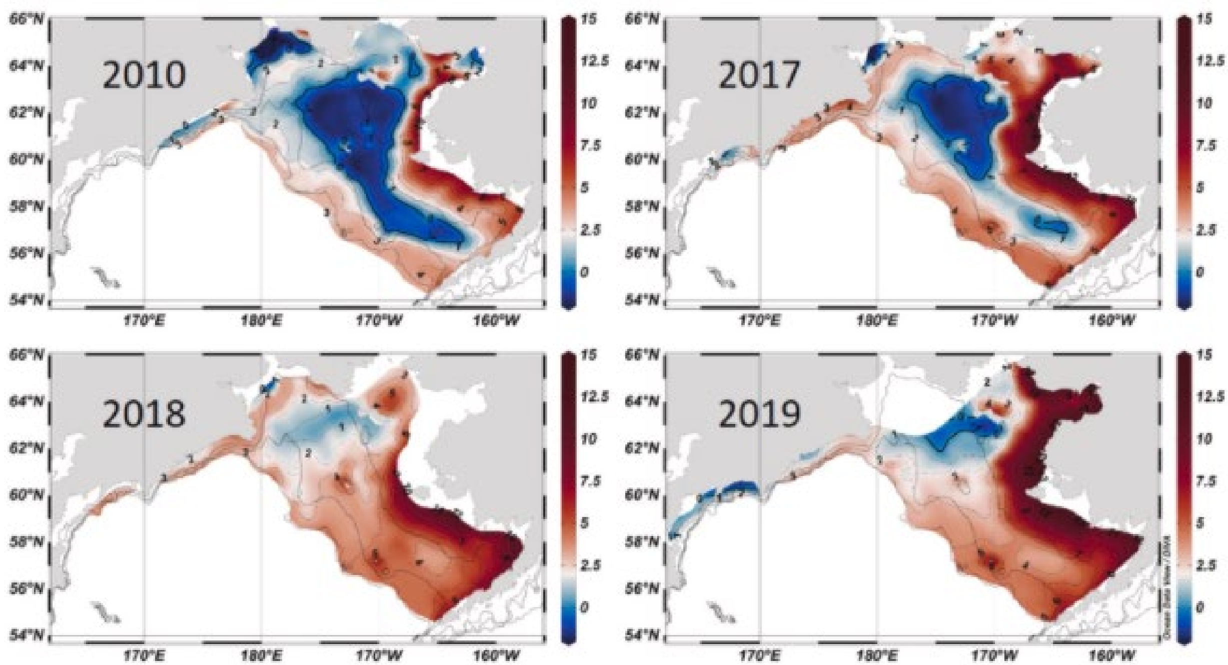


**Figure 16. Bottom temperatures from summer oceanographic surveys. Graphic display of the shrinkage of the cold pool over time. From  Eisner et al. (2020).**

### 4.1.1.3 Ocean Acidification

For 650,000 years or more, the average global atmospheric carbon dioxide ($CO_2$) concentration varied between 180 and 300 parts per million (ppm), but since the beginning of the industrial revolution in the late 1700s, atmospheric $CO_2$ concentrations have been increasing rapidly, primarily due to anthropogenic inputs (Fabry et al. 2008; Lüthi et al. 2008). The world's oceans have absorbed approximately one-third of the anthropogenic $CO_2$ released, which has buffered the increase in atmospheric $CO_2$ concentrations (Feely et al. 2004; Feely et al. 2009). Despite the oceans' role as large carbon sinks, the $CO_2$ level continues to rise and is currently over 416 ppm[6].

As the oceans absorb $CO_2$, the pH of seawater is reduced. This process is referred to as ocean acidification. Ocean acidification reduces the saturation states of certain biologically important calcium carbonate minerals like aragonite and calcite that many organisms use to form and maintain shells (Bates et al. 2009; Reisdorph and Mathis 2014). When seawater is supersaturated with these minerals, calcification (growth) of shells is favored. Likewise, when the sea water becomes undersaturated, dissolution is favored (Feely et al. 2009).

High latitude (colder) oceans have naturally lower saturation states of calcium carbonate minerals than more temperate or tropical waters, making Alaska's oceans more susceptible to the effects of ocean acidification (Fabry et al. 2009; Jiang et al. 2015). Model projections indicated that aragonite undersaturation would start to occur by about 2020 in the Arctic Ocean and by 2050, all of the Arctic will be undersaturated with respect to aragonite (Feely et al. 2009; Qi et al. 2017). Large inputs of low-alkalinity freshwater from glacial runoff and melting sea ice contribute to the problem by reducing the buffering capacity of seawater to changes in pH (Reisdorph and Mathis 2014). As a result, seasonal undersaturation of aragonite was already detected in the Bering Sea at sampling stations near the outflows of the Yukon and Kuskokwim Rivers, and the Chukchi Sea (Fabry et al. 2009). Models and observations indicate that rapid sea ice loss will increase the uptake of $CO_2$ and exacerbate the problem of aragonite undersaturation in the Arctic (Yamamoto et al. 2012; DeGrandpre et al. 2020).

Undersaturated waters are potentially highly corrosive to any calcifying organism, such as corals, bivalves, crustaceans, echinoderms and many forms of zooplankton such as copepods and pteropods, and consequently may affect Arctic food webs (Fabry et al. 2008; Bates et al. 2009). Pteropods, which are often considered indicator species for ecosystem health, are prey for many species of carnivorous zooplankton, fishes including salmon, mackerel, herring, and cod, and baleen whales (Orr et al. 2005). Because of their thin shells and dependence on aragonite, under increasingly acidic conditions, pteropods may not be able to grow and maintain shells (Lischka and Riebesell 2012). It is uncertain if these species, which play a large role in supporting many levels of the Alaskan marine food web, may be able to adapt to changing ocean conditions (Fabry et al. 2008; Lischka and Riebesell 2012).

[6] NOAA Global Monitoring Laboratory website. Trends in Atmospheric Carbon Dioxide. Available at https://www.esrl.noaa.gov/gmd/ccgg/trends/, accessed November 22, 2023.

### 4.1.2 Biological Effects

Climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the structure and function of marine, coastal, and terrestrial ecosystems in the foreseeable future (Hinzman et al. 2005; Burek et al. 2008; Doney et al. 2012; Huntington et al. 2020). The physical effects on the environment described above have impacted, are impacting, and will continue to impact marine species in a variety of ways (IPCC 2014), such as:

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

Some of the biological consequences of the changing Arctic conditions are shown in Table 5 .

**Table 5. A summary of possible direct and indirect health effects for Arctic marine mammals related to climate change, adapted from Burek et al. (2008).**

| Effect | Result |
|---|---|
| **Direct** | |
| Increase in ocean temperature | Changes in distribution and range (fish, whales)<br>Increase in harmful algal blooms (all affected)<br>Loss of suitable habitat<br>Change in prey base |
| Loss of sea ice platform (seals) | Reduction of suitable habitat for feeding, resting, molting, breeding<br>Movement, distribution, life history may be affected |
| Changes in weather | Reduction in snow on sea ice, loss of suitable lair habitat for ringed seals |
| Ocean acidification | Changes in prey base (all affected) |
| **Indirect** | |
| Changes in infectious disease transmission (changes in host–pathogen associations due to altered pathogen transmission or host resistance) | Increased host density due to reduced habitat, increasing density-dependent diseases.<br>Epidemic disease due to host or vector range expansion.<br>Increased survival of pathogens in the environment.<br>Interactions between diseases, loss of body condition, and increased immunosuppressive contaminants, resulting in increased susceptibility to endemic or epidemic disease. |

| Effect | Result |
|---|---|
| Alterations in the predator–prey relationship | Affect body condition and, potentially, immune function. |
| Changes in toxicant pathways (harmful algal blooms, variation in long-range transport, biotransport, runoff, increased use of the Arctic) | Mortality events from biotoxins<br>Toxic effects of contaminants on immune function, reproduction, skin, endocrine systems, etc. |
| Other negative anthropogenic impacts related to longer open water period | Increased likelihood of ship strikes, fisheries interactions, acoustic injury<br>Chemical and pathogen pollution due to shipping or aquaculture practices.<br>Introduction of nonnative species |

Climate change is likely to have its most pronounced effects on species whose populations are already in tenuous positions (Isaac 2009). For species that rely primarily on sea ice for major parts of their life history, such as ringed and bearded seals, we expect that the loss of sea-ice will negatively impact those species' ability to thrive. Consequently, we expect the future population viability of at least some ESA-listed species to be affected with global warming.

Changes in ocean surface temperature may impact species migrations, range, prey abundance, and overall habitat quality. For ESA-listed species that undertake long migrations, if either prey availability or habitat suitability is disrupted by changing ocean temperature regimes, the timing of migration can change. For example, cetaceans with restricted distributions linked to cooler water temperatures may be particularly exposed to range restriction (Learmonth et al. 2006; Isaac 2009). Macleod (2009) estimated that, based on expected shifts in water temperature, 88 percent of cetaceans will be affected by climate change, 47 percent will be negatively affected, and 21 percent will be put at risk of extinction. Of greatest concern are cetaceans with ranges limited to non-tropical waters, and preferences for shelf habitats (Macleod 2009).

## 4.2 Status of Listed Species Likely to be Adversely Affected by the Action

This opinion examines the status of the Arctic ringed seal, which is likely to be adversely affected by the proposed action. Species status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR § 402.02.

We present a summary of information on the population structure and distribution of the Arctic ringed seal to provide a foundation for the exposure analyses that appear later in this opinion. Then we summarize information on the threats to the species and the species' status given those threats to provide points of reference for the jeopardy determinations we make later in this opinion. That is, we rely on a species' status and trend to determine whether an action's effects are likely to increase the species' probability of becoming extinct.

### 4.2.1 Ringed seal

#### 4.2.1.1.1 Population Structure and Status

Under the MMPA, NMFS recognizes one stock of Arctic ringed seals, the Alaska stock, in U.S. waters (and the action area). The Arctic ringed seal was listed as threatened under the ESA on December 28, 2012, primarily due to expected impacts on the population from declines in sea ice and snow cover stemming from climate change within the foreseeable future (77 FR 76706 (December 28, 2012)). NMFS has not prepared a Recovery Plan for the Arctic subspecies of ringed seal. Critical habitat for the Arctic ringed seal was designated on April 1, 2022 (87 FR 19232).

Ringed seal population surveys in Alaska have used various methods and assumptions, incompletely covered their habitats and range, and were conducted more than a decade ago. Therefore, current and comprehensive abundance estimates or trends for this species are not available. Frost et al. (2004) conducted aerial surveys within 40 km of shore in the Alaska Beaufort Sea during May and June from 1996 through 1999 and observed ringed seal densities ranging from 0.81 seals per square kilometer in 1996 to 1.17 seals per square kilometer in 1999. Moulton et al. (2002) conducted similar, concurrent surveys in the Alaska Beaufort Sea between 1997 and 1999, but reported substantially lower ringed seal densities than Frost et al. (2004). The reason for this disparity was unclear (Frost et al. 2004). Bengtson et al. (2005) conducted aerial surveys in the Alaska Chukchi Sea during May and June of 1999 and 2000. While the surveys were focused on the coastal zone within 37 km of shore, additional survey lines were flown up to 185 km offshore. Population estimates were derived from observed densities corrected for availability bias using a haul-out model from six tagged seals. Ringed seal abundance estimates for the entire survey area were 252,488 (standard error = 47,204) in 1999 and 208,857 (standard error = 25,502) in 2000. Using the most recent survey estimates from surveys by Bengtson et al. (2005) and Frost et al. (2004) in the late 1990s and 2000, Kelly et al. (2010b) estimated the total population in the Alaska Chukchi and Beaufort seas to be at least 300,000 ringed seals. This estimate is likely an underestimate since the Beaufort Sea surveys were limited to within 40 km from shore.

Though a reliable population estimate for the entire Alaska stock is not available, research programs have developed new survey methods and partial, but useful, abundance estimates. In spring of 2012 and 2013, U.S. and Russian researchers conducted image-based aerial abundance and distribution surveys of the entire Bering Sea and Sea of Okhotsk (Moreland et al. 2013). Conn et al. (2014), using a sub-sample of the data collected from the U.S. portion of the Bering Sea in 2012, calculated an abundance estimate of 171,418 ringed seals (95% CI: 141,588-201,090). This estimate did not account for availability bias due to seals in the water at the time of the surveys and did not include ringed seals in the shorefast ice zone, which were surveyed using a different trackline design that will require a separate analysis. Thus, the actual number of ringed seals in the U.S. portion of the Bering Sea is likely much higher, perhaps by a factor of two or more. Researchers expect to provide a population estimate, corrected for availability bias, for the entire U.S. portion of the ringed seal stock once the final Bering Sea results are combined with the results from spring surveys of the Chukchi Sea (conducted in 2016) and Beaufort Sea. Therefore, for the purposes of the IHA, the Permits Division used a conservative population estimate of 171,418 based on a subsample of data collected from the U.S. portion the Bering Sea in 2012 (Conn et al. 2014).

#### 4.2.1.1.2 Distribution

Arctic ringed seals have a circumpolar distribution and are found throughout the Arctic basin and in adjacent seasonally ice-covered seas. They remain with the ice most of the year and use it as a haul-out platform for resting, pupping, and nursing in late winter to early spring, and molting in late spring to early summer. During summer, ringed seals range hundreds to thousands of kilometers to forage along ice edges or in highly productive open-water areas (Harwood and Stirling 1992; Freitas et al. 2008; Kelly et al. 2010b; Harwood et al. 2015). Harwood and Stirling (1992) reported, in late summer and early fall, aggregations of ringed seals in open-water in some parts of their study area in the southeastern Canadian Beaufort Sea where primary productivity was thought to be high. Harwood et al. (2015) also found that in the fall, several satellite-tagged ringed seals showed localized movements offshore east of Point Barrow in an area where bowhead whales are known to concentrate in the fall to feed on zooplankton. With the onset of freeze-up in the fall, ringed seal movements become increasingly restricted. Seals that have summered in the Beaufort Sea are thought to move west and south with the advancing ice pack, with many seals dispersing throughout the Chukchi and Bering seas while some remain in the Beaufort Sea (Frost and Lowry 1984; Crawford et al. 2012; Harwood et al. 2012). Some adult ringed seals return to the same small home ranges they occupied during the previous winter (Kelly et al. 2010a). In analyzing data from ringed seals tagged from 2011-2017, Von Duyke et al. (2020) found that continental shelf waters were occupied for greater than 96 percent of tracking days, during which repetitive diving (suggestive of foraging), primarily to the seafloor, was the most frequent activity.

#### 4.2.1.1.3 Occurrence in the Action Area

In Alaskan waters, during winter and early spring when sea ice is at its maximal extent, ringed seals are abundant in the northern Bering Sea, Norton and Kotzebue Sounds, and throughout the Chukchi and Beaufort seas (Frost 1985; Kelly 1988b), and therefore are in the action area. Passive acoustic monitoring (PAM) of ringed seals from a high frequency recording package deployed at a depth of 240 m in the Chukchi Sea 120 km north-northwest of Utqiaġvik, Alaska detected ringed seals in the area between mid-December and late May over the four year study (Jones et al. 2014). At the onset of the fall freeze, ringed seal movements become increasingly restricted and seals move west and south with the advancing ice pack into the Chukchi and Bering Seas, with some remaining in the Beaufort Sea (Frost and Lowry 1984; Crawford et al. 2012; Harwood et al. 2012).

Previously, density derived from a habitat suitability model (Kaschner et al. 2006) was used to estimate acoustic exposures of marine mammals using The Navy Acoustic Effects Model (NAEMO); however, this density data drastically overestimated the abundance of ringed seals in past ICEX study areas and led to an inaccurate number of modeled ringed seal exposures. Instead, using data from sighting surveys that previously occurred in the ICEX study area was determined to be the better approach for estimating ringed seal presence and exposure. Ringed seal presence in the ICEX study area was obtained using sighting data from the OBIS-SEAMAP (Halpin et al. 2009). The ICEX study area was overlaid on the OBIS-SEAMAP ringed seal sightings map that included sightings from the years 2000 to 2007 and the year 2013. Sighting data were only available for the mid to late summer and fall months. Due to the paucity of winter and spring data, the average number of individual ringed seals per year was assumed to be present in the ICEX study area during the proposed action; therefore, it is assumed that three ringed seals would be present in the study area during the proposed action. It is assumed that the OBIS-SEAMAP reported sightings will correspond to a more accurate number of animals that could be present at the time of the proposed action than the previously used densities. It is also assumed that ringed seals will be present in the flight and transit corridor, which is a corridor approximately 40 km wide and the most direct route between Prudhoe Bay and the ice camp (the ice camp will be established approximately 100 to 200 nm north of Prudhoe Bay, Alaska). However, any ringed seals along the coast that are in the flight path from Deadhorse Airport to the ice camp are assumed to be habituated to the sight and sound of aircraft and their reactions, if they occur at all, would not be measurable. The proposed project will increase the number of flights from the airport by approximately 15 percent with the most flights occurring during camp construction and demobilization. The mitigation measures regarding flight altitude and distance from seals will further reduce the potential for there to be adverse effects of the aircraft on ringed seals. Taking all of these factors into account, we expect that a few individuals may be exposed to overflight noise but the exposure would be brief and transitory, it would be noise they are accustomed to, and it is extremely unlikely to disrupt normal behavioral patterns.

#### 4.2.1.1.4 Threats to the Species

The primary threat to the Arctic ringed seal is diminishing ice and snow cover as a consequence of climate change. As discussed in section 4.1, the duration of ice cover is projected to be substantially reduced in the future. Snow cover adequate for the formation and occupation of birth lairs is forecasted to be greatly reduced. Without the protection of lairs, ringed seals, especially newborn, are vulnerable to freezing and predation. In addition, other consequences of climate change that lead to impacts on prey, increased harmful algal blooms, or susceptibility to disease could also impact population viability.

#### 4.2.1.1.5 Reproduction and Growth

Ringed seal pups are born and nursed in the spring (March through May), normally in subnivean birth lairs, with the peak of pupping occurring in early April (Frost and Lowry 1981). Subnivean lairs provide thermal protection from cold temperatures, including wind chill effects, and some protection from predators (Smith and Stirling 1975; Smith 1976). These lairs are especially important for protecting pups. Arctic ringed seals appear to favor shore-fast ice for whelping habitat. Ringed seal whelping has also been observed on both nearshore and offshore drifting pack ice (e.g., Lentfer 1972). Seal mothers continue to forage throughout lactation, and move young pups between lairs within their network of lairs. The pups spend time learning diving skills, using multiple breathing holes, and nursing and resting in lairs (Smith and Lydersen 1991; Lydersen and Hammill 1993). After a 5 to 8 week lactation period, pups are weaned (Lydersen and Hammill 1993; Lydersen and Kovacs 1999).

