DRAFT

Supplemental Environmental Assessment/ Overseas Environmental Assessment for Ice Exercise

October 2019

Lead Agency
Department of the Navy

Action Proponent
Commander, U.S. Fleet Forces Command

DRAFT SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT/OVERSEAS ENVIRONMENTAL ASSESSMENT

FOR

ICE EXERCISE

Lead Agency:	Department of the Navy
Cooperating Agency:	None
Title of the Proposed Action:	Ice Exercise
Designation:	DRAFT

ABSTRACT

The United States Department of the Navy prepared this Supplemental Environmental Assessment (EA)/Overseas Environmental Assessment (OEA) in compliance with the National Environmental Policy Act (NEPA) and Executive Order (EO) 12114, Department of Defense regulations found at 32 Code of Federal Regulations Part 187, Department of Defense Directive 6050.7, and the Chief of Naval Operations Instruction 5090.1D and its accompanying manual (M-5090).

This Supplemental EA/OEA evaluates the potential impact to the environment from an Ice Exercise (ICEX). The need for the Proposed Action is to prepare forces capable of extended operations and warfighting in the Arctic in accordance with Title 10 U.S.C. § 8062, and to support the aims of the Arctic Research and Policy Act (15 United States Code §§ 4101 *et seq.*). The purpose of the Proposed Action is to conduct realistic training and testing in an Arctic environment, and if resources are available, to gather data on environmental conditions and technology suitability in an Arctic environment. This Supplemental EA/OEA evaluates the following alternatives: the No Action Alternative and the Proposed Action.

In this Supplemental EA/OEA, the Navy analyzed potential impact to the environment that could result from the No Action Alternative and the Proposed Action. The resources evaluated include marine mammals. All other resources are fully analyzed in the previous programmatic ICEX EA/OEA which was written in 2018, and the analysis and activities are still relevant to the current activities.

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Executive Summary

PROPOSED ACTION

A Programmatic Ice Exercise (ICEX) Environmental Assessment (EA)/ Overseas Environmental Assessment (OEA) written in 2018, hereinafter, the ICEX EA/OEA, analyzed the conduct of an ICEX, which involves the construction of a camp on an ice floe to support the submarine training and testing, to include torpedo training exercises. Additionally, some submarine training and testing may occur throughout the deep Arctic Ocean basin near the North Pole, within the Study Area (Figure 2-1) was included in the analysis. The activities analyzed in the ICEX EA/OEA include the establishment of a tracking range and temporary ice camp, and if resources are available, conduct research in an Arctic environment. The purpose of the Proposed Action was to evaluate the employment and tactics of submarine operability in Arctic conditions. The Proposed Action also evaluated emerging technologies and assessed capabilities in the Arctic environment, and gathered data on Arctic environmental conditions.

ICEX 2020 would be conducted in a manner similar to the activities analyzed in the ICEX EA/OEA. The difference is that there would be no torpedo training exercises and there would be additional research activities. This Supplemental EA/OEA includes the analysis of those changes, as well as some of the background information in order to provide a more complete picture of ICEX 2020.

ALTERNATIVES

For this Supplemental EA/OEA, two alternatives were analyzed: the No Action Alternative and the Proposed Action.

ENVIRONMENTAL CONSEQUENCES

The only potential environmental stressor included in this Supplemental EA/OEA includes the potential effects from acoustic transmissions. All other stressors remain the same as the ICEX EA/OEA and the analysis and effects remain the same. The potential environmental consequences of acoustic transmissions have been analyzed in this Supplemental EA/OEA for marine mammals; all other physical, biological, and socioeconomic resources are analyzed in the ICEX EA/OEA. Quantitative analysis was performed on those resources, namely marine mammals, for which numerical impact thresholds have been established.

The results of the analysis indicate that, with the implementation of standard operating procedures and mitigation measures, that the Proposed Action would not significantly impact the natural and physical environment.

Under section 7 of the Endangered Species Act (ESA), the Navy initiated an informal consultation with the U.S. Fish and Wildlife Service (USFWS) for the polar bear. USFWS concurred on XXX, 2019 with the Navy's finding that the Proposed Action may affect, but is not likely to adversely affect, polar bears (*Ursus maritimus*). A formal Biological Evaluation was submitted to NMFS for the bearded seal and ringed seal on August 29, 2019, and NMFS issued a Biological Opinion that the Proposed Action may adversely affect the bearded and ringed seal on XXX, 2019. In accordance with the Marine Mammal Protection Act, an incidental harassment authorization (IHA) was prepared for the incidental take of marine mammals (ringed seals) and submitted to National Marine Fisheries Service on July 2, 2019. The IHA was issued to the Navy on XXX, 2019. In addition, an intentional take permit (for the active deterrence of polar bears) under the Marine Mammal Protection Act was obtained from the USFWS on XXX, 2019. The Navy completed consultation with NMFS for the previous ICEX (in 2016 and 2018), in accordance with the Magnuson-Stevens Fishery Conservation and Management Act. Since NMFS determined that the Proposed Action would not likely reduce the quantity or quality of Essential Fish Habitat and no conservation recommendations were provided, consultation was not reinitiated for ICEX in 2020. Finally, the Navy received a National Pollutant Discharge Elimination System permit from the Environmental Protection Agency for the discharge of graywater and reverse osmosis reject water from the ice camp into the Beaufort Sea for the previous ICEX in 2018, which was modified to account for changes in the Study Area; this permit was received XXX, 2019.

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Acronyms and Abbreviations

CFR	Code of Federal Regulations
cm	centimeter(s)
dB	decibel(s)
dB re 1 μPa	decibel(s) referenced to 1 micropascal
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EO	Executive Order
ESA	Endangered Species Act
ICEX	Ice Exercise
km	kilometer(s)
km^2	kilometers squared
kHz	kilohertz
m	meter(s)
MMPA	Marine Mammal Protection Act
NAEMO	Navy Acoustic Effects Model
Navy	United States Department of the Navy
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
PTS	Permanent Threshold Shift
SEL	Sound Exposure Level
SPL	Sound Pressure Level
TTS	Temporary Threshold Shift
U.S.	United States
U.S.C.	United States Code

CHAPTER 1 PURPOSE AND NEED

1.1 INTRODUCTION

The United States (U.S.) Department of the Navy (Navy) has maintained a presence in the Arctic region for decades. Navy experience spans Admiral Byrd's historic overflight of the North Pole in 1926, various campaigns in World War II, consistent activity during the Cold War, and combined exercises with surface, subsurface, aviation, and expeditionary forces today. While the Arctic is not unfamiliar for the Navy, expanded capabilities and capacity are needed for the Navy to increase its engagement in this region.

In 2018, Arctic sea ice reached its second smallest yearly extent in recorded history, following only the smallest yearly extent record, set in 2017 (NOAA National Centers for Environmental Information 2018). This type of physical change in the Arctic is unprecedented in both the rate and scope of change. As a result, commercial shipping, resource development, research, tourism, environmental interests, and military focus in the region are projected to reach new levels of activity. Because of these changes, the Navy Arctic Roadmap (a document that provides direction to the Navy to enhance the Navy's ability to operate in the Arctic region) has indicated that "[b]y 2020, the Navy will increase the number of personnel trained in Arctic operations. The Navy will grow expertise in all domains by continuing to participate in exercises, scientific missions, and personnel exchanges in Arctic-like conditions" (Chief of Naval Operations 2014).

Ice Exercises (ICEXs) are typically conducted every two to three years in the waters north of Alaska. ICEXs are conducted to allow for the continued training of submarine forces in the Arctic and to refine and validate procedures and required equipment. In addition to Navy submarine training and testing and evaluation (hereafter referred to as "training and testing"), military and academic institutions coordinate and collaborate with the Navy during each ICEX to further their research objectives of better understanding the Arctic environment, and the suitability and survivability of particular technologies in the environment.

The Navy prepared this Supplemental Environmental Assessment Overseas Environmental Assessment (Supplemental EA/OEA) to analyze the potential effects from a proposed ICEX on the environment in compliance with the National Environmental Policy Act (NEPA), Executive Order (EO) 12114, Department of Defense regulations found at 32 Code of Federal Regulations (CFR) Part 187, and the Chief of Naval Operations Instruction 5090.1D and its accompanying manual (M-5090.1).

1.2 PURPOSE AND NEED

The primary purpose of the Proposed Action is to evaluate the employment and tactics of submarine operability in Arctic conditions; this overall purpose has not changed since it was fully analyzed in the ICEX EA/OEA written in 2018, (referred to herein as "ICEX EA/OEA"). Secondarily, the Proposed Action would also test emerging technologies and assess capabilities in the Arctic 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 U.S. Navy Arctic Roadmap 2014-2030 Strategic Objectives.