Mating is thought to take place under the ice in the vicinity of birth lairs while mature females are still lactating (Kelly et al. 2010a). The sex ratio is even to slightly male dominated (Smith 1970; Quakenbush et al. 2011). Ringed seals undergo an annual molt (shedding and regrowth of hair and skin) that occurs between mid-May to mid-July, during which time they spend many hours hauled out on the ice (Reeves 1998) . The relatively long periods of time that ringed seals spend out of the water during the molt have been ascribed to the need to maintain elevated skin temperatures during new hair growth (Feltz and Fay 1966). Figure 17 summarizes the approximate annual timing of Arctic ringed seal reproduction and molting (Kelly et al. 2010a).

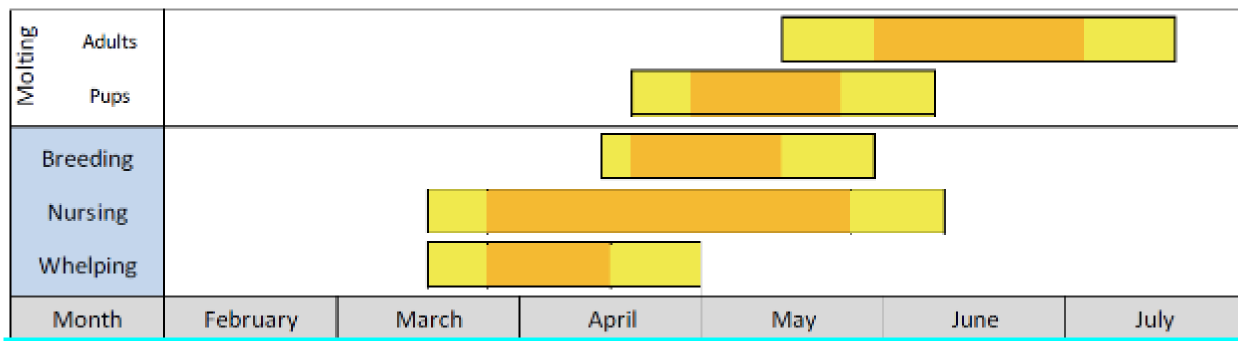


**Figure 17. Approximate annual timing of Arctic ringed seal reproduction and molting. Yellow bars indicate the "normal" range over which each event is reported to occur and orange bars indicate the "peak" timing of each event (Kelly et al. 2010a).**

### 4.2.1.1.6 Feeding and Prey Selection

Ringed seals feed year-round, but forage most intensively during the open-water period and early freeze-up, when they spend 90 percent or more of their time in the water (Kelly et al. 2010a). Many studies of the diet of Arctic ringed seal have been conducted and although there is considerable variation in the diet regionally, several patterns emerge. Preferred prey tends to be schooling fish species that form dense aggregations. Fish of the cod family tend to dominate the diet from late autumn through early spring in many areas (Kovacs 2007). Arctic cod (*Boreogadus saida*) is often reported to be the most important prey species for ringed seals, especially during the ice-covered periods of the year (Lowry et al. 1980; Smith 1987; Holst et al. 2001; Labansen et al. 2007). Quakenbush et al. (2011) reported evidence that in general, the diet of Arctic ringed seals sampled from Alaska waters consisted of cod, amphipods, and shrimp. Fish are generally more commonly eaten than invertebrate prey, but diet is determined to some extent by availability of various types of prey during particular seasons as well as preference, which in part is guided by energy content of various available prey (Reeves 1998; Wathne et al. 2000). Invertebrate prey seem to become more important in the diet of Arctic ringed seals in the open-water season and often dominate the diet of young animals (e.g., Lowry et al. 1980; Holst et al. 2001).

#### 4.2.1.1.7 Diving and Social Behavior

Ringed seals tend to haul out of the water during the daytime and dive at night during the spring to early summer breeding and molting periods, while the inverse tended to be true during the late summer, fall, and winter (Kelly and Quakenbush 1990; Lydersen 1991; Teilmann et al. 1999; Carlens et al. 2006; Kelly et al. 2010a; Kelly et al. 2010b). Diel activity patterns suggested greater allocation of foraging efforts to midday hours (Von Duyke et al. 2020). Haul-out patterns were complementary, occurring mostly at night until April-May when midday hours were preferred (Von Duyke et al. 2020).

#### 4.2.1.1.8 Vocalization, Hearing, and Other Sensory Capabilities

Ringed seals vocalize underwater in association with interspecific behaviors. Stirling (1973) concluded that no vocalizations played a role solely in reproductive behavior. Underwater audiograms for phocids suggest that they have very little hearing sensitivity below 1 kHz, and make calls between 90 Hz and 16 kHz (Richardson et al. 1995). NMFS defines the functional hearing range for phocids as 50 Hz to 86 kHz (NMFS 2018). Arctic ringed seals are not known to echolocate to communicate or find prey (Kelly 2022). Unlike many other phocids, ringed seal vocalizations cannot be heard by a human on the ice. Stirling and Thomas (2003) suggest that the exceptionally low signal strength of ringed seal vocalizations may have evolved in part to avoid detection by polar bears.

Elsner et al. (1989) indicated that ringed seals primarily use vision to locate breathing holes from under the ice, followed by their auditory and vibrissal senses for short-range pilotage. Hyvärinen (1989) suggested that ringed seals in Lake Saimaa, Finland may use a simple form of echolocation along with a highly developed vibrissal sense for orientation and feeding in dark, murky waters. The vibrissae likely are important in detecting prey by sensing their turbulent wakes as demonstrated experimentally for harbor seals (Dehnhardt et al. 1998). Sound waves could be received by way of the blood sinuses and by tissue conduction through the vibrissae (Riedman 1990).

# 5 ENVIRONMENTAL BASELINE

The “environmental baseline” refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action areas that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR § 402.02).

## 5.1 Climate Change

All areas of the action area are being affected by climate change. Although the species living in the Arctic successfully adapted to changes in the climate in the past, the current rate of change is accelerated (Simmonds and Eliott. 2009). The life cycles and physiological requirements of many specialized polar species are closely linked to the annual cycles of sea ice and photoperiod and they may not be able to quickly adapt (Doney et al. 2009; Wassmann et al. 2011). Additionally, the loss of sea ice as a barrier increases the potential for further anthropogenic impacts as vessel traffic for transportation and tourism increases, resource extraction activities expand, and pathogens or disease have a path into newly ice-free regions.

As discussed in Section 4.2, the Arctic is warming at two or more times the global average. One consequence of the warming is a reduction in the length of the snow season (Figure 18). The depth and duration of snow cover are projected to continue to decline substantially throughout the range of the Arctic ringed seal, reducing the areas with suitable snow depths for their lairs by an estimated 70 percent by the end of this century (Hezel et al. 2012). It has been observed that the mean thickness of snow accumulating on sea ice has declined from approximately 35 to 22 cm in the western Arctic and 33 to 15 cm in the Beaufort and Chukchi Seas since the mid-1900s (Webster et al. 2014). A decrease in the availability of suitable sea ice conditions (including depth of snow on ice available for lair formation) may not only lead to high mortality of ringed seal pups but may also produce behavioral changes in seal populations (Loeng et al. 2005). The persistence of this species will likely be challenged as decreases in ice and, especially, snow cover lead to increased juvenile mortality from premature weaning, hypothermia, and predation (Kelly et al. 2010b).

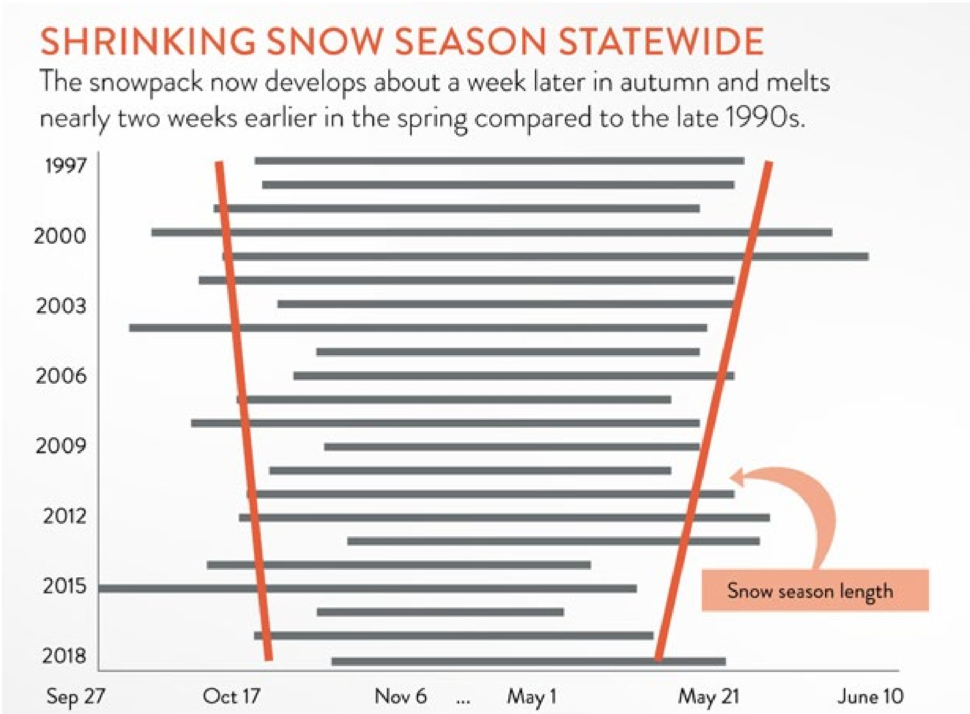


**Figure 18. Length of the snow season (gray bars) in Alaska each year from 1997-2018. Orange slanting bars show the trends of the date when the state becomes 50 percent snow covered in fall and when half the winter snow has melted in spring. Image by Rick Thoman, Alaska Center for Climate and Policy.**

Because the sea ice extent and thickness have been decreasing consistently, vessel traffic, and more importantly for seals, ice breaker traffic will be increasing in the Arctic (U.S. Committee on the Marine Transportation System 2019; NMFS 2020). Although seals are maneuverable enough to avoid vessels in open water, icebreakers could be lethal to nursing pups through collisions or crushing by displaced ice (Wilson et al. 2017; Wilson et al. 2020). In a study of Caspian seals (*Pusa capsica)* from 2006-2013, Wilson et al. (2017) documented the response of seals to ice breakers that made regular transits across the Caspian Sea. The ice breaking route had high densities of breeding seals in most years. A whole range of impacts to mothers and their pups was documented including being struck by the ice breaker, moving away from the ice breaker as it approached, and having mothers and pups separated. Vessel passage may destroy birth sites, water access holes, and pup shelters replacing those features with brash ice or open water. Often pups were marooned on fragments of intact ice or wetted in brash ice. Fragmented brash ice may cause disorientation, stress, and increased energetic demands (Wilson et al. 2017). With the Northern Sea Route and Northwest Passage being available more often and an increase in icebreakers, we will expect that ice dependent seals could be affected.

## 5.2 Biotoxins

As temperatures in the Arctic waters warm and sea ice diminishes, marine mammal health may be compromised through nutritional and physiological stress, and toxins from harmful algal blooms. *Alexandrium catenella*, a cyst-forming dinoflagellate creates a potent biotoxin, saxitoxin or paralytic shellfish poison. An exceptionally large cyst bed has been documented in the Chukchi Sea that can support germination and the development of recurrent, locally originating blooms (Anderson et al. 2021). Cyst concentrations are among the highest reported globally for this species and the cyst bed is at least six times larger in area than any other (Anderson et al. 2021). The region is now poised to support annual blooms that are massive in scale (Anderson et al. 2021). Fey et al. (2015) found that across all animal taxa, biotoxicity from harmful algal blooms was one of the events most often associated with mass mortality events. Domoic acid, another biotoxin produced by diatoms, was first recognized as a threat to marine mammal health in 1998 when hundreds of California sea lions (*Zalophus californianus*) died along beaches in central California or exhibited signs of neuroexcitotoxicity including seizures, head weaving, and ataxia (Scholin et al. 2000). Although biotoxins can cause death, they can also cause sublethal effects including reproductive failure and chronic neurological disease (Broadwater et al. 2018).

Lefebvre et al. (2016) examined 13 species of marine mammals from Alaska including the humpback whale (*Megaptera novaeangliae*), bowhead whale (*Balaena mysticetus*), beluga whale (*Delphinapterus leucas*), harbor porpoise (*Phocoena phocoena*), northern fur seal (*Callorhinus ursinus*), Steller sea lion, harbor seal (*Phoca vitulina*), ringed seal, bearded seal, spotted seal (*Phoca largha*), ribbon seal (*Histriophoca fasciata*), Pacific walrus (*Odobenus rosmarus divergens*), and northern sea otter (*Enhydra lutris*) for the presence of biotoxins (Figure 19). Domoic acid and saxitoxin (a form of paralytic shellfish poison) were both found in ringed seals (Lefebvre et al. 2016). It is not known if exposure to multiple toxins results in additive or synergistic effects or perhaps suppresses immunity to make animals more vulnerable to secondary stressors (Broadwater et al. 2018). With declining sea ice, warmer water temperatures, and changes in ocean circulation patterns, NOAA anticipates that harmful algal blooms in the Arctic will likely worsen in the future[7].

Hendrix et al. (2021) examined 998 seals harvested for subsistence purposes in western and northern Alaska during 2005–2019 for domoic acid and saxitoxin. Both toxins were detected in bearded, ringed, and spotted seals, though no clinical signs of acute neurotoxicity were reported in harvested seals. Bearded seals had the highest prevalence of each toxin, followed by ringed seals. Bearded seal stomach content samples from the Bering Sea showed a significant increase in domoic acid prevalence with time (logistic regression, $p = .004$). These findings are consistent with predicted northward expansion of domoic acid-producing algae. A comparison of paired samples taken from the stomachs and colons of 15 seals found that colon content consistently had higher concentrations of both toxins (Hendrix et al. 2021).

[7] NOAA Arctic Program. Arctic Report Card: Update for 2018, Available at https://arctic.noaa.gov/report-card/report-card-2018/harmful-algal-blooms-in-the-arctic/, accessed November 22, 2023.


**Figure 19. Algal toxins detected in 13 species of marine mammals from southeast Alaska to the Arctic from 2004 to 2013 (Lefebvre et al. 2016).Marine mammal species are listed as follows: (A) humpback whales, (B) bowhead whales, (C) beluga whales, (D) harbor porpoises, (E) northern fur seals, (F) Steller sea lions, (G) harbor seals, (H) ringed seals, (I) bearded seals, (J) spotted seals, (K) ribbon seals, (L) Pacific walruses and (M) northern sea otters.**

## 5.3 Disease

In addition to influencing animal nutrition and physiological stress, environmental shifts caused by climate change may foster exposure to new pathogens in Arctic marine mammals. Through altered animal behavior and absence of physical barriers, loss of sea ice may create new pathways for animal movement and introduction of infectious diseases into the Arctic. The health impacts of this new normal in the Arctic are unknown, but new open water routes through the Arctic suggest that opportunities for Phocine distemper virus (PDV) and other pathogens to cross between North Atlantic and North Pacific marine mammal populations may become more common (VanWormer et al. 2019). PDV is a pathogen responsible for extensive mortality in European harbor seals (*Phoca vitulina vitulina*) in the North Atlantic. Prior to 2000, serologic surveys of Pacific harbor seals (*Phoca vitulina richardsii*), Steller sea lions, and northern sea otters off Alaska showed little evidence of exposure to distemper viruses, and PDV had not been identified as a cause of illness or death. PDV was not confirmed in the North Pacific Ocean until it was detected in northern sea otters sampled in 2004 (VanWormer et al. 2019). In addition to PDV, *Brucella*, and Phocid herpesvirus-1 have been found in Alaskan marine mammals (Zarnke et al. 2006). Herpesviruses were implicated in fatal and nonfatal infections of harbor seals in the

North Pacific (Zarnke et al. 2006).

Ringed seals have co-evolved with numerous parasites and diseases, and these relationships are presumed to be stable. However, beginning in mid-July 2011, elevated numbers of sick or dead seals, primarily ringed seals, with skin lesions were discovered in the Arctic and Bering Strait regions. By December 2011, there were more than 100 cases of affected pinnipeds, including ringed seals, bearded seals, spotted seals, and walruses, in northern and western Alaska. Due to the unusual number of marine mammals discovered with similar symptoms across a wide geographic area, NMFS and USFWS declared a Northern Pinniped Unusual Mortality Event (UME) on December 20, 2011. Disease surveillance efforts in 2012 through 2014 detected few new cases similar to those observed in 2011. To date, no specific cause for the disease and deaths has been identified.

Likewise, in 2019, a UME was declared for bearded, ringed, and spotted seals in the Bering and Chukchi seas because of elevated mortality documented starting in June 2018 and continuing through 2022[8]. From June 1, 2018, to January 7, 2022, NMFS confirmed 368 strandings[8] (Table 6). The cause of the UME has not been determined but many of the seals had low fat thickness. All age classes were affected. The seals that were sampled did not have the hair loss or skin lesions that were prominent in the prior UME. Subsistence hunters noted that some of the seals had less fat than normal. The lowest sea ice maximums occurred in 2017 and 2018 when the retreat of sea ice was very rapid. It is unknown if these extreme sea ice conditions played a role in the health of the seals. Strandings and mortalities have returned to baseline levels (there were eight confirmed reports of dead ringed seals in 2022; NOAA unpublished data); the causes of the event are still being investigated.

**Table 6. Stranded seals in the Bering and Chukchi Seas from 2018-2022**

| Year | Bearded | Ringed | Spotted | Unidentified | Total |
|---|---|---|---|---|---|
| 2018 (June 1-Dec 31) | 35 | 29 | 20 | 27 | 111 |
| 2019 | 50 | 35 | 26 | 53 | 164 |
| 2020 | 10 | 9 | 8 | 11 | 38 |
| 2021 | 11 | 22 | 8 | 14 | 55 |
| 2022 (as of January 7)) | 0 | 0 | 0 | 0 | 0 |
| **Total*** | **106** | **95** | **62** | **105** | **368** |
| Source: https://www.fisheries.noaa.gov/alaska/marine-life-distress/2018-2022-ice-seal-unusual-mortality-event-alaska | | | | | |

[8]NOAA Fisheries. 2018-2022 Ice seal unusual mortality event in Alaska webpage. Available at: https://www.fisheries.noaa.gov/alaska/marine-life-distress/2018-2022-ice-seal-unusual-mortality-event-alaska, accessed November 16, 2023.