1.3 APPLICABLE LAWS AND DIRECTIVES

- National Environmental Policy Act
- Executive Order 12114
- Arctic Research and Policy Act
- Clean Water Act
- Endangered Species Act
- Marine Mammal Protection Act
- Magnuson-Stevens Fishery Conservation and Management Act
- Migratory Bird Treaty Act

CHAPTER 2 PROPOSED ACTION AND ALTERNATIVES

The activities analyzed in this SEA/OEA are largely a continuation of activities that were analyzed previously in the ICEX EA/OEA. This Supplemental EA/OEA includes any changes to activities previously analyzed, and reflects the most up-to-date compilation of training and testing activities deemed necessary to accomplish military readiness requirements.

2.1 PROPOSED ACTION

The Proposed Action is to conduct submarine training and testing activities, which includes the establishment of a tracking range and temporary ice camp, and if resources are available, conduct research in an Arctic environment. The purpose of the Proposed Action is to evaluate the employment and tactics of submarine operability in Arctic conditions. The Proposed Action would also evaluate emerging technologies and assess capabilities in the Arctic environment, and gather data on Arctic environmental conditions. The vast majority of submarine training and testing would 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 2-1). Though the Study Area is large, the area where the proposed ice camp would be located is a much smaller area (see 2020 ice camp proposed action area). However, the Proposed Action would occur with an expanded ice camp proposed action area when compared to that defined in the ICEX EA/OEA.

Though the configuration of equipment and/or the types of equipment used may differ between the ICEX EA/EOA and this Supplemental EA/OEA, the general activities will remain the same. The Proposed Action for this Supplemental EA/OEA differs from the ICEX EA/OEA action in that:

- No torpedo exercises would occur
- Eastward expansion of the ice camp Study Area

The Proposed Action, as well as the construction and demobilization of the ice camp, would occur over approximately six-week period from February through April (considered winter through early spring). The submarine training and testing and the research activities would occur over approximately four weeks during the six-week period. Graywater and reverse osmosis reject water discharges would occur over five and four weeks, respectively. Neither graywater nor reverse osmosis reject water would be discharged during the construction of the ice camp. Additionally, the reverse osmosis unit is expected to be the primary means of generating freshwater. The camp should be fully functional within five days after initial flights to drop-off equipment have been made.

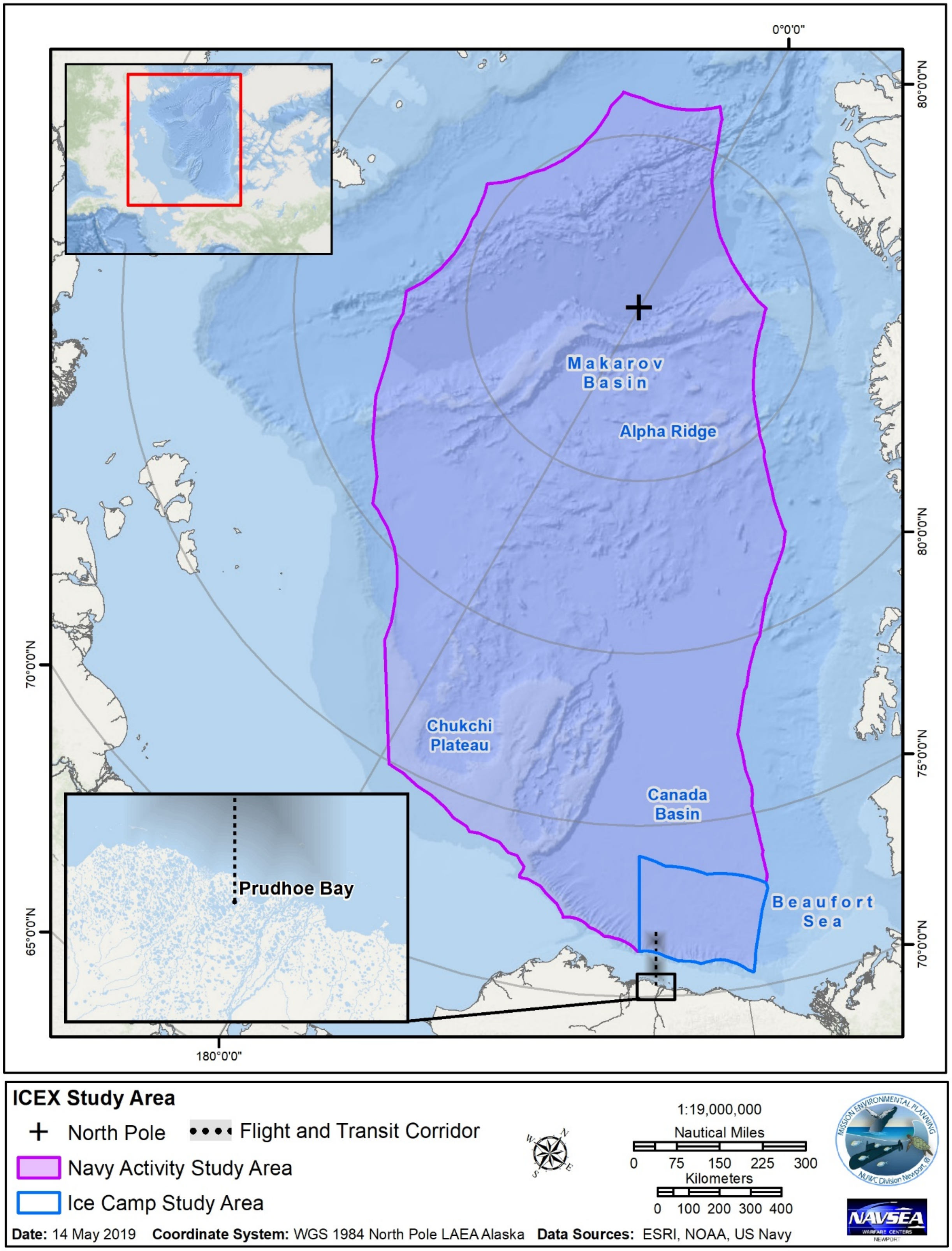


Figure 2-1. ICEX Study Area

2.1.1 Ice Camp

For the purposes of this Supplemental EA/OEA, the ice camp would operate in the same manner as was described in the ICEX EA/OEA. The ice camp would consist of a command hut, dining tent, sleeping quarters, tents to house temporary visitors, an outhouse, a powerhouse, runway, and helipad (Figure 2-2). The number of structures/tents ranges from 10 to 20, and are typically 2 to 6 meters (m) by 6 to 10 m in size. Some tents may be octagon shaped that are approximately 6 m in diameter. Berthing tents would contain bunk beds, a heating unit, and a circulation fan. The completed ice camp, including runway, is approximately 1.6 kilometers (km) in diameter. Support equipment for the ice camp includes snowmobiles, gas powered augers and saws (for boring holes through the ice), and diesel generators.

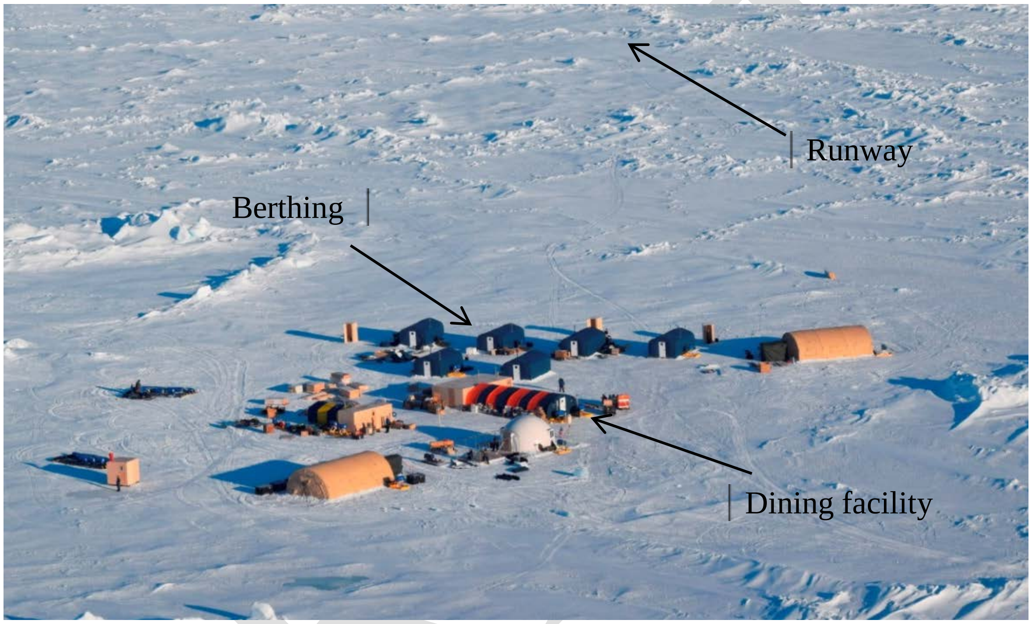


Figure 2-2. Example Ice Camp

All ice camp materials, fuel, and food would be transported from Prudhoe Bay, Alaska, and delivered by air-drop from military transport aircraft (e.g., C-17 and C-130), or by landing at the ice camp runway (e.g., small twin-engine aircraft and military and commercial helicopters). Aircraft would 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. During ice camp operations, one to three round trips per day would occur. At the completion of ICEX, the ice camp would be demobilized, and all personnel and materials would be removed from the ice floe. All shelters, solid waste, hazardous waste, and sanitary waste would be removed from the ice upon completion of ICEX and disposed of in accordance with applicable laws and regulations.