## 5.4 Fisheries

While no commercial fishing is currently authorized in the Chukchi and Beaufort Seas, ringed seals may be impacted by commercial fishing interactions as they migrate through the Bering Sea to the Chukchi and Beaufort seas. Commercial fisheries may impact ringed seals through direct interactions (i.e., incidental take or bycatch) and indirectly through competition for prey resources and other impacts on prey populations (e.g. disruption or destruction of prey habitat). From 2014 to 2018 the minimum mean estimated annual mortality and serious injury rate for the ringed seal by the U.S. commercial fisheries was 4.8 for the Bering Sea/Aleutian Island flatfish and Pollock trawl (Young et al. 2023). Entanglement and entrapment in trawl fishery gear was the leading cause of serious injury and mortality for all phocids analyzed in Freed et al. (2023). As commercial fisheries adapt to changes in the location of commercially valuable fisheries, moving northward in the Bering Sea as a consequence of climate change, an increase in seal interactions with fisheries gear is likely.

## 5.5 Oil and Gas

Oil and gas exploration activities have occurred on the North Slope since the early 1900s, and oil production started at Prudhoe Bay in 1977. Oil production has occurred for over 40 years in the region, and presently spans from the Alpine field, which is approximately 96 km (60 mi) west of Prudhoe Bay, to the Point Thomson project, which is approximately 96 km east of Prudhoe Bay. Additionally, onshore gas production from the Barrow gas field began over 60 years ago. Associated industrial development has included the creation of industry-supported community airfields at Deadhorse and Kuparuk, and an interconnected industrial infrastructure that includes roadways, pipelines, production and processing facilities, gravel mines, and docks.

Offshore oil and gas development in Alaska poses a number of threats to listed marine species, including increased ocean sound, risk of hydrocarbon spills, production of waste liquids, habitat alteration, increased vessel traffic, and risk of ship strike. NMFS reviewed the potential effects of oil and gas development in a Final Environmental Impact Statement for the effects of oil and gas activities in the Arctic Ocean (NMFS 2013) and has conducted numerous Section 7 consultations on oil and gas activities in the Chukchi and Beaufort Seas (available at https://www.fisheries.noaa.gov/alaska/consultations/section-7-biological-opinions-issued-alaska-region).

Many of the consultations have analyzed the take (by harassment) of ringed seals from sounds produced during geophysical (including seismic) surveys and drilling operations conducted by leaseholders during open water (i.e., summer) months. Geophysical seismic survey activity has been described as one of the loudest man-made underwater sound sources, with the potential to harass or harm marine mammals (Richardson et al. 1995). Controlled-source, deep-penetration reflection seismology, similar to sonar and echolocation, is the primary tool used for onshore and offshore oil exploration (Smith et al. 2017). Seismic surveys are conducted by towing long arrays of sensors affixed to wires at approximately 10 knots behind large vessels following a survey grid. High power air cannons are fired below the water surface, and the sound waves propagate through the water and miles into the seafloor. When those soundwaves encounter strong impedance contrasts (e.g., between water and the ocean floor, or between different densities of substrates), a reflection signal is detected by the sensors. Those signals can be interpreted to determine the stratigraphy of the substrate and identify oil and gas deposits.

Seismic surveys have been conducted in the Chukchi Sea and Beaufort Sea since the late 1960s and early 1970s, resulting in extensive coverage over the area. Seismic surveys vary, but a typical two-dimensional/three-dimensional (2D/3D) seismic survey with multiple guns emits sound at frequencies of about 10 Hz to 3 kHz (Austin et al. 2015). Seismic airgun sound waves are directed towards the ocean bottom, but can propagate horizontally for several kilometers (Greene and Richardson 1988; Greene and Moore 1995). Analysis of sound associated with seismic operations in the Beaufort Sea and central Arctic Ocean during ice-free conditions also documented propagation distances up to 1,300 km (808 mi) (Richardson 1998; Richardson 1999; Thode et al. 2010). Because the Chukchi Sea continental shelf has a highly uniform depth of 30 to 50 m, it strongly supports sound propagation in the 50 to 500 Hz frequency band (Funk et al. 2008). The sound generated from seismic surveys has been linked to behavioral disturbance of wildlife and potential auditory injury to marine mammals in the marine environment (Smith et al. 2017). Seismic surveys are often accompanied by test drilling. Test drilling involves fewer direct impacts than seismic exploration, but the potential risks of test drilling, such as oil spills, may have broader consequences (Smith et al. 2017). Oil and gas exploration, including seismic surveys, occur within the action area.

As stated, NMFS has conducted numerous ESA section 7 consultations related to oil and gas activities in the Chukchi and Beaufort seas. Many of the consultations have estimated take of ringed seals from sounds produced during geophysical (including seismic) surveys and other exploration and development activities. Although large numbers of take for ringed seals have been estimated for seismic surveys related to oil and gas exploration, several of those projects never came to fruition, and the ones that did occur reported that only a small fraction of the estimated take actually happened (NMFS unpublished data). Currently we have no evidence that the take which has occurred from oil and gas exploration has had a lasting adverse effect on ringed seal individuals or populations.

### 5.5.1 Pollution and Discharge (Excluding Spills)

Previous development and discharges in portions of the action area are the source of multiple pollutants that may be bioavailable (i.e., may be taken up and absorbed by animals) to ringed seals or their prey (NMFS 2013). Drill cuttings and fluids contain contaminants that have high potential for bioaccumulation, such as dibenzofuran and polycyclic aromatic hydrocarbons. Historically, drill cuttings and fluids have been discharged from oil and gas developments in the Beaufort Sea near the action area, and residues from historical discharges may be present in the affected environment (Brown et al. 2010). Polycyclic aromatic hydrocarbons are also emitted to the atmosphere by flaring waste gases at production platforms or gas treatment facilities. For example, approximately 162,000 million standard cubic feet of waste gas was flared at Northstar in 2004 (Neff 2010).

The Clean Water Act of 1972 (CWA) has several sections or programs applicable to activities in offshore waters. Section 402 of the CWA authorizes the EPA to administer the NPDES permit program to regulate point source discharges into waters of the United States. Section 403 of the CWA requires that EPA conduct an ocean discharge criteria evaluation for discharges of pollutants from point sources into the territorial seas, contiguous zones, and the oceans. The Ocean Discharge Criteria (40 CFR Ch. I, Subch. D, Pt. 125, Subpt. M) sets forth specific determinations of unreasonable degradation that must be made before permits may be issued. The EPA has issued an NPDES permit (permit #AK0053783) for the Navy Arctic Ice Camp effective January 1, 2022 through December 31, 2026 for the discharge of pollutants (camp graywater and reverse osmosis reject water) from specified outfalls located within the area of camp operations[9].

The principal regulatory mechanism for controlling pollutant discharges from vessels (grey water, black water, coolant, bilge water, ballast, deck wash, etc.) into waters of the Arctic outer continental shelf (OCS) is also in the CWA. Discharges are covered under the Vessel Incidental Discharge Act, which is in the CWA Section 312(p)[10]. In addition, the U.S. Coast Guard has issued regulations that address pollution prevention with respect to discharges from vessels carrying oil, noxious liquid substances, garbage, municipal or commercial waste, and ballast water (33 CFR part 151). The State of Alaska regulates water quality standards within three miles of the shore.

### 5.5.2 Spills

BOEM and BSEE define small oil spills as <1,000 barrels (bbl). Large oil spills are defined as 1,000-150,000 bbl, and very large oil spills (VLOS) are defined as ≥ 150,000 bbl (BOEM 2017). Offshore petroleum exploration activities have been conducted in State of Alaska waters in the Beaufort and Chukchi seas since the late 1960s. Based on a review of potential discharges and on the historical oil spill occurrence data for the Alaska OCS and adjacent State of Alaska waters, several small spills in the Beaufort Sea from refueling operations (primarily at West Dock) were reported to the National Response Center. Small oil spills have occurred with routine frequency and are considered likely to occur (BOEM 2017).

In the past 30 years, 43 wells have been drilled in the Beaufort and Chukchi seas lease program areas. From 1985 to 2013, eight crude oil spills of ≥ 550 bbl were documented along the Alaska North Slope, one of which was ≥ 1,000 bbl. During the same time period, total North Slope production was 12.80 billion bbl (Bbbl) of crude oil and condensate. On average, approximately 2,000 oil and hazardous substance spills are reported to the Alaska Department of Environmental Conservation (DEC) every year.[11] Most were in nearshore and shallow coastal waters and were primarily diesel (BLM 2019). Only one percent of the spills were crude oil. If a marine mammal came in direct contact with a small, refined oil spill it could experience inhalation and respiratory

[9] https://www.epa.gov/npdes-permits/npdes-permit-us-navy-arctic-ice-camp-alaska, accessed 1/3/2024
[10] https://www.epa.gov/vessels-marinas-and-ports/vessel-incidental-discharge-act-vida
[11] https://dec.alaska.gov/spar/ppr/response-resources/local-response, viewed 12/19/2023

distress from hydrocarbon vapors, or ingestion directly or indirectly by consuming contaminated prey, and less likely skin and conjunctive tissue irritation (Engelhardt 1987). Certain marine mammals may also be prone to fouling of pelage by oil, which may subsequently be ingested during grooming or cleaning. Small offshore spills of refined petroleum products are expected to dissipate rapidly. A small spill could impact marine mammals through their ingestion of contaminated prey, but prey contamination likely will be localized and temporary.

Marine mammals can ingest spilled compounds while feeding, inhale the volatile components, or be affected by direct contact. Effects of oil ingestion on marine mammals can range from progressive organ damage to death, depending on the quantity and composition of the ingested oil (Geraci and St. Aubin 1990). The effects of an oil spill on ringed seals would depend largely on the size, season, and location of the spill. Surface contact with oil spills can damage mucous membranes and eyes of seals, or disrupt thermoregulation in seal pups (Geraci and St. Aubin 1990). If a spill were to occur during the ice free, open water season, seals may be exposed to oil through direct contact, or perhaps through contaminated food items. However, St. Aubin (1990) notes that with their keen olfaction and good vision, ringed seals may be able to detect and avoid oil spills in the open water season (St. Aubin 1990).

Immersion studies by Geraci and Smith (1976) found ringed seals may develop mild liver injury, kidney lesions, and eye injury from immersion in crude oil. The eye damage was often severe, suggesting permanent eye damage might occur with longer periods of exposure to crude oil, and the overall severity of the injuries was most likely associated with the exposure duration to crude oil. Geraci and Smith (1976) concluded the direct effects of an oil blow-out or spill may result in transient eye damage to healthy seals in open water; however, ringed seals exposed to a slick of crude oil showed no impairment in locomotion or breathing.

If ringed seals have encountered any of the spills that have occurred in their habitat, these encounters have not been documented. The small size of the spills and the dispersive action of waves and currents likely has reduced the probability of an encounter and adverse reaction to extremely low levels. While the potential for a large spill exists, and could have devastating effects on ringed seals, we have no evidence that the spills that have occurred are negatively affecting ringed seals at this time.

### 5.5.3 Contaminants Found in Listed Species

Metals and hydrocarbons introduced into the marine environment from offshore exploratory drilling activities are not likely to enter the Beaufort Sea food webs in ecologically significant amounts. However, there is a growing body of scientific literature on concentrations of metals and organochlorine chemicals (e.g., pesticides and polychlorinated biphenyls [PCBs]) in tissues of higher trophic level marine species, such as marine mammals, in cold-water environments.

There is particular concern about mercury in Arctic marine mammal food webs (MacDonald 2005). Mercury concentrations in marine waters in much of the Arctic are higher than concentrations in temperate and tropical waters due in large part to deposition of metallic and inorganic mercury from long-range transport and deposition from the atmosphere (Outridge et al. 2008). However, there is no evidence that significant amounts of mercury are coming from oil operations around Prudhoe Bay (Snyder-Conn et al. 1997) or from offshore drilling operations (Neff 2010).

Heavy metals can enter marine mammals through uptake from the atmosphere through the lungs, absorption through the skin, across the placenta before birth, via milk during lactation, ingestion of sea water, and ingestion of food (Vos et al. 2003). The major route of heavy metal contamination for marine mammals seems to be via feeding. Additionally, being a top predator in the food web can influence heavy metal levels, such as mercury, especially in marine mammals relying on fish (Vos et al. 2003).

Contaminants research on ringed seals is extensive throughout the Arctic environment where ringed seals are an important part of the diet for coastal human communities. Pollutants such as organochlorine compounds and heavy metals have been found in all of the subspecies of ringed seal with the exception of the Okhotsk ringed seal. The variety, sources, and transport mechanisms of contaminants vary across ringed seal ecosystems (Kelly et al. 2010b).

Heavy metals such as mercury, cadmium, lead, selenium, arsenic, and nickel accumulate in ringed seal vital organs, including liver and kidneys, as well as in the central nervous system (Kelly et al. 2010). Gaden et al. (2009) suggested that during ice-free periods, ringed seals eat more Arctic cod (and mercury). They also found that mercury levels increased with age for both sexes (Dehn et al. 2005; Gaden et al. 2009). Becker et al. (1995) reported ringed seals had higher levels of arsenic in Norton Sound than ringed seals taken by residents of Point Hope, Point Lay, and Barrow (now Utqiaġvik). Arsenic levels in ringed seals from Norton Sound were quite high for marine mammals, which likely reflects localized natural arsenic sources.

## 5.6 Vessels

The general seasonal pattern of vessel traffic in the Arctic is correlated with seasonal ice conditions, which results in the bulk of the traffic being concentrated within the months of July through October, and unaided navigation being limited to an even narrower time frame. However, this pattern appears to be rapidly changing, as ice-diminished conditions become more extensive during the summer months.

Decreasing Arctic sea ice will: 1) facilitate an increase in vessel traffic associated with oil and gas exploration; 2) allow for increased tourism; and 3) open historically closed trade routes. Vessel traffic in the Chukchi and Beaufort seas is currently limited to late spring, summer, and early autumn. However, surface air temperatures in the Arctic Region are increasing at double the rate of the global average (Adams and Silber 2017). Continued expansion of the duration and extent of seasonal ice-free waters in the Chukchi and Beaufort seas is expected over the coming decades, likely resulting in increased vessel traffic and increased duration of the navigation season. As seasonal ice-free waters expand, the international commercial transport of goods and people in the area is projected to increase 100-500 percent in some Arctic areas by 2025 (Adams and Silber 2017).

The U.S. Committee on the Marine Transportation System (CMTS) reported that the number of vessels operating in the Chukchi and Beaufort seas increased 128 percent from 2008 to 2018. The vessels include those used for research, natural resource exploration and extraction, commercial shipping, government/law enforcement/search and rescue, and tourism. Of the 255 vessels that transited through the US Arctic and surrounding region from 2015-2017, over 50 percent were tug, towing, and cargo vessels. Thirty-two flag states transited the region, although US flagged vessels were the most prevalent. The length of the navigation season has been growing by as much as 7-10 days annually, which, extrapolated over the next decade, could result in a 2.5 months longer navigation season over what was seen in 2019 (U.S. Committee on the Marine Transportation System 2019).

In the projections developed by the CMTS for the most plausible scenario, 72 vessels are expected to be active annually by 2030 in natural resource exploration and development, which is also the activity ranked as the largest contributor to projected traffic growth. More than 50 percent of this growth is expected to be from non-US natural resource extraction (Russian exports of LNG and mineral extraction in Canada). By 2030 in the most plausible scenario, 28 vessels are expected to be active for rerouted shipping through the Arctic and 17 vessels in the expansion of the Arctic fleet (icebreakers, and ice-hardened cruise ships). However, these estimates do not include the small vessel transits used for commercial fishing, subsistence harvest, or lightering goods from large barges to shore using smaller vessels.

Marine vessel traffic may pose a threat to ringed seals in the action area, because of ship strikes and vessel sound. The U.S. Committee on the Marine Transportation System (CMTS) reported that about 255 vessels transited through the US Arctic and surrounding region from 2015-2017, as determined by automatic identification system (AIS) data.

### 5.6.1 Vessel Sound

Vessel sound can create auditory interference, or masking, in which the sound can interfere with an animal's ability to understand, recognize, or even detect sounds of interest. This can lead to behavioral changes in marine mammals, such as increasing their communication sound levels or causing them to avoid noisy areas. Commercial shipping traffic is a major source of low frequency (5 to 500 Hz) human generated sound in the oceans (Simmonds and Hutchinson 1996; NRC 2003). The types of vessels operating in the Beaufort Sea typically include barges, skiffs with outboard motors, icebreakers, scientific research vessels, and vessels associated with oil and gas exploration, development, and production. The primary underwater sound associated with vessel operations is the continuous sound produced from propellers and other on-board equipment. Cavitation sound is expected to dominate vessel acoustic output when tugs are pushing or towing barges or other vessels. Other sound sources include onboard diesel generators and the main engine, but both are subordinate to propeller harmonics (Gray and Greeley 1980). Shipping sounds are often at source levels of 150 to 190 dB re 1 μPa at 1 m (BOEM 2011) with frequencies of 20 to 300 Hz (Greene and Moore 1995). Sound produced by smaller boats is typically at a higher frequency, around 300 Hz (Greene and Moore 1995). In shallow water, vessels more than 10 km away from a receiver generally contribute only to background-sound levels (Greene and Moore 1995). Sound from icebreakers comes from the ice physically breaking, the propeller cavitation of the vessel, and the "bubbler systems" that blow compressed air under the hull which moves ice out of the way of the ship. Broadband source levels for icebreaking operations are typically between 177 and 198 dB re 1 µPa at 1m (Greene and Moore 1995; Austin et al. 2015); however, they can be extremely variable mainly due to the varying thickness of ice that is being broken and the resulting horsepower required to break the ice. In a study of Caspian seals (*Pusa capsica)* from 2006-2013, Wilson et al. (2017) documented the response of seals to ice breakers that made regular transits across the Caspian Sea. The ice breaking route had high densities of breeding seals in most years. A whole range of impacts to mothers and their pups was documented including being struck by the ice breaker, moving away from the ice breaker as it approached, and having mothers and pups separated. Vessel passage may destroy birth sites, water access holes, and pup shelters replacing those features with brash ice or open water. Often pups were marooned on fragments of intact ice or wetted in brash ice. Fragmented brash ice may cause disorientation, stress, and increased energetic demands (Wilson et al. 2017). With the Northern Sea Route and Northwest Passage being available more often and an increase in icebreakers, we will expect that ice dependent seals could be affected.

### 5.6.2 Vessel Strikes

Current shipping activities in the Arctic pose varying levels of threats to marine mammals depending on the type and intensity of the shipping activity and its degree of spatial and temporal overlap with their habitats. The presence and movements of ships in the vicinity of seals can affect their normal behavior (Jansen et al. 2010) and may cause them to abandon their preferred breeding habitats in areas with high traffic (Smiley and Milne 1979; Mansfield 1983). To date, no ringed seal carcasses have been found with propeller marks. However, Sternfeld (2004) documented a single spotted seal stranding in Bristol Bay, Alaska, that may have resulted from a propeller strike.

## 5.7 Ocean Sound

In addition to vessel sound described above, ESA-listed species in the action area are exposed to several other sources of natural and anthropogenic sound. Natural sources of underwater sound include sea ice, wind, waves, precipitation, and biological sound from marine mammals, fishes, and crustaceans. Other anthropogenic sources of underwater sound of concern to listed species in the action area include in-water construction activities such as drilling, dredging, and pile driving; oil, gas, and mineral exploration and extraction; Navy sonar and other military activities; geophysical seismic surveys; and ocean research activities. Levels of anthropogenic (human-caused) sound can vary dramatically depending on the season, type of activity, and local conditions. The combination of anthropogenic and natural sounds contributes to the total sound at any one place and time. Sound impacts to listed marine mammal species from many of these activities are mitigated through ESA Section 7 consultations.

Sound is of particular concern to marine mammals because many species use sound as a primary sense for navigating, finding prey, avoiding predators, and communicating with other individuals. As described in greater detail later in this opinion, high levels of sound may cause marine mammals to leave a habitat, impair their ability to communicate, reduce their survival rate, or cause stress. Sound can cause behavioral disturbances, can mask other sounds, including their own vocalizations, may result in injury, and, in some cases may result in behaviors that ultimately lead to death. The severity of these impacts can vary greatly between minor impacts that have no real cost to the animal, to more severe impacts that may have lasting consequences.

Because responses to anthropogenic sound vary among species and individuals within species, it is difficult to determine long-term effects. Habitat abandonment due to anthropogenic sound exposure has been found in terrestrial species (Francis and Barber 2013). The presence and movements of ships in the vicinity of seals can affect their normal behavior (Jansen et al. 2010) and may cause them to abandon their preferred breeding habitats in areas with high traffic (Sullivan 1980; Allen 1984; Henry and Hammill 2001; Edrén et al. 2010; London et al. 2012).

### 5.7.1 Ambient Sound

Ambient sound, as it is considered here, refers to naturally produced sound in the absence of measurable anthropogenic sound. Ambient sound is different from "background sound," which can include anthropogenic sounds that are typical for a particular location.

The presence of ice can contribute significantly to ambient sound levels and affects sound propagation. While sea ice can produce substantial amounts of ambient sounds, it also can function to dampen or heighten ambient sound. Smooth annual ice can enhance sound propagation compared to open water conditions (Richardson et al. 1995). However, with increased cracking, ridging, and other forms of sub-surface deformation, transmission losses generally become higher compared to open water (Richardson et al. 1995; Blackwell and Greene 2001). Urick (1996) discussed variability of ambient sound in water, including under Arctic ice. He stated that "the ambient background depends upon the nature of ice, whether continuous, broken, moving or ground-fast, the temperature of air, and the speed of the wind." Temperature affects the mechanical properties of the ice, and temperature changes can result in cracking. The spectrum of cracking ice sounds typically displays a broad range from 100 Hz to 1 kHz, and the spectrum level has been observed to vary as much as 15 dB re 1 μPa at 1 m within 24 hours due to diurnal variability in air temperatures (BOEM 2011). Data are limited, but in at least one instance it has been shown that ice-deformation sounds produced frequencies of 4 to 200 Hz (Greene 1981).

During the open-water season in the Arctic, wind and waves are important sources of ambient sound with levels tending to increase with increased wind and sea state, all other factors being equal (Richardson et al. 1995). Wind, wave, and precipitation sound originating close to the point of measurement dominate frequencies from 500 to 50,000 Hz.

There are many marine mammals in the Arctic marine environment whose vocalizations contribute to ambient sound including bowhead whales, gray whales, beluga whales, walrus, ringed seals, bearded seals, and spotted seals. Ringed seal calls have a source level of 95 to 130 dB re 1 µPa at 1 m, with the dominant frequency under 5 kHz (Cummings et al. 1986; Thomson and Richardson 1995).

### 5.7.2 Oil and Gas Exploration, Drilling, and Production Sound

As introduced in section 5.5, oil and gas exploration activities began on the North Slope in the early 1900s, and oil production started at Prudhoe Bay in 1977. NMFS reviewed the potential effects of oil and gas development in a Final Environmental Impact Statement for the effects of oil and gas activities in the Arctic Ocean (NMFS 2013) and has conducted numerous Section 7 consultations on oil and gas activities in the Chukchi and Beaufort Seas. Here we present a summary of the most recent and relevant consultations regarding oil and gas drilling, exploration, and production sound.

In 2018, NMFS Alaska Region completed a consultation with BOEM, BSEE, EPA, and USACE for oil and gas exploration activities for the Liberty Project taking place from December 2020 to November 2045 (NMFS 2018). In 2019, the NMFS Alaska Region reinitiated consultation with BOEM, BSEE, EPA, and USACE for the Liberty Project and conducted a consultation with the NMFS Permits Division on the issuance of a letter of authorization (LOA) to take marine mammals incidental to oil and gas exploration activities for the Liberty Oil and Gas Development and Production Activities (NMFS 2019a). The biological opinion estimates take of ringed seals: 831 by harassment due to sound and physical presence, 8 by injury due to sound, and 10 by mortality. This project has not yet begun.

In 2019, NMFS Alaska Region completed a programmatic consultation with the Bureau of Land Management for the implementation of the oil and gas lease sales for the Arctic National Wildlife Refuge coastal plain (NMFS 2019b). The consultation was based on the most likely scenario for oil exploration, development, production, and abandonment. An incidental take statement is not issued for programmatic consultations; however, consultations will be required for future oil and gas activities within the refuge boundaries that may affect listed species, and new lease sales for the area have not occurred.

Hilcorp and ENI proposed the construction and maintenance of ice roads and trails over five years (2020-2025) for three drilling sites in the North Slope of Alaska that could incidentally harass up to 125 Arctic ringed seals and could result in the mortality or serious injury of 12 Arctic ringed seals (MMPA authorization: 85 FR 83451 (December 22, 2020); ESA Section 7 Opinion: AKRO-2019-00194). In 2020, Hilcorp reported two ringed seals were observed from a distance but not disturbed, and no reports of ringed seals were received in 2021. In 2022, a ringed lair appeared in the middle of an ice trail after the trail had been in daily use for three months. The location was monitored and mitigation measures were implemented to protect the seal. No other seals were reported near the ice trails.

In 2019, the Alaska Gasoline Development Corporation proposed a liquid natural gas pipeline that would extend from Prudhoe Bay, generally following the existing Trans Alaska Pipeline

System through interior Alaska, to end at the Liquefaction Facilities in Nikiski in Southcentral Alaska (85 FR 59291 (September 21, 2020)). The project would increase shipping traffic through the Bering, Chukchi, and Beaufort seas and could incidentally harass 1765 ringed seals (ESA Section 7 Opinion: AKRO-2018-01319). Project activities were permitted from 2021-2025. Construction on this project has not begun.

Although some ringed seal individuals may have been affected by oil and gas exploration and development activities, we do not have evidence that these activities have had a lasting negative effect on ringed seal individuals or populations.

#### 5.7.3 Aircraft Sound

In a study examining responses of ringed seals to anthropogenic sound, Kelly et al. (1988) found their response to helicopters to be variable. Responses to take offs and landings were noted six times with seals departing on two occasions when the helicopters were at one and three kilometers. On four occasions, all at distances greater than 2.5 km the seals remained in their lairs. Seals departed lairs in five of 14 cases in response to airborne helicopters. Tolerance of helicopters varied with some seals leaving its lair when the helicopter was 5 km away at an altitude of 152 m and others tolerating helicopters 0.6 km away at an altitude of 122 m and directly overhead at 762 m (Kelly et al. 1988). We note observations of helicopter response was opportunistic as the primary purpose of the study was to document the response of seals to seismic surveys and island building. Over 700 seal lairs were observed across the four years of the study; the observed response to helicopters represents a limited picture of the ringed seal response and many seals may have remained in their lairs and were never spotted. Ringed seals are most adversely affected by sound disturbance in late March through June when they spend greater amounts of time out of the water and their movements are limited to small areas due to their dependent offspring (Kelly et al. 1988). One study indicated that the risk of flushing ringed seals into the water can be substantially reduced if small-type helicopters do not approach closer than 1500 m and small fixed-wing aircraft do not approach closer than 500 m (Born et al. 1999).

### 5.8 Direct Mortality

Within the proposed action area there are several potential sources of direct mortality of listed species, including subsistence harvest, stranding, and predation. Direct mortality associated with vessels strikes is addressed in Section 5.6.

#### 5.8.1 Subsistence Harvest

The ESA and MMPA allow for the harvest of marine mammals by Alaska Natives for subsistence purposes and for the creation of authentic native articles of handicraft, provided neither is accomplished in a wasteful manner. Ringed seals are important subsistence species for many northern coastal communities. Approximately 64 Alaska Native communities in western and northern Alaska, from Bristol Bay to the Beaufort Sea, regularly harvest ringed seals for subsistence purposes (Nelson et al. 2019). Estimates of subsistence harvest of ringed seals are available for several of these communities based on annual household surveys, but more than 50 other communities that harvest these species for subsistence were not surveyed within this time period or have never been surveyed. From 2012-2017, only 4 percent (3 of 64) of the coastal communities that harvest ice seals have been surveyed in two or more consecutive years (Ice Seal Committee 2019). Household surveys are designed to estimate harvest for the specific community surveyed; extrapolation of harvest estimates beyond a specific community is not appropriate because of local differences in seal availability, cultural hunting practices, and environmental conditions (Ice Seal Committee 2019). In 2015, the total annual ringed seal harvest estimate across surveyed communities was 6,454 (Nelson et al. 2019). Nelson et al. (2019) determined this level of harvest is sustainable.

**Table 7. Average regional and statewide subsistence harvest (including struck and lost animals) of Arctic ringed seals in 2015 (summarized from Nelson et al. (2019)).**

| Region | Average harvest (including struck and lost) Ringed Seals |
|---|---|
| North Slope Borough | 1,146 |
| Maniilaq | 493 |
| Kawerak | 2,287 |
| Association of Village Council Presidents | 2,484 |
| Bristol Bay Native Association | 44 |
| Statewide total | 6,454 |

### 5.8.2 Stranding

As discussed in Section 5.3, the NMFS AKR Stranding Network received reports of many stranded ice seals in spring and summer 2019. In September 2019, NMFS declared an Unusual Mortality Event (UME) for ringed, bearded, and spotted seals, dating back to June 1, 2018 and continuing through 2022, with 368 confirmed strandings. The cause, or causes, of these deaths is currently being investigated by NMFS.

### 5.8.3 Predation

Polar bears are the main predator of ringed seals (Cameron et al. 2010; Kelly et al. 2010b). Other predators of ringed seals include walruses and killer whales (*Orcinus orca*) (Burns and Eley 1976; Heptner et al. 1976; Fay et al. 1990; Derocher et al. 2004; Melnikov and Zagrebin 2005). In addition, Arctic foxes prey on ringed seal pups by burrowing into lairs; and gulls, ravens, and possibly snowy owls successfully prey on pups when they are not concealed in lairs (Smith 1976; Kelly et al. 1986; Lydersen et al. 1987; Lydersen and Smith 1989; Lydersen 1998). The threat currently posed to ringed seals by predation is considered moderate, but predation risk is expected to increase as snow and sea ice conditions change with a warming climate (Cameron et al. 2010; Kelly et al. 2010b).

Polar bear predation on ringed seal pups tripled when pups were prematurely exposed as a consequence of unseasonably warm conditions. Hammill and Smith (1991) further noted that polar bear predation on ringed seal pups increased four-fold when average snow depths in their study area decreased from 23 cm to 10 cm. Gulls, ravens, and possibly snowy owls prey on ringed seal pups when the latter are forced out of subnivean lairs prematurely because of low snow accumulation and/or early melts (Lydersen et al. 1987; Lydersen and Smith 1989; Lydersen and Ryg 1990; Lydersen 1998). Avian predation is facilitated not only by lack of sufficient snow cover but also by conditions favoring influxes of birds (Kelly et al. 2010b).

## 5.9 Plastics

A growing source of contaminants in the Arctic comes from plastics. The impact of marine debris is of global concern, affecting at least 914 species through entanglement and/or ingestion (Kühn and van Franeker 2020). Jambeck et al. (2015), in an analysis of plastic waste generated by 20 coastal communities world-wide, estimated that 4.8 to 12.7 million MT of plastic waste entered the ocean in 2010. It is estimated that between 62,000 to 105,000 tons of plastic are transported to the Arctic Ocean each year (Zarfl and Matthies 2010). Larger sized plastics such as bottle caps, plastic bags, bottles, and strapping are problems for marine sea birds, turtles, and mammals because of ingestion and entanglement (Laist 1997; Derraik 2002; Law 2017; Peeken et al. 2018). Today's global abundance is estimated at approximately 82–358 trillion plastic particles weighing 1.1–4.9 million tons (Eriksen et al. 2023).We have no documented reports of strandings of ringed seals caused by entanglement or plastic ingestion from the action area and only one report of a live entangled ringed seal in Alaska (Figure 20). However, entanglement of northern fur seals from around the Pribilof Islands is well documented (Laist 1997; Savage 2019). With increased development in the Beaufort and Chukchi Seas, increased vessel traffic through the Northwest passage, an increased number of observers (tourists, scientists, employees), and longer periods of open water that can promote delivery of plastics to the Arctic, ingestion and entanglement of ringed seals is more likely to be documented in coming years.

Microplastics, defined as < 5 mm in size, occur due to the release of manufactured plastic particles in various products (primary microplastics) and the fragmentation of larger plastic pieces (secondary microplastics) (Cole et al. 2011). Microplastics are distributed globally. In an examination of ice cores from widely dispersed locations across the Arctic Ocean, Obbard et al. (2014) found from 38 to 234 particles per cubic meter of ice. The microplastic concentrations were several orders of magnitude greater than those reported in the North Pacific Subtropical Gyre (0.12 particles per cubic meter of water). The highest concentration of microplastics ever determined in sea ice was found in the Makarov Basin in the central Arctic Ocean (Peeken et al. 2018). The ice core there contained concentrations comparable to those from South Korean waters, which were previously highest levels recorded (Peeken et al. 2018). The types of microplastics found in the Arctic included polystyrene, acrylic, polyethylene, polypropylene, nylon, polyester, and rayon (Obbard et al. 2014; Peeken et al. 2018). Microplastics are also abundant in Arctic benthic substrates (Lusher et al. 2015; Bergmann et al. 2017) and water (La Daana et al. 2018; La Daana et al. 2020).

Marine plastic debris is associated with a ‘cocktail of chemicals’, including chemicals added or produced during manufacturing (Lithner et al. 2011; Rochman 2015) and those present in the marine environment that accumulate onto the debris from surrounding seawater (Mato et al. 2001; Hirai et al. 2011). Persistent organic pollutants, including PCBs, and metals have been well documented as sorbing onto plastic particles in studies dating back to 1972 (Mato et al. 2001; Ogata et al. 2009; Zarfl and Matthies 2010). Microplastics and the persistent bioaccumulative toxins they carry have been documented in filter feeders including zooplankton, mussels, planktivorus fish and humpback whales (Besseling et al. 2014; Besseling et al. 2015; Fang et al. 2021) and benthic invertebrates from the shelf of the Bering and Chukchi Seas (Fang et al. 2018). There is evidence that the absorbed contaminants are bioavailable to a variety of marine mammals and invertebrates (Teuten et al. 2009; Rochman 2015). Researchers are actively investigating whether these plastic-associated contaminants biomagnify in higher trophic levels as a direct result of plastic ingestion and how important bioaccumulation from plastic is relative to bioaccumulation from other sources of chemical contamination in the environment (Avio et al. 2015; Rochman 2015; Miller et al. 2020).

## 5.10 Other Arctic Projects

In the winters of 2014, 2017, 2018, 2020, and 2022 the U.S. Navy conducted submarine training, testing, and other research activities in the northern Beaufort Sea and Arctic Ocean from a temporary camp constructed on an ice flow toward the northern extent of the U.S. EEZ, about 185 to 370 km north of Prudhoe Bay. Equipment, materials, and personnel were transported to and from the ice camp via daily flights based out of the Deadhorse Airport (located in Prudhoe Bay). An IHA was issued to the U.S. Navy to incidentally harass ringed seals during submarine training and testing activities associated with Ice Exercise 2020 and Ice Exercise 2022 north of Prudhoe Bay, Alaska from February 2020 through January 2021, and February through April 2022, respectively. Monitoring reports from the 2014-2022 projects indicate that no ringed seals were observed during any of the years.

In 2016, NMFS Alaska Region conducted internal consultations with NMFS Permits Division on the issuance of an Incidental Harassment Authorizations (IHA) to Fairweather, LLC (81 FR 52407, August 8, 2016) to take marine mammals incidental to anchor retrieval in the Chukchi, and Beaufort seas during the 2016 open water season. The biological opinion estimated exposures (by harassment) of 231 bearded seals and 6,895 ringed seals as a result of exposure to continuous or impulsive sounds at received levels at or above 120 dB or 160 dB re 1 μPa rms, respectively. Based on the number of actual hours that sound was produced it was estimated that 316 ringed seals may have been harassed by the sounds produced by the project. However, protected species observers saw no ringed seals during the anchor retrieval process.

In 2016 and 2017, NMFS Alaska Region conducted internal consultations with NMFS Permits Division on the issuance of an IHA to Quintillion Subsea Operations, LLC (Quintillion) (82 FR

38877, August 16, 2017) associated with the continuation of fiber optic cable laying. Quintillion was permitted to install 1,904 km (1,183 mi) of subsea fiber optic cable during the open-water season, including a main trunk line and six branch lines to onshore facilities in Nome, Kotzebue, Point Hope, Wainwright, Utqiaġvik, and Oliktok Point. The biological opinion estimated exposures (by harassment) of 922 ringed seals as a result of exposure to sounds of received levels at or above 120 dB re 1 $\mu Pa_{rms}$ from sea plows, anchor handling, and operation and maintenance activities (NMFS 2016). Monitoring reports from the project indicated that 50 ringed seals were taken by harassment.