A portable tracking range for submarine training and testing would be installed in the vicinity of the ice camp; ten hydrophones, located on the ice and extending to 100 m below the ice, would be deployed. The hydrophones would be deployed by drilling/melting holes in the ice and lowering the cable down into the water column. Hydrophones would be linked remotely to the command hut. Acoustic communications with the submarines would be used to coordinate the training and research schedule with the submarines; an underwater telephone would 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 would be left in place.

Freshwater would be primarily generated at the camp via reverse osmosis, secondary freshwater collection would be via ice mining which entails collecting and melting of multi-year ice. Freshwater would only be made available in the camp's dining facility. This water would be available for limited food preparation, dishwashing, and human consumption. Additionally, a hygiene station would be available at the ice camp for hand washing. The hygiene station would be located in the dining facility and consist of a gravity fed container which would provide water for hand sanitizing and/or face washing if needed. The hygiene station would utilize the same drain as the kitchen sink for grey water discharge. No shower facilities would be available at the camp.

Dishwashing and a hygiene station would use biodegradable, chlorine-, and phosphate-free detergent that meets the Environmental Protection Agency's Safer Choice standards (U.S. Environmental Protection Agency 2015). Prior to use, dishwashing water would be heated using an on-demand propane water heater. Wastewater generated during food preparation and dishwashing would be discharged to the Beaufort Sea via a single drain in the camp's dining facility. The drain would consist of a corrugated pipe, wrapped in electric heat tape to prevent the pipe from freezing, which would be placed through a hole drilled/melted into the ice. The drain would utilize a removable metal screen to capture solid debris (i.e., food particles) in the wastewater prior to discharge. The metal screen would have a mesh size of no greater than 0.16 centimeters (cm). Solids captured in the screen would be disposed of via the camp's solid waste containers and brought back to Prudhoe Bay, Alaska, for disposal. A tray ration heater would be used for the majority of food preparation. The tray ration heater utilizes approximately 20 gallons of heated potable water per meal to heat trays of individual rations. The water used for warming rations will be reused since the food would never come in direct contact. The use of the tray ration heater would largely eliminate the need to wash utensils and food preparation serving dishes, since the ration packaging and utensils will be disposed of in the ice camp's solid waste containers. The camp would have an average discharge rate of 100 gallons per day, with a maximum discharge rate of 195 gallons per day during the two weeks of peak camp operations. The estimated total discharge from the ice camp's dining facility is 2,925 gallons.

Most freshwater for drinking and cooking would be produced by reverse osmosis through desalination. However, the camp may also utilize 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 would also 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 144 gallons per 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 would be approximately 288 gallons per day. The extreme conditions of the ice camp would influence both the system's efficiency and ability to operate, which is why the output from the system would be variable. Assuming continuous operation (24 hours per day) for the 4 weeks of camp operations (excluding a week each for construction and demobilization), a maximum total discharge of reject water from the ice camp would be 8,064 gallons.

Sanitary/human waste generated at the camp would be collected in zero-discharge sanitary facilities (e.g., barrels lined with a plastic bag), which would then 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. These areas (used for expeditionary forces) would 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 would be removed from the ice upon completion of the activities.

2.1.2 Prudhoe Bay

During the Proposed Action, flights to and from Prudhoe Bay would utilize the public airport in Deadhorse, Alaska. Up to nine round trips could occur daily during camp mobilization and demobilization. Regular round trips to the camp would average approximately one to three per day, in addition to the regular traffic occurring at the airport. All flights would leave from Deadhorse Airport and fly directly to the ice camp. The approximate flight and transit corridor is shown in Figure 2-1. The flight corridor is approximately 25 miles wide and would be the most direct route to the camp.

An average of 6 to 12 personnel would stay at the local lodging facilities during the duration of the ICEX. Since the personnel would be staying in commercial lodging facilities, they would easily be absorbed into the communities' infrastructure and would not require any additional resources. The community is set up for transient type communities and handling influxes of groups such as oil and gas employees. The additional personnel would not impact any other resources because of the minimal amount of time spent in the area and the concentration of people moving from lodging to the ice camp.

2.1.3 Submarine Training and Testing

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

2.1.4 Research Activities

Personnel and equipment proficiency testing and multiple research and development activities would be conducted (Table 2-1). Each type of activity scheduled for ICEX has been reviewed and placed into one of seven general categories of actions (Table 2-1); these categories of actions are analyzed herein. Due to the uncertainty of extreme cold, some activities may not be able to be conducted. Therefore, Table 2-1 is a potential list of activities, which may occur at the ice camp. All researcher personnel traveling to the ice camp would be berthed at the established ice camp facilities.

Table 2-1. 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	Aerial Data Collection	Aircraft	Use of manned aircraft and sensors to collect ice and snow thickness data and to validate/calibrate satellite measurements.
		Balloon	Launch of balloons to collect atmospheric data, primarily for weather forecasting.
	In-water Device Data Collection	Buoy	Deployment of surface buoys through the ice to collect measurements of conductivity, temperature, and ocean/ice fluxes.
		Array	Use of acoustic arrays to collect data on ambient noise, as well as determine signal propagation through Arctic environments.
	Personnel/ Equipment Proficiency	Diving Evolutions	Diver personnel conduct cold water diving evolutions under the ice using various equipment.
		Personnel/ Equipment Air-Drop	Fixed-wing and rotary-wing aircraft deliver paratroopers and equipment to the ice camp. Equipment is dropped by parachute to support camp operations (e.g., food, fuel, building materials) as well as to test search and rescue equipment delivery capability.
		Aircraft Landing Evaluation	Military aircraft are flown to the ice camp to evaluate the use of landing skis on an ice flow runway in the Arctic environment.
	Unmanned Aerial System Testing	Fixed-Wing	Fixed-wing unmanned aerial systems are launched by hand or pneumatic catapult. Fixed-wing systems may have up to a 3 m wingspan and fly at speeds up to 80 knots.
		Rotary-Wing	Rotary-wing unmanned aerial systems ("quadcopters") used individually or simultaneously. Rotary-wing systems are approximately 51 cm square and fly at speeds up to 30 knots.
	Unmanned Underwater Vehicle Testing	Vehicle Testing	Autonomous and tethered unmanned underwater vehicles deployed to test navigation, control, and communications in the polar environment, as well as to gather data on existing oceanographic conditions.

2.2 Platform Descriptions

Typical platforms used for ice camp logistics and those necessary to support proposed research activities include on-ice vehicles (e.g., snowmobiles), aircraft, unmanned vehicles (both aerial and underwater), and passive devices. Although details on some specific systems are provided as examples, the general categories of platforms are analyzed for their potential effect to the environment. No additional platforms have been proposed that have not been previously analyzed in the ICEX EA/OEA; therefore, platform descriptions (i.e., on-ice vehicles, aircraft, unmanned devices, and passive scientific devices) can be found in the ICEX EA/OEA.

2.2.1 Scientific Devices

Various passive acoustic devices would be used for data collection, including weather balloons, a vertical array, and buoys.

2.3 Alternatives

Screening criteria were used in the development and selection of alternatives for ICEX EA/OEA. These criteria were developed based upon training and testing requirements, as well as geographic and temporal limitations associated with the Arctic. Screening criteria for the selection of alternatives include:

(1) ICEX must be conducted during a time of year when there are sufficient hours of daylight to support several hours of training and testing each day.

(2) The training location must be on a large area of stable ice that does not have (and is not likely to develop) open leads or “gaps” and can sustain a runway and a camp for several weeks.

(3) The location must have sufficient water depth to accommodate safe submarine activities.

(4) The location must be in sufficient proximity to shore logistics centers to allow for transfers of personnel and equipment to and from the ice camp.

For the purposes of this Supplemental EA/OEA, only two alternatives will be addressed herein: a No Action Alternative and the Proposed Action.

2.3.1 No Action Alternative

Under the No Action Alternative, ICEX would occur as it was analyzed in the ICEX EA/OEA. This alternative requires no subsequent analysis of potential consequences to environmental resources, as all potential consequences to environmental resources have already been analyzed.

2.3.2 Proposed Action

Under the Proposed Action, the Navy would conduct the submarine training and testing activities as described in Section 2.1; in contrast to the ICEX in 2018, the Proposed Action would not include torpedo exercises. The ice camp would be established approximately 100–200 nautical miles north of Prudhoe Bay, Alaska, and the exact location cannot be identified ahead of time as required conditions (e.g., ice cover) cannot be forecasted until exercises are expected to commence. The vast majority of submarine training and testing would 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 2-1). Though the Study Area is large, the area where the proposed ice camp would be located is a much smaller area (See ice camp proposed action area on Figure 2-1). Prior to the set-up of the ice camp, reconnaissance flights would be conducted to locate suitable ice conditions required for the location of the ice camp. The reconnaissance flights would occur over an area of approximately 70,374 square kilometers (km^2); the actual ice camp is no more than 1.6 km in diameter (approximately 2 km^2 in area). The research activities would involve gathering data on environmental conditions and evaluating various technologies in Arctic conditions. Research activities are conducted for acoustic data collection to assess the effects of the changing arctic environment on acoustic propagation which, among other things, is critical to provide a better understanding of how military equipment, sensors and training and operations events may be affected by the changing arctic environment effects to acoustic propagation.

2.3.3 Alternatives Eliminated from Further Consideration

Other action alternatives considered but not carried forward for detailed analysis include geographic, seasonal, and operational variations. As discussed in the screening criteria (Section 2.3), holding ICEX in a different location (i.e., Study Area), or at a different time of year, would not satisfy the purpose and need. For example, holding ICEX closer to shore would not afford sufficiently thick ice to support an ice camp as well as the submarine tracking range to conduct the required submarine training and testing. Additionally, submarines need a relatively deep depth in which to operate. Positioning the camp further from shore would put the camp beyond the reach of logistics support required to sustain the activity. Seasonal alternatives are likewise not feasible because the combination of ice conditions and sufficient daylight required to support the ice camp are only available in the timeframe identified for the Proposed Action.

Finally, altering how submarine training and testing is conducted (e.g., reducing source level or limiting duration) is not feasible because the training and test plans are designed to specifically meet or test certain objectives. Conducting the training and testing differently would not meet the purpose and need of these requirements. Therefore, the Study Area identified in Figure 2-1 is the only suitable location, February through April is the only suitable timeframe, and the Proposed Action must be conducted as proposed to meet training and testing objectives.

2.4 RESOURCE ANALYSIS

As part of the process to determine the potential impact from the Proposed Action, the Navy identified potential resources and issues to be analyzed (Table 2-3). Table 2-4 lists the resources eliminated from further analysis and provides an explanation for their dismissal.

Table 2-2. Relevant Resources and Potential Effects of the Proposed Action

Resource	Potential Stressors
Biological Environment	
Mammals	Acoustic transmissions, aircraft noise, on-ice vehicle noise, on-ice vehicle strike, in-water vessel and vehicle strike, human presence, entanglement, and ingestion have the potential to impact marine mammals.

Table 2-3. Resources Eliminated from Analysis

Resource	Reason for Elimination
Physical Environment	
Airspace	The majority of Proposed Action would occur in the water or on the ice surface. Aircraft would depart from Deadhorse, Airport in Prudhoe Bay, but with a maximum of nine flights per day at the height of the exercise, would not have an impact to airspace use. All flights would be coordinated with the airport and would not create undue congestion of airspace. Low flying aircraft may be used for a portion of the training and testing but would not interfere with regular public airspace usage given that the offshore location is not a frequently used flight corridor. Therefore, the Proposed Action would not impact use of airspace.
Floodplains and Wetlands	The Proposed Action would occur in open water and would not impact the physical attributes of floodplains or wetlands. Therefore, the Proposed Action would not impact floodplains or wetlands.
Geology	No construction or dredging is planned as part of the Proposed Action. Therefore, the Proposed Action would not impact geological resources.
Land Use	The Proposed Action would occur in offshore of Prudhoe Bay, Alaska on ice-covered water and not on land. Therefore, the Proposed Action would not impact land use.
Terrestrial Environment	The Proposed Action would occur offshore, except for aircraft flights from Deadhorse Airport, in Prudhoe Bay. Because the Proposed Action would take place during the winter and early spring no biological resources would be present within the Deadhorse Airport, in Prudhoe Bay, so further analysis of these terrestrial resources are not included. Therefore, the Proposed Action would not impact the terrestrial environment including parks, forests, and prime and unique farmland.
Wild and Scenic Rivers	The Proposed Action would occur on or in ocean waters. Therefore, the Proposed Action would not impact wild and scenic rivers.
Biological Environment	
Terrestrial Wildlife	With the exception of the Arctic fox, no other terrestrial wildlife is anticipated to occur at the ice camp. Therefore, no impact would occur to these species.
Deep Sea Corals and Coral Reefs	No deep sea corals or coral reefs are present in the Study Area. Therefore, no impact would occur to these species.
Sea Turtles	No sea turtles would be present in the Study Area. Therefore, no impact would occur to these species.
Socioeconomic Environment	
Aesthetics	Aircraft movements out of the Deadhorse Airport, in Prudhoe Bay would be consistent with the typical flights coming in and out of the airport. Vessel movements would be at least 100-150 nautical miles (nm) from shore and would be under the ice in the Study Area. Therefore, the Proposed Action would not impact aesthetics.
Archaeological and Historical Resources	No known archaeological or historical resources are located within the Study Area. Therefore, the Proposed Action would not impact archaeological and historical resources.
Commercial and Recreational Fisheries	There are no commercial or recreational fisheries near or in the Study Area. Therefore, the Proposed Action would not impact commercial and recreational fisheries.

Resource	Reason for Elimination
Commercial Shipping and Transportation	Although, there is a shipping lane in the Study Area (i.e. Northwest Passage) it is only used during late July through mid-October (depending on the route and year). Since this is outside of the timeframe of the Proposed Action there would be no impact to commercial shipping and transportation.
Cultural Resources	The Study Area is offshore of known cultural resources.
Environmental Justice	The Proposed Action would occur on the water and there would be no disproportionately high or adverse human health or environmental impacts on minority or low-income populations. Additionally, Prudhoe Bay does not have a minority of low income population. Therefore, the Proposed Action would not impact environmental justice.
Infrastructure	No modification of infrastructure would occur as a result of the Proposed Action. Therefore, the Proposed Action would not impact infrastructure.
Recreational Boating and Tourism	During the timeframe of the Proposed Action there would be no recreational boating and tourism in the Study Area. Therefore, the Proposed Action would not impact recreational boating and tourism.
Utilities	The Proposed Action would not occur near any utilities. Therefore, the Proposed Action would not impact utilities.

CHAPTER 3 EXISTING ENVIRONMENT

This chapter presents a description of the environmental resources which may be affected from the changes in the Proposed Action which differ from the ICEXEA/OEA.

All potentially relevant environmental resource areas were initially considered for analysis in the ICEX EA/OEA. The following resources were analyzed in the ICEXEA/OEA and are not further analyzed herein: Physical resources (air quality, bottom substrate, and water quality), biological resources (marine vegetation, invertebrates, marine birds, fish, and essential fish habitat, and mammals), and socioeconomic resources (subsistence hunting).

The potential impacts to the following resource areas are considered to be negligible or non-existent so they were not analyzed in the ICEX EA/OEA and will not be analyzed herein: physical environment (airspace, floodplains and wetlands, geology, land use, terrestrial environment, wild and scenic rivers), biological environment (terrestrial wildlife [excluding Arctic fox], deep sea corals and coral reefs, sea turtles), and socioeconomic resources (aesthetics, archaeological and historical resources, commercial and recreational fisheries, shipping and transportation, cultural resources, environmental justice, infrastructure, recreational boating and tourism, and utilities).