These projects indicate that although high numbers of take of ringed seals are often estimated to occur, the estimated numbers of take have not been realized and actual take can vary from zero animals to a small percent of the estimated amount. Currently we have no evidence that the projects occurring in the Arctic on which NMFS consulted, and which have associated levels of take, are having a lasting impact on ringed seal individuals or populations.

## 5.11 Scientific Research

Research provides essential information on the life history, distribution, health, and abundance of threatened and endangered species. However, research activities can also harass and harm the animals. Research on marine mammals often requires boats, adding incrementally to the vessel traffic, sound, and pollution in the action area. NMFS issues scientific research permits that are valid for five years for ESA-listed species. When permits expire, researchers often apply for a new permit to continue their research. Additionally, applications for new permits are issued on an on-going basis; therefore, the number of active research permits is subject to change in the period during which this biological opinion is valid.

Ringed seals are exposed to research activities documenting their population status and trends, health, movements, habitat use, foraging ecology, response to activities, distribution, and movements throughout their ranges.

There are several active scientific research permits for marine mammals in Alaska (see: APPS; seals). Their activities may include behavioral observations, counting/surveying, photo-identification, and capture and restraint (e.g. by hand, net, or trap). The following samples may be collected from marine mammals: blood, hair, urine and feces, nasal and oral swabs, whiskers, skin, blubber, or muscle biopsies, and weight and body measurements. Drugs are administered if necessary (e.g. intramuscular, subcutaneous, or topical) for pain, restraint, or to prevent infection, instruments are attached to hair or flippers, and ultrasound may be used to measure blubber thickness.

**Table 8. Current NMFS scientific research and enhancement permits authorizing take of Arctic ringed seals.**

| File Number | Applicant | Project Title |
|---|---|---|
| 21482 | HDR | Assessing marine mammals populations that occur within U.S. Navy training, offshore energy development, and nearshore construction areas via the use of aerial and vessel surveys, behavioral focal follows, PAM, and tagging techniques. |
| 22298 | ADFG | Steller sea lion recovery investigations in Alaska |
| 23858 | MML | Ecology, Health, Abundance and Trends of Alaskan Phocids |
| 24334 | ADFG | Movements, habitat use, and stock structure of cetaceans (bowhead, gray, humpback, killer whale, and beluga) in Alaska. |
| 25563 | MML | Northeast Pacific cetacean population abundance, distribution, ecology and status at the AFSC's Marine Mammal Laboratory |
| 26254 | ADFG | Population Status, Health, Movements, and Habitat Use of Ringed, Bearded, Spotted, and Ribbon Seals in the Bering, Chukchi, and Beaufort Seas |

These activities may cause stress to individual pinnipeds and cause behavioral responses. Two ringed seals have died as a consequence of research activities over the last 10 years. Protocols are modified when a mortality occurs. All research is evaluated and permitted. Take is authorized if appropriate.

### 5.12 Summary of Environmental Baseline

The Arctic ecosystem is currently undergoing many changes at an unprecedented rate. The most important of the changes are related to global warming and include diminishment in the extent and thickness of sea ice, increasing surface water temperatures, shrinkage of the cold water pool, increased harmful algal blooms, increased vessel traffic, and increased levels of plastics. Other activities like subsistence harvest, oil and gas activities, and predation have been ongoing for decades. Counting ringed seals is extremely difficult and for that reason it has not been possible to determine an accurate count for this species. Consequently, trends in abundance are unknown. The most recent abundance estimate for ringed seals is 171,418 (95% CI: 141,588-201,090) (Conn et al. 2014) but is likely much higher. This gives researchers a window of opportunity to increase our knowledge about the species and refine methods to better estimate their population numbers. Ringed seals appear to be resilient to the perturbations they have faced thus far.

# 6 EFFECTS OF THE ACTION

"Effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR § 402.02).

This biological opinion relies on the best scientific and commercial information available. We try to note areas of uncertainty, or situations where data is not available. In analyzing the effects of the action, NMFS aims to minimize the likelihood of false negative conclusions (i.e. concluding that adverse effects are not likely when such effects are, in fact, likely to occur).

We organize our effects analysis using a stressor identification – exposure – response – risk assessment framework for the proposed activities.

We conclude this section with an *Integration and Synthesis of Effects* that integrates information presented in the *Status of the Species* and *Environmental Baseline* sections of this opinion with the results of our exposure and response analyses to estimate the probable risks the proposed action poses to endangered and threatened species.

NMFS identified and addressed all potential stressors; and considered all consequences of the proposed action, individually and cumulatively, in developing the analysis and conclusions in this opinion regarding the effects of the proposed action on ESA-listed species and designated critical habitat.

## 6.1 Project Stressors

Stressors are any physical, chemical or biological phenomena that can induce an adverse response. The effects section starts with identification of the stressors produced by the constituent parts of the proposed action. The proposed activities will expose ringed seals to sonar used by the submarines, the sounds and physical presence of manned and unmanned aircraft, snow machines and other on-ice vehicles, ice drilling, activities at the ice camp, passive sound sources, and active underwater sound sources (*classified*).

Based on our review of the project activities, the proposed activities may cause the following stressors:

1. Sound field produced by active transmission (sonar) from submarines and other

underwater active acoustic technologies (pingers, echosounder)

2. Human presence at the ice camp
3. Entanglement in equipment and/or ingestion of trash and debris
4. Pollution from unauthorized spills and other sources (e.g., waste water)
5. On-ice sound produced by snow machines, other on-ice vehicles, and ice drilling/coring
6. On-ice vehicle strike (*landing area must be clear of animals so aircraft strike is not included here*)
7. Risk of submarine and unmanned underwater vehicle striking ringed seals
8. Aircraft sound produced by manned aircraft and unmanned aerial systems

Of these, number 1 is a major stressor that is likely to result in take of ringed seals by harassment, and numbers 2-8 are minor stressors that are unlikely to result in take by harassment.

### 6.1.1 Minor Stressors on ESA-Listed Species and Critical Habitat

#### 6.1.1.1 Human presence at the ice camp

The ice camp established as part of ICEX 2024 will consist of essential personnel only as the project is focused on having a small footprint on the physical and biological environment.

The construction of the ice camp and associated human presence could potentially cause ringed seals to leave an established lair or breathing hole. However, ringed seals typically build several lairs and breathing holes, and are assumed to be readily able to move to another lair or breathing hole within their home range (Kelly 1988a). The ice camp location will be selected, in part, to avoid areas near pressure ridges where ringed seals may build their subnivean lairs. If the ice camp were near a subnivean lair or breathing hole, it could cause ringed seals to evacuate the lair or leave their breathing hole. Although ringed seals may abandon their subnivean lair or breathing hole, the population effect will most likely be minor since ringed seals are assumed to be readily able to move to different areas under the ice (Kelly 1988b). It is expected that construction of the camp will be completed prior to whelping. As such, pups are not expected to be in the vicinity of the camp at the commencement of the exercises, and therefore mothers will not need to move newborn pups due to construction sound from camp.

Because of the low density of ringed seals in the action area, the very limited time period over which human presence will potentially intersect with ringed seals, and because of standard operating procedures and mitigation measures which are designed to minimize the impact of human activities on marine mammals, human presence is likely to have a minimal effect on ringed seals.

#### 6.1.1.2 Entanglement in equipment and/or ingestion of trash and debris

The risks of entanglement will be from the lines coming from the hydrophones, buoys, and acoustic arrays. However, we expect entanglement of ringed seals in lines and tethers will be highly unlikely as the lines will be kept taut from their anchor attachments, reducing the risk of entanglement. The hydrophones, buoys, and acoustic array lines will have weights attached so that no loops or slack in the lines are expected. When the camp is active, the likelihood of entanglement will be further reduced because personnel will be monitoring for the presence of marine mammals under the proposed mitigation measures and will be aware of their presence in the area. Recovery of the hydrophones is planned; however, if emergency demobilization is required, or the hydrophones are frozen in place and are unrecoverable, they will be left in place, and this could cause potential future entanglement risk.

Although there is a potential for entanglement from ice-camp activities, the amount of material is expected to be extremely low to none. Accidental loss of equipment could occur and although every effort is made to maintain a clean camp, wind could randomly pick up trash and blow it offsite, eventually to end up in the water. Although northern fur seals have become entangled with discarded fishing gear and plastic packing bands in the Bering Sea (Laist 1997; Savage 2019), we have only one report by ADFG of a ringed seal entangled in a plastic packing band (Figure 20).

**Figure 20. Ringed seal entangled in plastic packing band (photo: ADFG).**

Therefore, based on the low incidence of ringed seal entanglements in this region and the very low amount of project materials capable of causing entanglement, the probability of ringed seals becoming entangled in project-related materials is extremely small.

#### 6.1.1.3 Pollution from unauthorized spills and other sources

The air-drop of equipment and material poses some potential risk, particularly from the drop of fuel drums. Fuel may be dropped in bundles of five 55-gallon drums from a military cargo aircraft (e.g., C-130 or C-17). Military aircrews are highly trained in this activity and routinely drop equipment and supplies, including fuel, in expeditionary environments across the globe (including environments similar to the Arctic such as Greenland and Antarctica) without incident. The air drop bundles are made of several layers of a plywood structure with honeycomb insulation protecting the drums. Air-drop of material will occur only after initial construction of the camp has begun and personnel are available to respond to any potential rupture with proper spill containment procedures.

Under the Navy's standard operating procedures, all air-drop of materials will include the use of a parachute meant to stabilize the fall and slow the load so that it impacts the ice with minimal force. Equipment and material that may be air-dropped to the camp includes construction material, food, vehicles, and fuel. A worst-case scenario would be that a parachute fails to open for a single load of fuel (five 55-gallon drums), in which case 275 gallons of fuel could be released to the ice. Even in the case of a parachute failure, typically only one or two barrels would be dented or possibly ruptured. In the event of a fuel drum rupture, personnel will be standing by with applicable spill control measures and spill kits (e.g., absorbent materials) to remove any spilled fuel from the ice floe. Snow and ice cover that become contaminated will be collected and removed from the ice floe to the greatest extent practicable. All personnel will have oil spill response training, and oil spill response and reporting procedures will be followed.

In addition to a rupture from air-dropped fuel, refueling activities at the camp (e.g., for snow machines and generators) could result in small spills. Camp activities such as snow machines refueling and generator refueling will temporarily increase the risk of accidental fuel and lubricant spills. Accidental spills may occur from a spilled container, vessel leak, or air dropped container. However, the standard operating procedures which includes training of personnel, hazardous waste clean-up supplies, and measures to contain spills that may occur (i.e. containment trays), and protective packing, will minimize the probability and extent of any spills. In addition, only small volumes of fuel would be present on the ice floe and undetectable to ringed seals.

Because all human waste will be removed from the ice floe, and flown back to land and properly disposed of, no pollution is expected from human waste. See section 2.1.1 regarding technical details regarding waste management and standard operating procedures. Through these standard operating procedures, adverse impacts to seals are extremely unlikely to occur, and any impacts that may occur would be immeasurably small.

#### 6.1.1.4 On-ice sound from vehicles and ice drilling/coring

The use of on-ice vehicles is integral to ice camp logistics (e.g., personnel and equipment transport) and to the completion of many research objectives. Small snow machines create sounds at higher frequencies than larger, slower machinery. The sound level associated with snow machines is dependent upon the model, engine size, and speed driven. In addition, sound levels are affected by the ice condition, amount of snow on the ice, wind, and other similar factors (Richardson et al. 1991), making precise predictions of the sound transmitted difficult. Snow machines produce sound at source levels of 104 dBA on average (Richardson et al. 1995).

Generally, two- and four-stroke snow machines traveling at approximately 32 kilometers per hour (km/hr) had a resultant average sound level of 66–71 dBA re 20 µPa at 15 m. At higher speeds of approximately 64 km/hr, the average sound level increased to 73–75 dBA re 20 µPa at 15 m. During acceleration, the highest sound level was recorded as 80.2 dBA re 20 µPa at 15 m. As reported in Malme et al. (1989), the under-ice sound pressure level for a snow machine driving 16 km/hr is 124 dB re 1 µPa at a frequency of 1.6 kHz. While this is well within the hearing range of phocids underwater, seals do not react to sounds at this frequency and decibel sound level (Kvadsheim et al. (2010) . In addition, at 100 m (mitigation distance) the received sound levels will be well below the 100 dB re 20 µPa $_{rms}$ threshold considered to cause Level B harassment (MMPA; 16 USC § 1362(18)(A)(ii)) or behavioral disturbance for non-harbor seal pinnipeds.

To the extent possible, the location for the ice camp will be selected to avoid pressure ridges and snow drifts to facilitate ease in camp construction, logistics, and aircraft landing safety. Any seals with lairs in the vicinity of the ice camp will likely move to a new lair during the gradual establishment of the camp prior to being subject to higher levels of activity once the camp is fully operational. If, after the ice camp is established, a new pressure ridge forms nearby, it is unlikely that a ringed seal will construct a lair in the area near the ice camp. During excursions away from the ice camp (e.g., to deploy research equipment), on-ice vehicles will use the same routes once routes are established. Use of the same route will minimize the number of subnivean lairs potentially exposed to on-ice vehicle sound as the routes will be established avoiding any pressure ridges, and it is not expected that a ringed seal will create a lair in the vicinity of a snow machine route once the route is established. Seal pups are not expected to be in the vicinity of the ice camp during operations, because breeding females are not expected to whelp within the camp's disturbance zone, and whelping is not expected prior to initiation of camp construction in February.

Because of the selection of the camp location to avoid pressure ridges and potential ringed seal habitat, the use of established snow machine routes, the high likelihood that ringed seal presence in the area is extremely low, the low received sound levels, and the low likelihood that sound from the snow machines will disturb seals either on the ice or under the ice, we conclude that ringed seal responses to sound associated with on-ice vehicles is expected to be extremely minor.

Holes will be drilled/melted in the ice for the deployment of hydrophones in the vicinity of the ice camp and to drain gray water from the dining hall and desalination "reject water". Greene et al. (2008) recorded underwater sound from an ice auger during ice road construction at the Northstar Development (Beaufort Sea) and found sound levels at the source were below 100 dB re 1µPa. These levels are below the behavioral threshold for underwater sound harassment for seals. Ringed seals that are out of the water in February through April are expected to be in lairs. Airborne sounds will be greatly attenuated by the ice and snow. The area disturbed by drilling holes in the ice is extremely small. Background sound from wind and movements of the ice are expected to be louder and more consistent than the short duration sound created by ice drilling. For these reasons the effects of ice drilling on ringed seals are expected to be undetectable.

### 6.1.1.5 On-ice vehicle strike

Four to six snow machines will be used for personnel and equipment transport, as well as supporting research activities away from the ice camp. Dependent on the type of equipment and supplies to be transported, the snow machines may tow a sled to accommodate the items. Additionally, small unit support vehicles may be used to establish the runway for fixed-wing aircraft landings. An all-terrain vehicle may be used by expeditionary forces to transport forces to and from the ice camp. Snow machine excursions away from the ice camp will support various research activities during the height of the proposed action (for a period of approximately four weeks). Some excursions away from the ice camp may last up to six hours, while shorter trips will only last one to two hours. Snow machines will not be in constant use during these trips; they will transport personnel and equipment to an offsite location (generally up to 3.2 km from camp) and then stand by until the experiment is complete before returning the personnel to the camp. Additionally, personnel movement on snow machines, small unit support vehicles, and all-terrain vehicles both away from and around camp will only occur during daylight hours (approximately six hours per day during this time of year), which will further reduce the potential for striking an exposed ringed seal.

During the timeframe of the proposed activities, it is highly unlikely that ringed seals will be basking on the surface of the ice as the molting period does not begin until mid-April (Figure 17). Kelly et al. (1986) tagged ringed seals from Reindeer Island and Kotzebue Sound off the coast of Alaska, in the Beaufort and Chukchi Sea, respectively. The tagged ringed seals spent between 3.5 and 30.8 percent of the time out of the water during the pre-basking period. Time spent out of the water during this period was only spent in lairs and not on the open sea ice.

Snow machine routes will be selected to avoid pressure ridges, and once established, snow machine routes will be re-used. Under the proposed action’s mitigation measures, all snow machine expeditions will have a dedicated observer looking for marine mammals and any ringed seal observed will be avoided by 100 m. Additionally, snow machines and all-terrain vehicles are highly mobile and will move easily to avoid any ringed seal spotted nearby. The risk of collision is further reduced by a ringed seal’s moving away from of any vehicle making sound before the vehicle approaches closely. For these reasons, the likelihood of an on-ice vehicle strike will be exceedingly remote.

### 6.1.1.6 In-water submarine and underwater vehicle disturbance and strike

Submarines and underwater vehicles that will be used during ICEX 2024 have the potential to result in strike to ringed seals. Submarines will typically operate at speeds less than 10 knots and unmanned underwater vehicles at typically less than 8 knots. In-water vessels and vehicles will operate at a maximum depth of 800 m during the proposed action.

Vessels have the potential to affect ringed seals by eliciting a behavioral response or causing mortality or serious injury from collisions. It is difficult to differentiate between behavioral responses to vessel sound and visual cues associated with the presence of a vessel (Richardson et al. 1995); thus, it is assumed that both play a role in prompting reactions from animals. Reactions to vessels often include changes in general activity (e.g. from resting or feeding to active avoidance), changes in surfacing-respiration-dive cycles, and changes in speed and direction of movement. Past experiences of the animals with vessels are important in determining the degree and type of response elicited from an animal-vessel encounter. Some species have been noted to tolerate slow-moving vessels within several hundred meters, especially when the vessel is not directed toward the animal and when there are no sudden changes in direction or engine speed (Richardson et al. 1995; Heide-Jørgensen et al. 2003).

Ringed seals react to vessels in a variety of ways. Some respond by retreating or engaging in antagonistic responses, while other animals ignore the stimulus altogether (Watkins 1986). The size of a vessel and speed of travel affect the likelihood of a collision. Reviews of stranding and collision records indicate that larger surface ships (80 m or larger) and ships traveling at or above 14 knots have a much higher instance of collisions with marine mammals that result in mortality or serious injury (Laist et al. 2001). The depths at which the submarines and unmanned underwater vehicles operate will overlap with known dive depths of ringed seals, which have been recorded to 300 m in depth (Lydersen 1991; Gjertz et al. 2000). For most of the training and testing activities during the proposed action, vessel and vehicle speeds will not exceed 10 knots during the time spent within the study area, which will lessen the likelihood of collisions with ringed seals. Additionally, as part of the Navy's standard operating procedures, personnel will be passively listening for marine mammals during marine training and testing activities, thereby further reducing the possibility of ship strike.