3.1 BIOLOGICAL RESOURCES

Biological resources include living, native, or naturalized plant and animal species and the habitats within which they occur. Plant associations are referred to generally as vegetation, and animal species are referred to generally as wildlife. Habitat can be defined as the resources and conditions present in an area that support a plant or animal.

Within the ICEX EA/OEA, biological resources were divided into six major categories: (1) marine vegetation, (2) invertebrates, (3) marine birds, (4) fish, (5) Essential Fish Habitat, and (6) mammals (marine and terrestrial). Only marine mammals are anticipated to potentially be impacted by the Proposed Action; therefore, only marine mammals are included herein, as the acoustic parameter changes have changed the potential marine mammal exposures.

3.1.1 Mammals

Marine mammals are found throughout the Study Area including on the sea ice and within the water column. All marine mammals are protected under the Marine Mammal Protection Act (MMPA), and some mammals, because they are threatened or endangered, are further protected by the Endangered Species Act (ESA). Table 3-1 lists the mammals, and stock designation, if applicable, that may be within the Study Area during the Proposed Action. Other species, such as bowhead and beluga whales (*Balaena mysticetus* and *Delphinapterus leucas*, respectively), and narwhals (*Monodon monoceros*), may inhabit the Study Area during other times of the year (Burns et al. 1981; Garland et al. 2015; Heide-Jørgensen 2009; Jefferson et al. 2008; Muto et al. 2016) but are not expected in the area during the Proposed Action. Details about the geographic range, habitat and distribution, hearing, and predator/prey interactions of each species expected to be present in the Study Area during the Proposed Action are included in the ICEX EA/OEA.

Table 3-1. Mammals Found in the Study Area during the Proposed Action

Common Name	Scientific Name	Stock(s) within the Study Area
Marine Mammals		
Bearded seal[1]	*Erignathus barbatus nauticus*[2]	Alaska[3]
Ringed seal[1]	*Phoca hispida*	Alaska[3]
Polar bear[1]	*Ursus maritimus*	Southern Beaufort Sea, Chukchi/Bering Sea

[1] Species currently listed as threatened under the ESA.
[2] Scientific name of subspecies within the Study Area
[3] Stock is designated by the MMPA.

The ringed seal is the only species for which there has been an update in the ESA listing status, and the update of that listing is further described below. There are no other changes associated with the life histories of the other marine mammal species within the Study Area.

3.1.1.1.a Ringed Seal

The ringed seal, specifically the Arctic/Bering Sea subspecies *Phoca hispida hispida,* occurs within the U.S. Exclusive Economic Zone (EEZ) of the Beaufort, Chukchi, and Bering Seas and overlaps with the Study Area (Kelly et al. 2009; Palo 2003; Palo et al. 2001). Currently, the ringed seal is listed as threatened under the ESA. In March 2016, the U.S. District Court for the District of Alaska in the case of *Alaska Oil & Gas Association v. National Marine Fisheries Service, et al.* (Case no:14-cv-00029-RRB) vacated the National Marine Fisheries Service's (NMFS) ESA listing of the Arctic/Bering Sea subspecies of ringed seals (*P. h. hispida*) as threatened under the ESA. On February 12, 2018, the U.S. Court of Appeals for the Ninth Circuit reversed the District Court's decision finding the listing determination of the arctic ringed seals as threatened to be arbitrary (Alaska Oil & Gas Ass'n v. Ross, 722 Fed. Appx. 666 [9th Cir. Feb. 12, 2018]). No critical habitat is currently designated. Critical habitat for the ringed seal that was proposed by NMFS in 2014 (79 FR 71714; December 3, 2014) would fall within the Study Area and includes all the contiguous marine waters from the coast line of Alaska to an offshore limit of the U.S. exclusive economic zone north of Alaska (Figure 3-1). The Arctic/Bering Sea subspecies is listed as depleted and strategic under the MMPA. For the purposes of this analysis, the Alaska stock of ringed seals, as designated under the MMPA, is considered to be the portion of the subspecies *P. h. hispida* that occurs within the U.S. EEZ of the Beaufort, Chukchi, and Bering Seas.

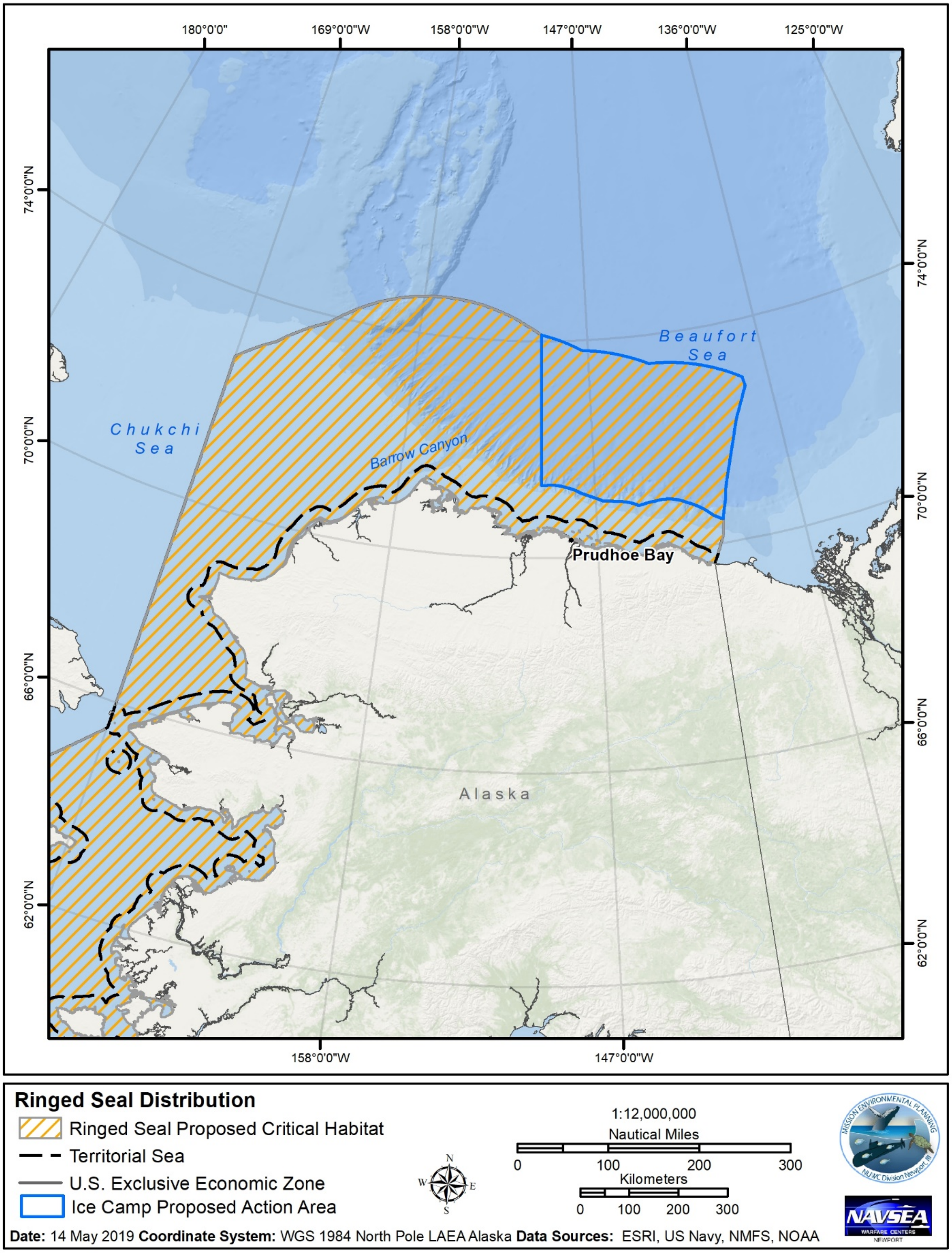
NMFS regulations (50 CFR § 424.12(b)) state that, in determining what areas qualify as critical habitat, the agencies "shall consider those physical and biological features that are essential to the conservation of a given species and that may require special management considerations or protection." These essential features "may include, but are not limited to, the following: spawning sites, feeding sites, seasonal wetland or dryland, water quality or quantity, geological formation, vegetation type, tide, and specific soil types."

In a proposed rule on December 3, 2014, NMFS identified areas used by ringed seals along with a description of those features essential to conservation. These three features are as follows:

1) Sea ice habitat suitable for the formation and maintenance of subnivean birth lairs used for sheltering pups during whelping and nursing.