Submarines and unmanned underwater vehicles are not expected to elicit an anti-predator response in a ringed seal. The primary predator to the ringed seal is the polar bear. Submarines are much larger than the natural predators to the ringed seal, and it will not be likely a submarine will cause a ringed seal to have an antipredator response. Although unmanned underwater vehicles are much smaller than a submarine, the movement patterns of these vehicles will not resemble the swimming pattern of a polar bear, and they will be underwater, not on the surface where polar bears swim. Therefore, they are very unlikely to result in anti-predator reactions. To date, no ringed seal carcasses have been found with propeller marks. However, Sternfeld (2004) documented a single spotted seal stranding in Bristol Bay, Alaska, that may have resulted from a propeller strike.

Considering the very low density of animals that may be present in the action area, the fact that the vessels will typically be traveling at less than 10 knots, and the speed and agility of ringed seals in water, we conclude that vessel strike is extremely unlikely and that the normal activities of ringed seals will not be measurably disrupted by vessel activity.

#### 6.1.1.7 Aircraft sound

Multiple types of aircraft will be used during the proposed action, including commercial small single engine and twin-engine fixed-wing aircraft, commercial rotary-wing aircraft (helicopters), military fixed wing and rotary-wing aircraft, and unmanned aerial systems. Flights to and from the ice camp will originate at the Deadhorse Airport, which currently supports approximately 58 daily flights (FAA 2023). ICEX 2024 will increase air traffic from the airport by 15.5 percent (maximum of nine trips per day during camp build-up and demobilization, and one to three trips per day during ice camp operations). In addition to flights from Deadhorse Airport to the ice camp, aircraft will be used during testing, training, and research activities.

Ringed seals may react to the sound of an aircraft or to its physical presence flying overhead, or both. During February through April, when the fixed-wing and helicopter flights associated with the proposed action will occur, ringed seals may be on the ice, in the water, or within their subnivean lairs. Ringed seals that are hauled out may react to the sound or visual stimulus by looking up at the aircraft, moving on the ice, entering a breathing hole or crack in the ice, or entering the water (Blackwell et al. 2004; Born et al. 2004). Reactions depend on several factors including the animal's behavioral state, activity, group size, habitat, the flight pattern of the aircraft, and local environmental conditions (sound is muffled on windy cloudy days, louder on clear calm days) (Richardson et al. 1995). Additionally, a study conducted by Born et al. (1999) found that wind chill was also a factor in level of response of ringed seals hauled out on ice (higher wind chill increases probability of leaving the ice), as well as time of day and wind direction. Ringed seal reactions to helicopter disturbance are difficult to predict, though helicopters have been recorded to elicit a stronger behavioral response than a fixed-wing aircraft (Burns and Frost 1979; Born et al. 1999).

The responses of ringed seals in subnivean lairs are typically stronger than that of a basking ringed seal (Burns et al. 1982). Ringed seal vocalizations in water were similar between areas subject to low-flying aircraft and areas that were less disturbed (Calvert and Stirling 1985). These data suggest that although a ringed seal may leave a subnivean lair, aircraft disturbance does not cause the animals to leave the general area. Additionally, ringed seals construct multiple breathing holes and lairs within their home ranges (Smith and Stirling 1975); these additional lairs and breathing holes are used as escape lairs from predators, and therefore could be a suitable alternative in the event they leave a lair directly below the flightpath of an aircraft.

During the proposed action, small, fixed-wing aircraft (the most frequently used aircraft) could operate at altitudes up to 3,500 m but will maintain an altitude of at least 457 m. At this altitude, the footprint of airborne sound at the ice surface will be an approximately 2 $km^2$ area which will move along the flight path of the aircraft. Due to the relatively small area over which aircraft sound will radiate outward, the sound will be transient (a maximum duration of about 15 seconds, assuming a flight speed of 120 kts). As received sound levels will be reduced by the time the sound reaches the ice from an overhead flight (attenuating in the air column) and will still have to travel through the ice, underwater sound will be brief in duration, of reduced intensity, and will transfer to water along a narrow swath.

Helicopter flights associated with the proposed action are used for logistical purposes (transport of personnel and equipment) and logistical training purposes (military pilots gaining proficiency in transporting equipment) and are not conducting typical training or testing; therefore, helicopters will not be hovering or flying a route pattern for an extended period. Helicopters produce low frequency sound (Richardson et al. 1995; Pepper et al. 2003) and contain dominant tones from the rotors that are generally below 500 Hz. Sound generated from helicopters is transient in nature and variable in intensity. Helicopters often radiate more sound forward than aft. The underwater sound produced is generally brief when compared with the duration of audibility in the air. Rotary-wing aircraft tend to be noisier than similar-sized fixed wing aircraft.

Various fixed-winged and rotary-winged unmanned aerial systems are proposed to be used during ICEX 2024. The rotary-wing unmanned aerial system operates in a similar manner as helicopters, but on a smaller scale. Based on a study by Christiansen et al. (2016), an initial analysis of underwater recordings at 1 m below the water surface of sound produced by a rotary-wing UAS was only detectable above ambient sound when the system was flown at altitudes lower than 10 m. Though the study found that in-air recordings showed that the sound levels produced by the UAS were within sound-level ranges known to cause disturbance in some marine mammals, the in-water received sound levels at 1 m depth were orders of magnitude below those shown to cause any direct damage on auditory systems or compromise physiology in marine mammals (Southall et al. 2007; Christiansen et al. 2016). The UAS that will be used will not hover over marine mammals in accordance with the mitigation measures, and will fly at an altitude of at least 15 m. The impacts of these devices will be very minor, and adverse effects to ringed seals, especially ringed seals within subnivean lairs, are expected to be immeasurably small, if they occur at all. Therefore, we conclude that adverse effects from UAS on ringed seals will be minimal or undetectable.

The intermittent use of fixed-wing aircraft and helicopters, the short-term impacts of any behavioral reactions from aircraft activities, and the implementation of the mitigation measures which will maintain distance between seals and the aircraft will greatly reduce the potential for adverse impacts to ringed seals. In addition, ICEX 2024 activities will largely be concluded by the end of March before seals in lairs become more sensitive to disturbance. For these reasons we conclude that the impact of aircraft sound is will be minimal or undetectable, adverse effects to ringed seals will be brief and of very low intensity, and any reactions by the seals are expected to be imperceptible or very brief.

### 6.1.2 Major Stressors on ESA-Listed Species and Critical Habitat

The following sections analyze the stressor likely to adversely affect the ringed seal due to underwater sounds created by active transmissions from the submarines and research activities. The submarine training and research activities (e.g., pingers, echosounders) have acoustic transmissions with potential effects to ringed seals. Some acoustic sources are either above the known hearing range of marine species or have narrow beam widths and short pulse lengths that affect a very small area of water for a very short amount of time and are therefore extremely unlikely to affect marine mammals that are present at low densities in the action area. Submarine training and testing, which are proposed to occur over a two-week period, are the only portions of the proposed action with active acoustics that require quantitative analysis. All other equipment and devices to be used will have *de minimis* effects which means they have low source levels, narrow beams, downward directed transmission, short pulse lengths, frequencies outside known marine mammal hearing ranges, or some combination of these factors (Navy 2021). Effects to seals swimming underwater are the primary concern regarding this active transmission, because the sound levels received by hauled out seals will be much lower, due to transmission loss through the ice and air.

Below, we provide a brief explanation of the sound measurements and acoustic thresholds used in the discussions of acoustic effects in this opinion.

### 6.1.2.1 Acoustic Thresholds

Since 1997, NMFS has used generic sound exposure thresholds to determine whether an activity produces underwater and in-air sounds that might result in impacts to marine mammals (70 FR 1871, 1872; January 11, 2005). NMFS has developed comprehensive guidance on sound levels likely to cause injury to marine mammals through onset of permanent and temporary thresholds shifts (PTS and TTS) (83 FR 28824; June 21, 2018; 81 FR 51693; August 4, 2016). NMFS is in the process of developing guidance for behavioral disruption (Level B harassment). However, until such guidance is available, NMFS uses the following conservative thresholds of underwater sound pressure levels,[12] expressed in root mean square[13] (rms), from broadband sounds that cause behavioral disturbance, and referred to as Level B harassment under section 3(18)(A)(ii) of the Marine Mammal Protection Act (MMPA) (16 U.S.C § 1362(18)(A)(ii)):

- impulsive sound: 160 $dB_{rms}$ re 1 μPa
- non-impulsive sound: 120 $dB_{rms}$ re 1μPa

Under the PTS/TTS Technical Guidance, NMFS uses the following thresholds (Table 9) for underwater sounds that cause injury, referred to as Level A harassment under section 3(18)(A)(i) of the MMPA (16 U.S.C § 1362(18)(A)(i)) (NMFS 2018). Different thresholds and auditory weighting functions are provided for different marine mammal hearing groups, which are defined in the Technical Guidance (NMFS 2018). The generalized hearing range for each hearing group is in Table 2.

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

[13] Root mean square (rms) is the square root of the arithmetic average of the squared instantaneous pressure values.

**Table 9. Underwater marine mammal hearing groups (NMFS 2018).**

| Hearing Group | ESA-listed Marine Mammals In the Project Area | Generalized Hearing Range[1] |
|---|---|---|
| Phocid pinnipeds (PW) *(true seals)* | Ringed seals | 50 Hz to 86 kHz |

[1]Respresents the generalized hearing range for the entire group as a composite (i.e., all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65 db threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall et al. 2007) and PW pinniped (approximation).

These acoustic thresholds are presented using dual metrics of cumulative sound exposure level ($L_E$) and peak sound level (PK) for impulsive sounds and $L_E$ for non-impulsive sounds.

Level A harassment radii can be calculated using the optional user spreadsheet[14] associated with NMFS Acoustic Guidance, or through modeling.

**Table 10. PTS Onset Acoustic Thresholds for Level A Harassment (NMFS 2018).**

| Hearing Group | PTS Onset Acoustic Thresholds[1] (Received Level) | |
|---|---|---|
| | Impulsive | Non-impulsive |
| Phocid Pinnipeds (PW) (Underwater) | $L_{pk,flat}$: 218 dB<br>$L_{E,PW,24h}$: 185 dB | $L_{E,PW,24h}$: 201 dB |

[1] Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.

Note: Peak sound pressure ($L_{pk}$) has a reference value of 1 μPa, and cumulative sound exposure level ($L_E$) has a reference value of 1μPa$^2$s. The subscript "flat" is being included to indicate peak sound pressure should be flat weighted or unweighted within the generalized hearing range. The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (LF, MF, and HF cetaceans, and PW and OW pinnipeds) and that the recommended accumulation period is 24 hours. The cumulative sound exposure level thresholds could be exceeded in a multitude of ways (i.e., varying exposure levels and durations, duty cycle). When possible, it is valuable for action proponents to indicate the conditions under which these acoustic thresholds will be exceeded.

The National Defense Authorization Act of Fiscal Year 2004 (PL 108-136) amended the definition of "harassment" under the MMPA, specifically as it applies to military readiness activities or scientific research activities conducted by or on behalf of the federal government (16 U.S.C. §1362 (18)(B)). The Fiscal Year 2004 National Defense Authorization Act adopted the definition of "military readiness activity" as set forth in the Fiscal Year 2003 National Defense

[14] The Optional User Spreadsheet can be downloaded from the following website: http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm

Authorization Act (PL 107-314). Research activities within the study area are composed of military readiness activities, as that term is defined in PL 107-314, because activities constitute realistic testing of military equipment, vehicles, and sensors for proper operation and suitability for combat use. For military readiness activities, the relevant definition of harassment under the MMPA is any act that:

- Injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild ("Level A harassment"); or
- Disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering to a point where such behavioral patterns are abandoned or significantly altered ("Level B harassment") (16 U.S.C. § 1362(18)(B)(i) and (ii)).

While the ESA does not define "harass," NMFS issued guidance interpreting the term "harass" under the ESA as to: "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (Wieting 2016). Exposure to sound capable of causing level A or Level B harassment under the MMPA often, but not always, constitutes take under the ESA. For the purposes of this consultation, we have determined the submarine training and research activities with active acoustic transmissions have sound source levels capable of causing take under the MMPA and ESA.

As described below, we anticipate that exposures to listed marine mammals from sound associated with the proposed action may result in behavioral disturbance. However, no mortalities or permanent impairment to hearing are expected.

## 6.2 Exposure Analysis

As discussed in the *Approach to the Assessment* section of this opinion, exposure analyses are designed to identify the listed species that are likely to co-occur with these effects in space and time and the nature of that co-occurrence. In this step of our analysis, we try to identify the number, age (or life stage), and gender of the individuals that are likely to be exposed to an action's effects and the populations or subpopulations those individuals represent. For critical habitat, exposure analyses identify any designated critical habitat likely to co-occur with effects and the nature of that co-occurrence. In this step of our analysis, we try to identify the physical and biological features likely to be exposed to an action's effects.

As discussed in Section 2.1.2 above, the Navy proposed mitigation measures that should avoid or minimize exposure of ringed seals to one or more stressors from the proposed action. The Arctic ringed seal is the only listed marine mammal that may be exposed to the project activities. The discussion below describes the model the Navy uses to determine how many ringed seals may be exposed to their proposed activities. The Permits Division and AKR have also adopted this approach in support of their proposed IHA and biological opinion, respectively, as it represents the best scientific data available.

The Navy Acoustic Effects Model (NAEMO) was previously used to produce a quantitative estimate of PTS, TTS, and behavioral exposures for seals. For ICEX 2024, a new approach that uses sighting data from previous surveys conducted within the study area was used to estimate Level B harassment. The Navy performed a quantitative analysis to estimate the number of mammals that could be harassed by the underwater acoustic transmissions during the proposed action. No numerical data exist regarding presence of ringed seals in the ICEX study area during the months of February, March, and April. Previously, density derived from a habitat suitability model (Kaschner et al. 2006) was used to estimate acoustic exposures of marine mammals using NAEMO; however, this density data drastically overestimated the abundance of ringed seals in the study area and led to an inaccurate number of modeled ringed seal exposures. Instead, using data from sighting surveys that previously occurred in the ICEX study area was determined to be the better approach for estimating ringed seal presence and exposure. Ringed seal presence in the ICEX study area was obtained using sighting data from the OBIS-SEAMAP (Halpin et al. 2009). The ICEX study area was overlaid on the OBIS-SEAMAP ringed seal sightings map that included sightings from the years 2000 to 2007 and the year 2013. Sighting data were only available for the mid to late summer and fall months. Due to the paucity of winter and spring data, the average number of individual ringed seals per year was assumed to be present in the ICEX study area during the proposed action; therefore, it is assumed that three ringed seals will be present in the study area during the proposed action. It is assumed that the OBIS-SEAMAP reported sightings will correspond to a more accurate number of animals that could be present at the time of the proposed action than the previously used densities.

When sound sources are active, exposure to increased sound pressure levels (SPLs) will likely involve individuals that are moving through the area during foraging trips. Ringed seals also may be exposed en route to haul out sites or subnivean lairs. If exposure were to occur, the pinnipeds could exhibit behavioral responses, such as avoidance, increased swimming speeds, increased surfacing time, or decreased foraging. Most likely, individuals affected by acoustic transmissions resulting from the proposed action will move away from the sound source. Ringed seals may be temporarily displaced from their subnivean lairs within the Ice Camp study area. Any pinniped will have to be within 10 km of the source for any behavioral reaction (e.g., flushing from a lair).

Table 11 shows the exposures expected for ringed seals based on the quantitative results. The quantitative analysis indicated that three ringed seals would be present within the study area. To be conservative, the Navy has assumed that all three ringed seals will be exposed to acoustic transmissions above the threshold for Level B take, and that each will be exposed each day of the proposed action (42 days total). Therefore, assuming an animal can only be taken once per day, the Navy requests 126 Level B exposures of ringed seals (Table 11). Unlike the NAEMO modeling approach used to estimate ringed seal exposures for ICEX 2022, the occurrence method used for ICEX 2024 does not support the differentiation between behavioral or temporary threshold shift (TTS) exposures. Therefore, all exposures are classified as Level B and not further distinguished. Modeling for the previous three ICEXs (2018, 2020, and 2022) did not result in any Level A exposures, even in years where torpedoes were used. Torpedoes are not used in ICEX 2024, but all other sound sources are similar to those previously modeled and are used in a similar manner. Therefore, no Level A exposures are expected during ICEX 2024. The numbers generated from the quantitative analysis provide conservative estimates of marine mammal exposures in the study area, while the short duration, limited geographic extent of ICEX 2024 activities, and mitigation measures will further limit actual exposures. Although ringed seals are also likely present in the flight corridor, any ringed seals along the coast that are in the flight path from Deadhorse Airport to the ice camp are assumed to be habituated to the sight and sound of aircraft and their reactions, if they occur at all, would not be measurable. The proposed project will increase the number of flights from the airport by approximately 15 percent with the most flights occurring during camp construction and demobilization. The mitigation measures regarding flight altitude and distance from seals will further reduce the potential for there to be adverse effects of the aircraft on ringed seals. Taking all of these factors into account, we expect that aircraft associated with this action will be flying at an altitude that will not expose ringed seals to acoustic harassment that would rise to Level B harassment. Therefore, no Level B exposures are expected or authorized associated with the flight corridor.

**Table 11. Quantitative Modeling Results of Potential Exposures for ICEX 2024 Activities**

| | | | |
|---|---|---|---|
| Ringed seal | 126 | 0 | 0.07 |

[1] Percentage of stock taken calculated based on proportion of number of Level B exposures per the stock population estimate of 171,418 (Moreland et al. 2013; Conn et al. 2014).

## 6.3 Response Analysis

As discussed in the *Approach to the Assessment* section of this opinion, response analyses determine how listed species / critical habitats are likely to respond after being exposed to an action's effects on the environment or directly on listed species themselves. Our assessments try to detect the probability of lethal responses, physical damage, physiological responses (particular stress responses), behavioral responses, and social responses that might result in reducing the fitness of listed individuals. Ideally, our response analyses consider and weigh evidence of adverse consequences, beneficial consequences, or the absence of such consequences.

### 6.3.1 Threshold Shifts

Exposure of marine mammals to very loud sound can result in physical effects, such as changes to sensory hairs in the auditory system, which may temporarily or permanently impair hearing.

TTS is a temporary hearing change, and its severity is dependent upon the duration, frequency, sound pressure, and rise time of a sound (Finneran and Schlundt 2013). TTSs can last minutes to days. Full recovery is expected, and this condition is not considered a physical injury. At higher received levels, or in frequency ranges where animals are more sensitive, permanent threshold shift (PTS) can occur. When PTS occurs, auditory sensitivity is unrecoverable (i.e., permanent hearing loss). The effect of sound exposure generally depends on a number of factors relating to the physical and spectral characteristics of the sound (e.g., the intensity, peak pressure, frequency, duration, duty cycle), and relating to the animal under consideration (e.g., hearing sensitivity, age, gender, behavioral status, prior exposures). Both TTS and PTS can result from a single pulse or from accumulated effects of multiple pulses from an impulsive sound source or from accumulated effects of non-pulsed sound from a continuous sound source. In the case of exposure to multiple pulses, each pulse need not be as loud as a single pulse to have the same accumulated effect.

As it is a permanent auditory injury, the onset of PTS may be considered an example of “Level A harassment” as defined in the MMPA. TTS is by definition recoverable rather than permanent and has historically been treated as “Level B harassment” under the MMPA. Behavioral effects may also constitute Level B harassment and are expected to occur at even lower sound levels than would generate TTS.

Based on the analysis completed by the Navy and in agreement with the Permits Division, we do not expect ringed seals to be exposed to sound levels that will cause PTS because no ringed seals are expected to be exposed to sound levels greater than 201 dB re 1 $\mu Pa^2 \cdot s$. If exposure to acoustic sources from 181-200 dB re 1 $\mu Pa^2 \cdot s$ occurs, ringed seals could experience TTS and could also exhibit behavioral responses which are discussed in more detail below.

### 6.3.2 Auditory Interference (masking)

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

Critical ratios, a measure of the relative ability of an animal to extract signals from sound, have been determined for pinnipeds (Southall et al. 2000; Southall et al. 2003) and bottlenose dolphins (Johnson 1967). These studies provide baseline information from which the probability of masking can be estimated.

Vocal changes in response to anthropogenic sound can occur across sounds produced by marine mammals, such as whistling, echolocation click production, calling, and singing. Changes to vocal behavior and call structure may result from a need to compensate for an increase in background sound. In cetaceans, vocalization changes have been reported from exposure to anthropogenic sound sources such as sonar, vessel sound, and seismic surveying. Vocalizations may also change in response to variation in the natural acoustic environment (e.g., from variation in sea surface motion) (Dunlop et al. 2014).

Ringed seals have good low-frequency hearing; thus, it is expected that they will be more susceptible to masking of biologically significant signals by low frequency sounds, such as those from vessel sound (Gordon et al. 2003). However, as explained in Section 6.1.1.7, vessel sound from this project is expected to have a very temporary and minor effect on ringed seals.

Evidence suggests that at least some marine mammals have the ability to acoustically identify predators. For example, harbor seals that reside in the coastal waters off British Columbia are frequently targeted by certain groups of killer whales, but not others. The seals discriminate between the calls of threatening and non-threatening killer whales (Deecke et al. 2002), a capability that should increase survivorship while reducing the energy required for responding to all killer whale calls. Auditory masking may prevent marine mammals from responding to the acoustic cues produced by their predators. The effects of auditory masking on the predator-prey relationship depends on the duration of the masking and the likelihood of encountering a predator.

Although ringed seals vocalize, there is no evidence that Arctic ringed seals use sound to find prey (echolocate) or evade predators (Kelly 2022). Ringed seals are prey for polar bears and killer whales. Because ringed seals are excellent swimmers, they are susceptible to attack by polar bears when basking on ice or exiting the water at a breathing hole, and not when they are in the water. Because ringed seals do not rely on sound in water to evade polar bears, auditory masking of a swimming polar bear is not a potential effect of this project. Killer whales are not present in the deep waters of the Beaufort Sea in the winter and therefore are not a threat at this time of year. Ringed seal calls are primarily barks, yelps, and growls (Jones et al. 2014). In looking at 928 recordings from the Chukchi Sea and 1,982 recordings from the Canadian High Arctic, (Jones et al. 2014) found that ringed seals mostly produce calls of very short duration (less than 0.3 seconds). The mean frequency of all calls was less than 1 kHz. Unlike many other phocids, ringed seal vocalizations cannot be heard by a human on the ice. Stirling and Thomas (2003) suggest that the exceptionally low signal strength of ringed seal vocalizations may have evolved in part to avoid detection by polar bears.

The extent to which ringed seals depend on vocalizations for mating and breeding is unclear; three years of recordings over the winter did not provide strong evidence that vocalizations were being used in mating (Jones et al. 2014). The characteristics of ringed seal vocalizations coupled with short term use of submarine transmissions indicates the probability that masking will occur is very low.

### 6.3.3 Behavioral Response

NMFS expects that ringed seals may have a behavioral response to the sounds created by the research devices. Marine mammals may exhibit a variety of behavioral changes in response to underwater sound and the general presence of project activities and equipment, which can be generally summarized as:

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

The response of a marine mammal to an anthropogenic sound will depend on the frequency, duration, temporal pattern, and amplitude of the sound as well as the animal's prior experience with the sound and the context in which the sound is encountered (i.e., what the animal is doing at the time of the exposure). The distance from the sound source and whether it is perceived as approaching or moving away can affect the way an animal responds to a sound (Wartzok et al. 2003). For marine mammals, a review of responses to anthropogenic sound was first conducted by Richardson et al. (1995). More recent reviews (e.g., Nowacek et al. 2007; Southall et al. 2007; Southall et al. 2009; Ellison et al. 2012) address studies conducted since 1995 and focus on observations where the received sound level of the exposed marine mammal(s) was known or could be estimated.

Except for some vocalization changes that may be compensating for auditory masking, all behavioral reactions are assumed to occur due to a preceding stress or cueing response; however, stress responses cannot be predicted directly due to a lack of scientific data (see following section). Responses can overlap; for example, a flight response is likely to be coupled with an increased respiration rate. Differential responses are expected among and within species since hearing ranges vary across species and individuals, the behavioral ecology of individual species is unlikely to completely overlap, and individuals of the same species may react differently to the same, or similar, stressor.

A review of behavioral reactions by pinnipeds to impulsive sound can be found in Richardson et al. (1995) and Southall et al. (2007). Blackwell et al. (2004) observed that ringed seals exhibited little or no reaction to drilling sound with mean underwater levels of 157 $dB_{rms}$ re 1 μPa rms and in air levels of 112 dB re 20 μPa, suggesting the seals had habituated to the sound. In contrast, captive California sea lions avoided sounds from an impulsive source at levels of 165 to 170 $dB_{rms}$ re 1 μPa (Finneran et al. 2003).

Experimentally, (Götz and Janik 2011) tested underwater responses to a startling sound (sound with a rapid rise time and a 93 dB sensation level [the level above the animal's threshold at that frequency]) and a non-startling sound (sound with the same level, but with a slower rise time) in wild-captured gray seals. The animals exposed to the startling treatment avoided a known food source, whereas animals exposed to the non-startling treatment did not react or habituate during the exposure period. The results of this study highlight the importance of the characteristics of the acoustic signal in an animal's habituation.

In cases where the seal response is brief (i.e., changing from one behavior to another, relocating a short distance, or ceasing vocalization), effects could rise to the level of take of individuals but are not likely to be significant at the population level. When individuals change their behavior, such as foraging, in response to underwater sound, it has the potential to affect the animal's energy budget, time budget, or both (the two are related because foraging requires time). Therefore, although the effects could rise to the level of take of a few individuals, a population level effect would not be expected.

Marine mammal responses to anthropogenic sound vary by species, state of maturity, prior exposure, current activity, reproductive state, time of day, and other factors (Ellison et al. 2012). Southall et al. (2007) reported that pinnipeds do not exhibit strong reactions to SPLs up to 140 $dB_{rms}$ re 1 µPa from non-impulsive sources. Data on hooded seals (*Cystophora cristata*) indicate avoidance responses to signals above 160–170 $dB_{rms}$ re 1 µPa (Kvadsheim et al. 2010), and data on gray (*Halichoerus grypus*) and harbor seals indicate avoidance response at received levels of 135–144 $dB_{rms}$ re 1 µPa (Götz et al. 2010). In each instance where food was available, which provided the seals motivation to remain near the source, habituation to the signals occurred rapidly. In the same study, it was noted that habituation was not apparent in wild seals where no food source was available (Götz et al. 2010). This implies that the motivation of the animal is necessary to consider in determining the potential for a reaction.

In one study that investigated the under-ice movements and sensory cues associated with under-ice navigation of ice seals, acoustic transmitters (60–69 kHz at 159 $dB_{rms}$ re 1 µPa at 1 m) were attached to ringed seals (Wartzok et al. 1992). An acoustic tracking system was then installed in the ice to receive the non-impulsive acoustic signals and provide real-time tracking of ice seal movements. Although the frequencies used in the study are at the upper limit of ringed seal hearing, the ringed seals appeared unaffected by the non-impulsive acoustic sources, as they maintained normal behaviors.

In studies by Götz et al. (2010), and Kvadsheim et al. (2010), seals that were exposed to non-impulsive acoustic sources with a received sound pressure level between 142–193 $dB_{rms}$ re 1 µPa, were shown to change their behavior by modifying diving activity and avoidance of the sound source (Götz et al. 2010; Kvadsheim et al. 2010). Although a minor change to a behavior may occur as a result of exposure to the sources in the proposed action, these changes would be within the normal range of behaviors for the animal (e.g., the use of a breathing hole further from the source, rather than one closer to the source, would be within the normal range of behavior) (Kelly et al. 1988).

These studies indicate that depending on a variety of factors including availability of food, past experiences with anthropogenic sound, and distance from the source, ringed seals may avoid the sounds created by the submarines used in this project or they may have very little reaction to them.

### 6.3.4 Non-auditory Physical or Physiological Effects

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

Anthropogenic activities have the potential to provide additional stressors above and beyond those that occur naturally. For example, various efforts have investigated the impact of vessels on marine mammals (both whale-watching and general vessel traffic sound) and demonstrated that impacts do occur (Erbe 2002; Williams et al. 2002; Bain et al. 2006; Noren et al. 2009; Pirotta et al. 2015). In an analysis of energy costs to killer whales, Williams and Noren (2009) suggested that whale-watching in the Johnstone Strait resulted in lost feeding opportunities due to vessel disturbance. During the time following September 11, 2001, shipping traffic and associated ocean sound decreased along the northeastern U.S. This decrease in ocean sound was associated with a significant decline in fecal stress hormones in North Atlantic right whales, suggesting that chronic exposure to increased sound levels, although not acutely injurious, can produce stress (Rolland et al. 2012). These levels returned to their previous level within 24 hours after the resumption of shipping traffic. Exposure to loud sound can also adversely affect reproductive and metabolic physiology (Kight and Swaddle 2011).

If a sound is detected by a marine mammal, a stress response (e.g., startle or annoyance) or a cueing response (based on a past stressful experience) can occur. Whales and seals use hearing as a primary way to gather information about their environment and for communication; therefore, we assume that limiting these abilities is stressful. Stress responses may also occur at levels lower than those required for TTS (NMFS 2006). Therefore, exposure to levels sufficient to trigger onset of PTS or TTS are expected to be accompanied by physiological stress responses (NRC 2003; NMFS 2006).

We expect that the proposed action may result in ringed seals temporarily exhibiting behavioral responses or (less likely) experiencing TTS from project activities. Therefore, we expect ringed seals may experience stress responses. If ringed seals are not displaced and remain in a stressful environment (i.e., within the behavioral harassment zone), we expect the stress response will decline shortly after the individual leaves the area or after the cessation of the acoustic stressor.

# 7 CUMULATIVE EFFECTS

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

We searched for information on non-Federal actions reasonably certain to occur in the action area. We did not find any information about non-Federal actions other than what has already been described in the Environmental Baseline (Section **Error! Reference source not found.**5 of this Opinion). Some continuing non-Federal activities are reasonably certain to contribute to climate change within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the climate change and environmental baseline sections (Sections 4.2 and 5.1, respectively).

There are currently no other known state or private activities reasonably certain to occur in the action area that may affect listed species and are not subject to section 7 consultation.

We expect all of those activities discussed in the Environmental Baseline section to continue into the future. We expect subsistence harvest of ringed seals to continue. We also expect that with commercial and private vessels operating in the Bering, Chukchi, and Beaufort Seas, the risk of non-permitted oil and pollutant discharges will continue and may increase. Because there is no federal nexus requiring section 7 consultation for the majority of vessels that will be transiting the Arctic, this topic is discussed in more detail. In addition, another emerging issue which has the potential to effect Arctic marine food webs and for which there is no federal nexus is microplastics.

## 7.1 Vessel Traffic

The general seasonal pattern of vessel traffic in the Arctic is correlated with seasonal ice conditions, which result in the bulk of the traffic being concentrated within the months of July through October. Unaided navigation is limited to an even narrower time frame. Decreasing ice levels will facilitate an increase in vessel traffic associated with oil and gas exploration, tourism, and open historically closed trade routes. The Northern Sea Route reduces the distance between Northwest Europe and Northeast Asia by 40% compared to the passage through the Suez Canal. The two Arctic routes allow shipping companies to avoid increased tolls in the Suez and Panama Canals and provide routes for super ships that are larger and able to carry greater volumes of cargo (Nong et al. 2018).

In an effort to predict the increase of vessel traffic through the Northwest Passage and the Northern Sea Route, Melia et al. (2016) used global climate models to project how sea ice loss might increase Arctic shipping. For a high-emission scenario, by late century, trans-Arctic shipping may be commonplace, with a season ranging from 4 to 8 months. For a low-emissions scenario, with global mean temperature stabilization of less than 2º C above preindustrial, the frequency of open water vessel transits still has the potential to double by midcentury with a season ranging from 2 to 4 months (Melia et al. 2016). As seasonal ice-free waters expand, the international commercial transport of goods and people in some Arctic areas is projected to increase 100-500 percent by 2025 (Adams and Silber 2017).

In the projections developed by the U.S. Committee on the Marine Transportation System (U.S. Committee on the Marine Transportation System 2019) for the most plausible scenario, 72 vessels are expected to be active annually by 2030 in natural resource exploration and development, which is also the activity ranked as the largest contributor to projected traffic growth in the Arctic. More than 50% of this growth is expected to be from non-US natural resource extraction (Russian exports of liquid natural gas and mineral extraction in Canada). By 2030 in the most plausible scenario, 28 vessels are expected to be active for rerouted shipping through the Arctic and 17 vessels in the expansion of the Arctic fleet (icebreakers, and ice-hardened cruise ships). However, these estimates do not include the small vessel transits used for commercial fishing, subsistence harvest, or lightering goods from large barges to shore using smaller vessels.

In the first week of January 2021, a 908-foot Russian tanker carrying liquified natural gas passed south through the Russian side of the Bering Strait, and two more followed the next week. The ships traversed the northern coast of Siberia, on the North Sea Route, in the middle of January with no icebreaker escort, an unprecedented event. The Nikolay Zubov, built in 2019, is one of a fleet of 15 Russian ships that are specially designed to transport LNG through thin sea ice. In May of 2020, the first vessels of the season set a record for the earliest passage of the route by commercial tankers[15]. The passage of these ships is a stark reminder of how much the Arctic is changing and how vessel traffic will inevitably increase.

A report released by the Center for High North Logistics at Norway's Nord University Business School cited 62 transits through the Northern Sea Route between January 1 and December 9, 2020, compared to just 37 in all of 2019. An estimated 32 million tons of cargo passed along the route in 2020, compared to just 10.7 million tons in 2017. In 2019, the Russian government released a plan to have at least 40 Arctic vessels by 2035, many of them nuclear-powered icebreakers to keep the route passable by regular cargo ships for most of the year.

A greater number of vessels using the Arctic is expected to increase air-borne emissions levels (CO2 and black carbon), underwater sound, the potential for oil spills, introduction of nonnative species, and the probability of ships striking whales.

## 7.2 Microplastics

Microplastics, defined as < 5 mm in size, occur due to the release of manufactured plastic particles in various products (primary microplastics) and the fragmentation of larger plastic pieces (secondary microplastics) (Cole et al. 2011). Microplastics are distributed globally. In an examination of ice cores from widely dispersed locations across the Arctic Ocean, Obbard et al. (2014) found from 38 to 234 particles per cubic meter of ice. The microplastic concentrations were several orders of magnitude greater than those reported in the North Pacific Subtropical Gyre (0.12 particles per cubic meter of water). The highest concentration of microplastics ever determined in sea ice was found in the Makarov Basin in the central Arctic Ocean (Peeken et al. 2018). The ice core there contained concentrations comparable to those from South Korean waters, which contained the highest levels previously recorded (Peeken et al. 2018). The types of microplastics found in the Arctic included polystyrene, acrylic, polyethylene, polypropylene,

[15] http://www.nomenugget.net/news/russian-tanker-passes-through-bering-strait-midst-winter

nylon, and polyester (Obbard et al. 2014; Peeken et al. 2018). Microplastics are also abundant in Arctic benthic substrates (Lusher et al. 2015; Bergmann et al. 2017) and water (La Daana et al. 2018; La Daana et al. 2020).

Marine plastic debris is associated with a 'cocktail of chemicals', including chemicals added or produced during manufacturing (Lithner et al. 2011; Rochman 2015) and those present in the marine environment that accumulate onto the debris from surrounding seawater (Mato et al. 2001; Hirai et al. 2011). Persistent organic pollutants, including PCBs, and metals have been well documented as sorbing onto plastic particles in studies dating back to 1972 (Mato et al. 2001; Ogata et al. 2009; Zarfl and Matthies 2010). Microplastics and the persistent bioaccumulative toxins they carry have been documented in filter feeders including zooplankton, mussels, planktivorus fish and humpback whales (Besseling et al. 2014; Besseling et al. 2015; Fang et al. 2021) and benthic invertebrates from the shelf of the Bering and Chukchi Seas ((Fang et al. 2018). There is evidence that the sorbed contaminants are bioavailable to a variety of marine mammals and invertebrates (Teuten et al. 2009; Rochman 2015). Researchers are actively investigating whether these plastic-associated contaminants biomagnify in higher trophic levels as a direct result of plastic ingestion and how important bioaccumulation from plastic is relative to bioaccumulation from other sources of chemical contamination in the environment (Avio et al. 2015; Rochman 2015; Miller et al. 2020). The introduction of microplastics into the environment, and potential effects on marine mammals, are expected to continue in the future, with the potential for the increasing presence of microplastics in the Arctic.