2) Sea ice habitat suitable as a platform for basking and molting, which is defined as sea ice of 15 percent or more concentration, except for bottom-fast ice extending seaward from the coastline in waters less than 2 m deep.

3) Primary prey resources to support Arctic ringed seals, which are defined to be Arctic cod, saffron cod, shrimps, and amphipods.

1 

2 **Figure 3-1. Ringed Seal Distribution in Study Area**

NMFS determined that the essential features of the habitat of the Arctic ringed seal may require special management considerations or protection in the future to minimize the risks posed to these features by potential shipping and transportation activities. The reason for this was because: (1) both the physical disturbance and noise associated with these activities could displace seals from favored habitat that contains the essential features, thus altering the quantity and/or quality of these features; and (2) in the event of an oil spill, sea ice essential for birth lairs and for molting could become oiled, and the quantity and/or quality of the primary prey resources could be adversely affected.

Ringed seals are the most common pinniped in the Study Area and have wide distribution in seasonally and permanently ice-covered waters of the Northern Hemisphere (North Atlantic Marine Mammal Commission 2004). Throughout their range, ringed seals have an affinity for ice-covered waters and are well adapted to occupying both shore-fast and pack ice (Kelly 1988b). Ringed seals can be found further offshore than other pinnipeds since they can maintain breathing holes in ice thickness greater than 2 m (Smith and Stirling 1975). Breathing holes are maintained by ringed seals' sharp teeth and claws on their fore flippers. They remain in contact with ice most of the year and use it as a platform for molting in late spring to early summer, for pupping and nursing in late winter to early spring, and for resting at other times of the year.

Ringed seals have at least two distinct types of subnivean lairs: haulout lairs and birthing lairs (Smith and Stirling 1975). Haulout lairs are typically single-chambered and offer protection from predators and cold weather. Birthing lairs are larger, multi-chambered areas that are used for pupping in addition to protection from predators. Ringed seals pup on both land-fast ice as well as stable pack ice. Lentfer (1972) found that ringed seals north of Barrow, Alaska (west of the ice camp proposed action area depicted in Figure 2-1), build their subnivean lairs on the pack ice near pressure ridges. Since subnivean lairs were found north of Barrow, Alaska, in pack ice, they are also assumed to be found within the sea ice in the ice camp proposed action area. Ringed seals excavate subnivean lairs in drifts over their breathing holes in the ice, in which they rest, give birth, and nurse their pups for 5–9 weeks during late winter and spring (Chapskii 1940; McLaren 1958; Smith and Stirling 1975). Snow depths of at least 50–65 cm are required for functional birth lairs (Kelly 1988a; Lydersen 1998; Lydersen and Gjertz 1986; Smith and Stirling 1975), and such depths typically are found only where 20–30 cm or more of snow has accumulated on flat ice and then drifted along pressure ridges or ice hummocks (Hammill 2008; Lydersen et al. 1990; Lydersen and Ryg 1991; Smith and Lydersen 1991). Ringed seals are born beginning in March, but the majority of births occur in early April. About a month after parturition, mating begins in late April and early May.

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). Passive acoustic monitoring 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 Barrow, Alaska, detected ringed seals in the area between mid-December and late May over the four year study (Jones et al. 2014). With the onset of the fall freeze, ringed seal movements become increasingly restricted and seals will either move west and south with the advancing ice pack with many seals dispersing throughout the Chukchi and Bering Seas, or remain in the Beaufort Sea (Crawford et al. 2012; Frost and Lowry 1984; Harwood et al. 2012). Kelly et al (2010a) tracked home ranges for ringed seals in the subnivean period (using shorefast ice); the size of the home ranges varied from less than 1 up to 27.9 km^2; (median is 0.62 km^2 for adult males and 0.65 km^2 for adult females). Most (94 percent) of the home ranges were less than 3 km^2 during the subnivean period (Kelly et al. 2010a). Near large polynyas, ringed seals maintain ranges up to 7,000 km^2 during winter and 2,100 km^2 during spring (Born et al. 2004). Some adult ringed seals return to the same small home ranges they occupied during the previous winter (Kelly et al. 2010a). The size of winter home ranges can, however, vary by up to a factor of 10 depending on the amount of fast ice; seal movements were more restricted during winters with extensive fast ice, and were much less restricted where fast ice did not form at high levels (Harwood et al. 2015).

Ringed seal population surveys in Alaska have used various methods and assumptions, had incomplete coverage of their habitats and range, and were conducted more than a decade ago; therefore, current, comprehensive, and reliable abundance estimates or trends for the Alaska stock are not available (Muto et al. 2016). Frost *et al*. (2004) conducted surveys within 40 km of shore in the Alaska Beaufort Sea during May-June 1996-1999, and observed ringed seal densities ranging from 0.81 seal/km^2 in 1996 to 1.17 seals/km^2 in 1999. Moulton *et al*. (2002) conducted similar, concurrent surveys in the Alaska Beaufort Sea during 1997-1999 but reported substantially lower ringed seal densities (0.43, 0.39, and 0.63 seals/km^2 in 1997-1999, respectively) than Frost *et al*. (2004). Using the most recent 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, which Kelly *et al*. (2010b) states is likely an underestimate since the Beaufort surveys were limited to within 40 km of shore.

In general, ringed seals prey upon fish and crustaceans. Ringed seals are known to consume up to 72 different species in their diet; their preferred prey species is the polar cod (Jefferson et al. 2008). Ringed seals also prey upon a variety of other members of the cod family, including Arctic cod (Holst et al. 2001), and saffron cod, with the latter being particularly important during the summer months in Alaskan waters (Lowry et al. 1980). Invertebrate prey seems to become prevalent in the ringed seals diet during the open-water season and often dominates the diet of young animals (Holst et al. 2001; Lowry et al. 1980). Large amphipods (e.g., *Themisto libellula*), krill (e.g., *Thysanoessa inermis*), mysids (e.g., *Mysis oculata*), shrimps (e.g., *Pandalus* spp., *Eualus* spp., *Lebbeus polaris*, and *Crangon septemspinosa*), and cephalopods (e.g., *Gonatus* spp.) are also consumed by ringed seals.

CHAPTER 4 ENVIRONMENTAL CONSEQUENCES

This chapter discusses the potential environmental consequences of the Proposed Action to the natural and physical environments described in Chapter 3, for which the analysis or stressors differ from the ICEX EA/OEA. The only stressor resulting from the Proposed Action that may potentially impact or harm the biological or physical environment which differs from the analysis in the ICEX EA/OEA is active acoustic transmissions. Therefore, only active acoustic transmissions will be analyzed for the impacts to the biological resources affected. The remaining environmental consequences are analyzed in the ICEX EA/OEA:

- Acoustic: aircraft noise, on-ice vehicle noise
- Physical: aircraft strike, on-ice vehicle strike, in-water vessel and vehicle strike, human presence
- Expended Material: bottom disturbance, entanglement, ingestion

Under the No Action Alternative, the ICEX in 2020 would occur as described in the ICEX EA/OEA; therefore, no additional analysis is included herein. Under the Proposed Action, all stressors except for acoustic transmissions would be the same as were analyzed in the ICEX EA/OEA. Impacts related to aircraft or in-water device noise, physical stressors, or chemical stressors are not analyzed herein, as the analysis is the same and the impacts would remain the same. The only difference between the No Action Alternative and the Proposed Action is the removal of torpedoes for upcoming ICEX, and associated changes to the active acoustic transmissions proposed for use; therefore, an analysis on this stressor will be presented herein.

4.1 ACOUSTIC STRESSORS

The only acoustic stressor analyzed from the Proposed Action are active acoustics. All other acoustic stressors are discussed in the ICEX EA/OEA and the analysis of those stressors has not changed.

4.1.1 Acoustic Transmissions

Both submarine training and research activities have acoustic transmissions that require quantitative analysis. Some acoustic sources are either above the known hearing range of marine species or have narrow beam widths and short pulse lengths that would not result in effects to marine species. Potential effects from these "*de minimis*" sources are analyzed qualitatively in accordance with current Navy policy. No research activities during ICEX 2020 would involve active acoustics above *de minimis* levels. Navy acoustic sources are categorized into "bins" based on frequency, source level, and mode of usage, as previously established between the Navy and NMFS (Department of the Navy 2013). These transmissions are associated with discrete events that may last up to 24 hours. Time between events would not have acoustic transmissions. All events would occur over an approximately four-week timeframe. Although details about submarine training events are classified, the analysis below includes submarine training activities.