# 8 INTEGRATION AND SYNTHESIS

The Integration and Synthesis section is the final step of NMFS's assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 6) to the environmental baseline (Section 5) and the cumulative effects (Section 7) to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) result in appreciable reductions in the likelihood of both the survival or recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) result in the adverse modification or destruction of critical habitat as measured through direct or indirect alterations that appreciably diminish the value of designated critical habitat as a whole for the conservation of the species. These assessments are made in full consideration of the status of the species (Section 4).

As we discussed in the *Approach to the Assessment* section of this opinion, we begin our risk analyses by asking whether the probable physical, physiological, behavioral, or social responses of endangered or threatened species are likely to reduce the fitness of endangered or threatened individuals or the growth, annual survival or reproductive success, or lifetime reproductive success of those individuals.

As part of our risk analyses, we identified and addressed all potential stressors and considered all consequences of exposing listed species to all the stressors associated with the proposed action, individually and cumulatively, given that the individuals in the action area for this consultation are also exposed to other stressors in the action area and elsewhere in their geographic range.

## 8.1 Ringed Seal Risk Analysis

As described in the Environmental Baseline (section 5) Arctic ringed seals in the project area have been and will continue to be affected by the following:

- Climate change
- Increased exposure to biotoxins (harmful algal blooms)
- Exposure or increased susceptibility to new diseases
- Interactions with Fisheries
- Oil and gas exploration
- Vessel sound and strike
- Ocean sound (ambient sound, oil and gas exploration, drilling, and production sound, aircraft sound)
- Direct mortality
    - Subsistence harvest
    - Stranding
    - Predation
- Plastics
- Scientific research and other Arctic projects.

Two overarching factors taken into consideration for our risk analysis are: 1) that the primary threat to ringed seals is climate change and loss of suitable habitat as a consequence of climate change; and 2) very few of the approximately 171,418 Arctic ringed seals (which is likely an underestimate of their true population size) are expected to be within the action area. These two factors help put the analysis of potential effects in perspective. Moreover, ICEX 2024 activities and their associated effects are very short term (mid-February to April 2024). While ringed seals are likely present in the flight corridor, aircraft associated with this action will be flying at an altitude that will not expose ringed seals to acoustic harassment that would rise to Level B harassment. Therefore, no Level B exposures are expected or authorized associated with the flight corridor.

Although the Navy used the best available information to determine ringed seal exposure, no surveys have been done in the Beaufort Sea in the vicinity of the ice camp in the winter. Previously, density derived from a habitat suitability model (Kaschner et al. 2006) was used to estimate acoustic exposures of marine mammals using NAEMO; however, this density data drastically overestimated the abundance of ringed seals in the study area and led to an inaccurate number of modeled ringed seal exposures. Instead, using data from sighting surveys that previously occurred in the ICEX study area was determined to be the better approach for estimating ringed seal presence and exposure.

It is unlikely that there will be high densities of ringed seals in the action area for the following reasons:

1. Frost et al. (2004) found that their density was highest at water depths between 25-35 m. Although their surveys extended only a short distance beyond the continental shelf, ringed seal density was significantly less at depths greater than 35-45 m (Frost et al. 2004). Frost et al. (2002) found the same significant relation, with seal density decreasing with depth up to 55 m (the maximum surveyed). Crawford et al. (2012) caught and tagged 25 seals from Kotzebue Sound in 2007 and 2008 and tracked their movements. Average water depth in which they stayed over time was 36.5 m. Likewise, Bengtson et al. (2005) found ringed seals were four to ten times more abundant in nearshore fast and pack ice environments than in offshore pack ice, consistent with the pattern reported by other authors such as Smith (1973), who reported that densities of ringed seals were much lower beyond 29 km from shore. Bengtson et al. (2005) concluded that the higher density of ringed seals in the coastal areas was not surprising, given the importance of shore fast ice for ringed seal lairs and breeding habitat. These results lead us to believe that far fewer ringed seals will be present in the ICEX 2024 study area because it will be well off the continental shelf in water 800 m or more in depth.
2. We expect that ringed seals select habitats in early winter where food is abundant and easily accessible to minimize the energy required to forage. Arctic cod, an important part of ringed seal diet, is abundant near shore from November to April when the fish concentrate to spawn (Logerwell et al. 2015). Foraging over the continental shelf where productivity is high and food more accessible (both fish and invertebrates available, and at shallower depths) is likely, in part, responsible for the distribution of seals that has been documented (Frost et al. 2002; Frost et al. 2004).
3. Because ringed seals have a diet that includes both benthic invertebrates and fish, at 800 m benthic invertebrates will be eliminated as a food option and ringed seals will have to depend exclusively on fish. We have no information on fish densities in the deep waters of the Arctic Ocean in the winter but reducing the food options will likely make the area less favorable for ringed seals.

Although ringed seals are likely present in the 40 km flight corridor between Deadhorse Airport and the ice camp, any ringed seals along the coast that are in the flight path from Deadhorse Airport to the ice camp are assumed to be habituated to the sight and sound of aircraft and their reactions, if they occur at all, would not be measurable. The proposed project will increase the number of flights from the airport by approximately 15 percent with the most flights occurring during camp construction and demobilization. The mitigation measures regarding flight altitude and distance from seals will further reduce the potential for there to be adverse effects of the aircraft on ringed seals. Taking all of these factors into account, we expect that aircraft associated with this action will be flying at an altitude that will not expose ringed seals to acoustic harassment that would rise to Level B harassment. In addition, during monitoring for the ICEX 2018, ICEX 2020, and ICEX 2022 in the same general area, the Navy did not visually observe ringed seals (Henderson et al. 2021; U.S. Department of the Navy 2022). During monitoring for the ICEX 2018 and ICEX 2020 in the same general area, the Navy also did not acoustically detect marine mammals (Henderson et al. 2021) [16]. Consequently, the exposures we discuss below are most likely affecting very few ringed seals.

Based on the results of the exposure analysis (see Section 6), we expect ringed seals will be exposed to underwater noise from submarine sonar and active acoustic devices. Although exposure will be minimized through mitigation measures, ringed seals will be exposed to sound that is likely to result in Level B harassment. As discussed in section 6.2, the Navy used available ringed seal sighting survey data from the OBIS-SEAMAP surveys (Halpin et al. 2009) to determine ringed seal exposure. It is assumed that the OBIS-SEAMAP reported sightings will correspond to a more accurate number of ringed seals that could be present at the time of the proposed action than the previously-used densities. Based on the OBIS-SEAMAP data, NMFS expects a maximum of 126 exposures of ringed seals from the submarine activities. Unlike the NAEMO modeling approach used to estimate ringed seal exposures in the ICEX 2022 IHA, the occurrence method used in this ICEX 2024 IHA does not support the differentiation between behavioral and temporary threshold shift (TTS) exposures. Therefore, all exposures are classified as Level B harassment. Effects on individuals that are taken by Level B harassment by behavioral disturbance could include alteration of dive behavior, alteration of foraging behavior, effects to breathing, interference with or alteration of vocalization, avoidance, flight, as well as stress. More severe behavioral responses are not expected due to the localized, intermittent use of active acoustic sources and listening for vocalizing marine mammals before initiating active acoustic sources, which will limit exposure to active acoustic sources. Most likely, individuals will be temporarily displaced by moving away from the sound source. Although a minor change to a behavior may occur as a result of exposure to the sound sources associated with the proposed specified activity, these changes will be within the normal range of behaviors for the animal (e.g., the use of a breathing hole further from the source, rather than one closer to the source). Thus, even repeated Level B harassment of some small subset of the overall population is unlikely to result in any significant realized decrease in fitness for the affected individuals, and will not result in any adverse impact to the Arctic subspecies as a whole. NMFS expects zero exposures of ringed seals to sounds capable of causing PTS.

Exposure to snow machine and on-ice vehicle sound, vessel sound, aircraft sound (fixed-wing aircraft, helicopters, and UAS), sound from habitat alteration (ice drilling/coring), authorized discharge, vessel strike, and small oil or lubricant spills may occur as part of the proposed action, but are considered insignificant and would not rise to the level of take. Because of the Standard

[16] PAM did not occur during ICEX 2022 (with the exception of PAM conducted during mitigation activities when there were not detections) because the ice camp ice flow broke up, and therefore, Navy had to relocate.

Operating Procedures and mitigation measures that are proposed as part of this action, stressors associated with human presence and on-ice activities (camp construction and demobilization, camp operation, excursions) are expected to affect individual ringed seals very infrequently, if at all.

Exposure to non-biodegradable marine debris, specifically to debris that can cause entanglement, remains an unquantifiable risk, but associated effects from this project would be minimal. Best practices regarding waste management (cutting loops prior to disposal) will further reduce the impact of debris on ringed seals. Entanglement and ingestion of marine debris is extremely unlikely to occur during this proposed action.

The primary mechanism by which the behavioral changes we have discussed affect the fitness of individual animals is through the animal's energy budget, time budget, or both (the two are related because foraging requires time). Early winter period, prior to the occupation of breeding sites, is important in allowing female ringed seals to accumulate enough fat stores to support estrus and lactation (Kelly et al. 2010b). This early winter period overlaps camp construction and the first weeks of the exercises. However, the individual and cumulative energy costs of the behavioral responses we have discussed are not likely to reduce the energy budgets of ringed seals. As a result, the ringed seal's probable responses (i.e., tolerance, avoidance, short-term masking, and short-term vigilance behavior) are not likely to reduce the fitness or current or expected future reproductive success or reduce the rates at which they grow, mature, or become reproductively active. Therefore, these exposures are not likely to reduce the abundance, reproduction rates, and growth rates (or increase variance in one or more of these rates) of the population those individuals represent. For physical disturbance, the ice camp will be sited to reduce potential disruption of ringed seal lairs. In addition, the mitigation measures further reduce the likelihood of a lair or a seal being affected by snow machine use. If an individual ringed seal were disturbed and flushed into the water this impact is not likely to reduce its reproductive rate, growth rate, or the growth rate of the population. The occurrence of vessel strikes are considered extremely unlikely due to the agility of seals in the water, their low density, implementation of mitigation measures, and low number of vessels associated with the action. Exposure to harmful pollution and marine debris is extremely unlikely.

As we discussed in the *Approach to the Assessment* (Section 3 of this opinion), an action that is not likely to reduce the fitness of individual seals would not be likely to reduce the viability of the populations those individual seals represent (that is, we would not expect reductions in the reproduction, numbers, or distribution of such populations). For the same reasons, an action that is not likely to reduce the viability of those populations is not likely to increase the extinction probability of the species those populations comprise; in this case, the ringed seal.

In conclusion, the effects associated with the proposed Arctic military exercises are not likely to appreciably reduce the ringed seals' likelihood of surviving or recovering in the wild by reducing the reproduction, numbers, or distribution of the species, and therefore, we conclude that the proposed action is not likely to reduce the viability of Arctic ringed seals.

# 9 CONCLUSION

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS's biological opinion that the proposed action is not likely to jeopardize the continued existence of Arctic ringed seal.

# 10 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the take of endangered species unless there is a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (16 U.S.C. § 1532(19)). "Incidental take" is defined as take that results from, but is not the purpose of, the carrying out of an otherwise lawful activity conducted by the action agency or applicant (50 CFR § 402.02). Based on NMFS guidance, the term "harass" under the ESA means to: "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (Wieting 2016).

The National Defense Authorization Act of Fiscal Year 2004 (PL 108-136) amended the definition of "harassment" under the MMPA, specifically as it applies to military readiness activities or scientific research activities conducted by or on behalf of the federal government (16 U.S.C. §1362(18)(B)). The Fiscal Year 2004 National Defense Authorization Act adopted the definition of "military readiness activity" as set forth in the Fiscal Year 2003 National Defense Authorization Act (PL 107-314). Research activities within the study area are composed of military readiness activities, as that term is defined in PL 107-314, because activities constitute realistic testing of military equipment, vehicles, and sensors for proper operation and suitability for combat use. For military readiness activities, the relevant definition of harassment under the MMPA is any act that:

- Injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild ("Level A harassment"); or
- Disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering to a point where such behavioral patterns are abandoned or significantly altered ("Level B harassment") (16 U.S.C. § 1362(18)(B)(i) and (ii)).

For this consultation, the Permits Division anticipates that any take will be by harassment only. No Level A takes are contemplated or authorized.

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

Section 7(b)(4)(C) of the ESA provides that if an endangered or threatened marine mammal is involved, the taking must first be authorized by section 101(a)(5) of the MMPA. Accordingly, **the terms of this incidental take statement become effective only upon the issuance of MMPA authorization to take the marine mammals identified here**. Absent such authorization, this incidental take statement is inoperative.

The Navy and the Permits Division have a continuing duty to regulate the activities covered by this ITS. In order to monitor the impact of incidental take, the Navy and the Permits Division must monitor and report on the progress of the action and its impact on the species as specified in the ITS (50 CFR § 402.14(i)(3)).

## 10.1 Amount or Extent of Take

Section 7 regulations require NMFS to estimate the number of individuals that may be taken by proposed actions or utilize a surrogate (e.g., other species, habitat, or ecological conditions) if we cannot assign numerical limits for animals that could be incidentally taken during the course of an action (50 CFR § 402.14(i)(1); see also 80 FR 26832; May 11, 2015).

NMFS anticipates the proposed ICEX 2024 project in the Beaufort Sea, Alaska, from February to April, 2024 is likely to result in the incidental take of ringed seals by harassment, including TTS. The Permits Division estimated take by considering: 1) acoustic thresholds above which the best available science indicates marine mammals will be behaviorally harassed or incur some degree of temporary hearing impairment; 2) the range to which behavioral effects were expected to reach; and 3) the occurrence of marine mammals within these ensonified areas.

Underwater acoustic transmissions associated with ICEX 2024 have the potential to result in Level B harassment of ringed seals (n = 126). No take by Level A harassment, serious injury, or mortality is expected to result from this activity and none is authorized. Further, at close ranges and high sound levels approaching those that could cause PTS, seals will likely avoid the area immediately around the sound source. This opinion considers the full amount of take authorization requested by the Navy and proposed by the Permits Division.

If the actual incidental take exceeds the estimated level or type of take, the Navy and the Permits Division may be required to reinitiate consultation. Likewise, if the action deviates from what is described in Section 2.1.2 of this biological opinion, the Navy and the Permits Division may be required to reinitiate consultation. All expected takes are expected to be by harassment, as described previously, involving temporary changes in behavior.

## 10.2 Effect of the Take

In Section 9 of this opinion, NMFS determined that the level of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the Arctic ringed seal.

The takes from the proposed action are associated with behavioral harassment from acoustic effects. Although the biological significance of behavioral responses remains unknown, this consultation has assumed that exposure to sound sources might disrupt one or more behavioral patterns that are essential to an individual animal's life history. However, any behavioral responses of the ringed seals to sound sources and any associated disruptions are not expected to affect the fitness of any individuals of these species, the viability of the population, or the species' survival or recovery.

## 10.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take." (50 CFR 402.02).

RPMs are distinct from the mitigation measures that are included in the proposed action (described in Section 2.1.2). We presume that the standard operating procedures and mitigation measures will be implemented as described in this opinion. The failure to do so will constitute a change to the action that may require reinitiation of consultation pursuant to 50 CFR § 402.16.

The RPMs included below, along with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. NMFS concludes that the following RPMs are necessary and appropriate to minimize or to monitor the incidental take of Arctic ringed seals resulting from the proposed action.

RPM 1: The Navy and the Permits Division must monitor for take and the effects of their action on listed marine mammals and should document and report relevant aspects of its research and testing activities to verify implementation of the mitigation measures and compliance with permits, and to improve future environmental assessments.

## 10.4 Terms and Conditions

The Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. These terms and conditions are in addition to the mitigation measures and standard operating procedures included in the proposed action, as set forth in Section 2.1.2 of this opinion. The Navy and Permits Division has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (50 CFR § 402.14(i)(3))).

Any taking that is in compliance with these terms and conditions is not prohibited under the ESA (50 CFR § 402.14(i)(5)).

These terms and conditions constitute no more than a minor change to the proposed action because they are consistent with the basic design of the proposed action.

*To carry out the RPM 1 listed in Section 10.3, the following must occur:*

1. The Navy and the Permits Division must provide NMFS AKR with written and photographic (if applicable) documentation of any observed effects of the proposed actions on listed marine mammals and implementation of the mitigation measures and standard operating procedures specified in section 2.1.2 of this Biological Opinion.

# 11 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR § 402.02).

In order to keep NMFS's Protected Resources Division informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Navy should notify NMFS of any conservation recommendations they implement in their final action.

1. The Navy should review all new and relevant marine mammal population and density data from the Arctic and incorporate that information into future density estimates for Arctic ringed seals.
2. The Navy should deploy passive acoustic monitors in the Beaufort Sea to provide a better understanding of marine mammal presence in the area during the ICEX timeframe.

# 12 REINITIATION OF CONSULTATION

As provided in 50 CFR § 402.16, reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action on listed species or designated critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this opinion, or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount of incidental take is exceeded, section 7 consultation must be reinitiated immediately (50 CFR § 402.14(i)(4)).

# 13 DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) (Data Quality Act (DQA)) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

## 13.1 Utility

This document records the results of an interagency consultation. The information presented in this document is useful to NOAA, the Navy, and the general public. These consultations help to fulfill multiple legal obligations of the named agencies. The information is also useful and of interest to the general public as it describes the manner in which public trust resources are being managed and conserved. The information presented in these documents and used in the underlying consultations represents the best available scientific and commercial information and has been improved through interaction with the consulting agency.

This consultation will be posted on the NMFS Alaska Region website http://alaskafisheries.noaa.gov/pr/biological-opinions/. The format and name adhere to conventional standards for style.

## 13.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

## 13.3 Objectivity

***Standards:*** This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the ESA Consultation Handbook, ESA Regulations, 50 CFR § 402.01 et seq.

***Best Available Information:*** This consultation and supporting documents use the best available information, as referenced in the literature cited section. The analyses in this opinion contain more background on information sources and quality.

***Referencing:*** All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

***Review Process:*** This consultation was drafted by NMFS staff with training in ESA implementation, and reviewed in accordance with Alaska Region ESA quality control and assurance processes.

## 14 REFERENCES

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