In assessing the potential for impacts to biological resources from acoustic transmissions, a variety of factors must be considered, including source characteristics, animal presence and associated density, duration of exposure, and thresholds for injury and harassment for the species that may occur in the Study Area. The types of potential consequences to biological resources from acoustic sources can be grouped in the following categories:

Non-auditory injury: Non-auditory injury can occur to lungs and organs and can cause tissue damage. Resonance occurs when the frequency of the sound waves matches the frequency of vibration of the air filled organ or cavity, causing it to resonate. This can, in certain circumstances, lead to damage to the tissue making up the organ or air filled cavity. Tissue damage can also be inflicted directly by sound waves in cases of sound waves with high amplitude and rapid rise time.

Auditory injury: A severe condition that occurs when sound intensity is very high or of such long duration that the result is a Permanent Threshold Shift (PTS) or permanent hearing loss on the part of the listener. The intensity and duration of a sound that will cause PTS varies across species and even between individual animals. PTS is a consequence of the death of sensory hair cells of the auditory epithelia of the ear and a resultant loss of hearing ability in the general vicinity of the frequencies of stimulation (Myrberg 1990; Richardson et al. 1995).

Physiological disruption: Sounds of sufficient loudness can cause a temporary condition impairing an animal's hearing for a period of time, called a Temporary Threshold Shift (TTS). After termination of the sound, its characterized by a normal hearing ability returning over a period of time that may range anywhere from minutes to days, depending on many factors including the intensity and duration of exposure to the intense sound. The precise physiological mechanism for TTS is not well understood. It may result from fatigue of the sensory hair cells as a result of over-stimulation, or from some small damage to the cells that are repaired over time. Hair cells may be temporarily affected by exposure to the sound but they are not permanently damaged. Thus, TTS is not considered to be an injury (Richardson et al. 1995), although animals may be at some disadvantage in terms of detecting predators or prey in affected frequency bands while the TTS persists.

Behavioral disruption: Marine animals may exhibit short-term behavioral reactions such as cessation of feeding, resting, or social interaction, and may also exhibit alertness or avoidance behavior (Richardson et al. 1995).

Masking: The presence of intense sounds or sounds within a mammals hearing range in the environment potentially can interfere with an animal's ability to hear relevant sounds. This effect, known as "auditory masking," could interfere with the animal's ability to detect biologically relevant sounds such as those produced by predators or prey, thus increasing the likelihood of the animal not finding food or being preyed upon (Myrberg 1981; Popper et al. 2004). Masking only occurs in the frequency band of the sound that causes the masking condition. Other relevant sounds with frequencies outside of this band would not be masked.

The potential effects of acoustic transmissions on marine mammals are provided below. All other impacts from acoustic transmissions and other stressors would remain the same as the ICEX18 EA/OEA analysis and therefore, are not further analyzed.

4.1.1.1 Marine Mammals

The only marine mammal susceptible to impacts from acoustic transmissions from the Proposed Action are the bearded seals and ringed seal, as polar bears are anticipated to remain on the ice surface and not be exposed to acoustic transmissions in the water column. Though bearded seals are not anticipated to be within the ice camp area, they would be within the area of the drifting buoy, which has the potential to pass by the bearded seal habitat. In assessing the potential effects on ringed seals from the Proposed Action, a variety of factors must be considered, including source characteristics, animal presence, animal hearing range, duration of exposure, and impact thresholds for species that may be present. Potential acoustic impacts could include PTS, TTS, or behavioral effects. To make these assessments, a model was used to quantitatively estimate the potential number of exposures that could occur, followed by a qualitative analysis to account for other factors not reflected by the model.

The Navy Acoustic Effects Model (NAEMO) was used to produce a quantitative estimate of PTS, TTS, and behavioral exposures for bearded seals and ringed seals (See Appendix E of the ICEX EA/OEA for additional details on NAEMO and the modeling process). The Navy then further analyzed the data and conducted an in-depth qualitative analysis of the species distribution and likely responses to the acoustic transmissions based on available scientific literature. The determination of the effects to the bearded seals and ringed seals were based on this combination of quantitative and qualitative analyses.

4.1.1.1.a Quantitative Analysis

A quantitative analysis of the potential effects to bearded and ringed seals from the proposed acoustic transmissions was conducted using a method that calculates the total sound exposure level (SEL) and maximum sound pressure level (SPL) that a ringed seal may receive from the acoustic transmissions. NAEMO was used for all modeling analysis (U.S. Department of the Navy 2017b). Environmental characteristics (e.g., bathymetry, wind speed, and sound speed profiles) and source characteristics (i.e., source level, source frequency, transmit pulse length and interval, horizontal and vertical beam width and source depth) were used to determine the propagation loss of the acoustic energy, which was calculated using the Comprehensive Acoustic System Simulation/Gaussian Ray Bundle (CASS/GRAB) propagation model. Additionally, an under-ice model (Oceanographic and Atmospheric Master Library ICE) for surface interaction was implemented in NAEMO. The propagation loss then was used in NAEMO to create acoustic footprints. The NAEMO model then simulated source movement through the Study Area and calculated sound energy levels around the source. Animats, or representative animals, were distributed based on density data obtained from the Navy Marine Species Density Database (U.S. Department of the Navy 2017c). The Navy used a Seasonal Relative Environmental Suitability model (Kaschner et al. 2006), based on seasonal habitat preferences and requirements of known occurrences, such as temperature, bathymetry, and distance to land data and literature review, because occurrence information for bearded and ringed seals in the Study Area is not well known. Empirical data is coupled with Relative Environmental Suitability modeling data to generate predictions of density data for locations where no survey data exist. The energy received by each animat distributed within the model was summed into a total sound exposure level. Additionally, the maximum SPL received by each animat was also recorded.

NAEMO provides two outputs. The first is the number of animats recorded with received levels within 1 decibel (dB) bins at and greater than 120 decibels referenced to 1 micropascal (dB re 1 µPa) and the total SEL (in dB re 1 $\mu Pa^2 \cdot s$) for each animat, prior to effect thresholds being applied (referred to as unprocessed animat exposures). These results are used to determine if a marine mammal may be exposed to the acoustic energy resulting from the Proposed Action, but they do not infer that any such exposure results in an effect to the animal from the action. The second output, referred to as calculated exposures, is the predicted number of exposures that could result in effects as determined by the application of acoustic threshold criteria. Criteria and thresholds for measuring these effects induced from underwater acoustic energy have been established for phocids. The thresholds established for physiological effects (SELs for PTS and TTS) and behavioral effects are provided in Table 4-1 and are described in detail in National Marine Fisheries Service (2016).

Table 4-1. In-Water Criteria and Thresholds for Predicting Physiological and Behavioral Effects on Marine Mammals Potentially Occurring in the Study Area

Group	Behavioral Criteria	Physiological Criteria	
		Onset TTS	Onset PTS
Phocidae (in water)	Pinniped Dose Response Function*	181 dB SEL cumulative	201 dB SEL cumulative

*See Figure 4-1

Behavioral response criteria are used to estimate the number of exposures that may result in a behavioral response. The Navy has defined a mathematical function used to predict potential behavioral effects (Figure 4-1 provides the function used for pinnipeds). This analysis assumes that the probability of eliciting a behavioral response from individual animals to active transmissions would be a function of the received SPL (in dB re 1 µPa). This analysis also assumes that sound poses a negligible risk to marine mammals if they are exposed to SPLs below a certain basement value (120 dB re 1 µPa). Details regarding the behavioral risk function are provided in Department of the Navy (2017a).

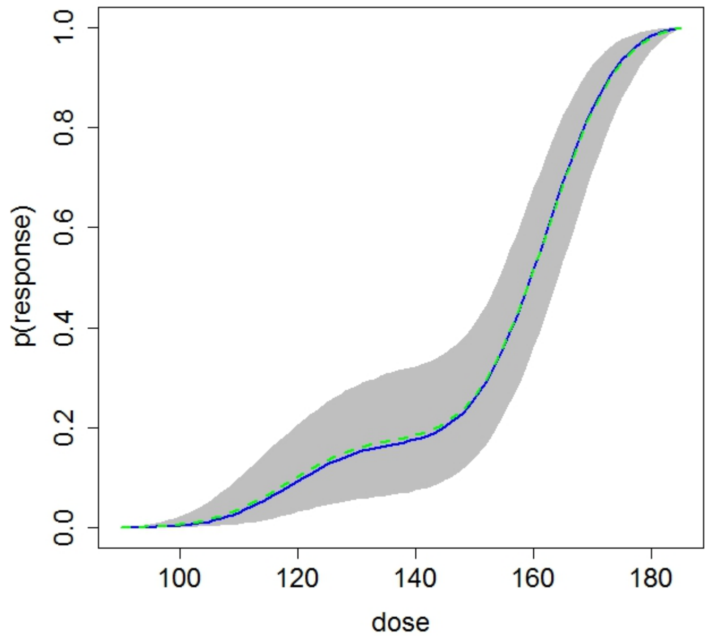


Figure 4-1. The Bayesian biphasic dose-response Behavioral Response Function for Pinnipeds. The blue solid line represents the Bayesian Posterior median values, the green dashed line represents the biphasic fit, and the grey represents the variance. [X-Axis: Received Level (dB re 1 µPa), Y-Axis: Probability of Response]

The results from the NAEMO acoustic analysis are provided in Table 4-2. NAEMO calculated that eleven ringed seals are likely to experience received SELs that may result in TTS. No bearded or ringed seals are likely to experience received SELs that may result in PTS. Due to the potential behavioral and TTS exposures, an incidental harassment authorization application was submitted to NMFS for take by Level B harassment of the bearded and ringed seals.

Table 4-2. NAEMO-Calculated Ringed Seal Exposures

Species	PTS (SEL of 201 dB re 1 µPa^2·s)	TTS (SEL of 181 dB re 1 µPa^2·s)	Behavior
Bearded Seal	0	1	3
Ringed Seal	0	11	1,395

These quantitative calculations were then analyzed qualitatively, taking into account the best available data on the species itself, and how the species has been observed to respond to similar types of influences.

4.1.1.1.b Qualitative Analysis

No research has been conducted on the potential behavioral responses of bearded seals or ringed seals to the type of acoustic sources used during the Proposed Action. However, data are available on (1) effects of non-impulsive sources (e.g., sonar transmissions) on other phocids in water, and (2) reactions of ringed seals while in subnivean lairs. All of this available information was assessed and incorporated into the findings of this analysis.

Effects of Non-impulsive Sources on Phocids in Water

For non-impulsive sounds (i.e., similar to the sources used during the Proposed Action), data suggest that exposures of pinnipeds to sources between 90 and 140 dB re 1 µPa do not elicit strong behavioral responses; no data were available for exposures at higher received levels for Southall et al. (2007) to include in the severity scale analysis. Reactions of harbor seals (*Phoca vitulina*) were the only available data for which the responses could be ranked on the severity scale. For reactions that were recorded, the majority (17 of 18 individuals/groups) were ranked on the severity scale as a 4 (moderate change in movement, brief shift in group distribution, or moderate change in vocal behavior) or lower; the remaining response was ranked as a 6 (minor or moderate avoidance of the sound source). Additional data on hooded seals (*Cystophora cristata*) indicate avoidance responses to signals above 160–170 dB re 1 µPa (Kvadsheim et al. 2010), and data on grey (*Halichoerus grypus*) and harbor seals indicate avoidance response at received levels of 135–144 dB 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 aimed to investigate the under-ice movements and sensory cues associated with under-ice navigation of ice seals, acoustic transmitters (60–69 kilohertz [kHz] at 159 dB re 1 µPa at 1 m) were attached to ringed seals (Wartzok et al. 1992a; Wartzok et al. 1992b). An acoustic tracking system then was installed in the ice to receive the acoustic signals and provide real-time tracking of ice seal movements. Although the frequencies used in this study are at the upper limit of ringed seal hearing, the ringed seals appeared unaffected by the acoustic transmissions, as they were able to maintain normal behaviors (e.g., finding breathing holes).

Seals exposed to non-impulsive sources with a received SPL within the range of calculated exposures, (142–193 dB re 1 µPa), have been 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).

Effects on Ringed Seals within Subnivean Lairs

Adult ringed seals spend up to 20 percent of the time in subnivean lairs during the timeframe of the Proposed Action (Kelly et al. 2010a). Ringed seal pups spend about 50 percent of their time in the lair during the nursing period (Lydersen and Hammill 1993). Ringed seal lairs are typically used by individual seals (haul-out lairs) or by a mother with a pup (birthing lairs); large lairs used by many seals for hauling out are rare (Smith and Stirling 1975). The acoustic modeling does not account for seals within subnivean lairs, and all animals are assumed to be in the water and susceptible to hearing acoustic transmissions 100 percent of the time. Therefore, the acoustic modeling output likely represents an overestimate given the percentage of time that ringed seals are expected to be in subnivean lairs, rather than in the water. Although the exact amount of transmission loss of sound traveling through ice and snow is unknown, it is clear that some sound attenuation would occur due to the environment itself. In-air (i.e., in the subnivean lair), the best hearing sensitivity for ringed seals has been documented between 3 and 5 kHz; at higher frequencies, the hearing threshold rapidly increases (Sills et al. 2015).

If the acoustic transmissions are heard and are perceived as a threat, ringed seals within subnivean lairs could react to the sound in a similar fashion to their reaction to other threats, such as polar bears and Arctic foxes (their primary predators), although the type of sound would be novel to them. Responses of ringed seals to a variety of human-induced noises (e.g., helicopter noise, snowmobiles, dogs, people, and seismic activity) have been variable; some seals entered the water and some seals remained in the lair (Kelly et al. 1988). However, in all instances in which observed seals departed lairs in response to noise disturbance, they subsequently reoccupied the lair (Kelly et al. 1988).

The Proposed Action would overlap with the beginning of the ringed seal pupping season, however, the camp would be built prior to the start of the start of the season and the exercise would be concluded before the height of the pupping season. Ringed seal mothers have a strong bond with their pups and may physically move their pups from the birth lair to an alternate lair to avoid predation, sometimes risking their lives to defend their pups from potential predators (Smith 1987). Additionally, it is not unusual to find up to three birth lairs within 100 m of each other, probably made by the same female seal, as well as one or more haul-out lairs in the immediate area (Smith et al. 1991). If a ringed seal mother perceives the acoustic transmissions as a threat, the network of multiple birth and haul-out lairs allows the mother and pup to move to a new lair (Smith and Hammill 1981; Smith and Stirling 1975). However, the acoustic transmissions are unlike the low frequency sounds and vibrations felt from approaching predators. Additionally, the acoustic transmissions are not likely to impede a ringed seal from finding a breathing hole or lair, as captive seals have been found to primarily use vision to locate breathing holes and no effect to ringed seal vision would occur from the acoustic transmissions (Elsner et al. 1989; Wartzok et al. 1992a). It is anticipated that a ringed seal would be able to relocate to a different breathing hole relatively easily without impacting their normal behavior patterns.

4.1.1.1.c Summary

The behavioral responses of bearded seals and ringed seals underwater sound vary. Non-impulsive sources have been shown to elicit minor or moderate avoidance responses from other phocids at the SPLs potentially received from the Proposed Action.

Submarine training and research activities would occur over an approximate four-week period during ICEX. During this time, the submarines, unmanned underwater vehicles, and active buoys would conduct intermittent acoustic events, and even during these events acoustic transmissions are not constant. The training and testing would occur in different locations and at different depths and speeds depending on the objective of the event. Transmissions from the submarines would occur within different locations but within the general area around the ice camp, so that they are within the tracking range acoustic boundary. As such, there likelihood of a single lair being exposed to the submarine activity for the entirety of the four-week period is low. Additionally, as the acoustic transmissions would not be conducted continuously for the four-week period, the short duration of the events would result in only short term reactions by ringed seals, after which time normal behavior would resume (Harris et al. 2001; Kvadsheim et al.

2010). An individual seal could potentially react to the acoustic transmissions by alerting to or temporarily avoiding the area close to the source (e.g., using a breathing hole/lair further from the source). Data show that likely reactions would be within the normal repertoire of the animal's typical movements, as seals routinely utilize a complex of breathing holes and/or lairs (Kelly et al. 1986; Smith and Hammill 1981; Smith and Stirling 1975). As most ringed seal lairs are only used by single seals or by a mother-pup pair, acoustic transmissions would not result in a significant abandonment of a haul-out location by many seals. These and similar reactions would not disrupt the animal's overall behavioral pattern (e.g., feeding or nursing), and would therefore not affect the animal's ability to survive, grow, or reproduce.

As described above, the sound sources in the Proposed Action are expected to result in, at most, minor to moderate avoidance responses of animals, over short and intermittent periods of time, and would likely not affect annual rates of recruitment or survival. Additionally, bearded seals are not expected to occur near the proposed ice camp area since they are closely associated with the ice edge, and are generally found over the continental shelf. The Proposed Action is not expected to cause significant disruptions such as mass haul outs, or abandonment of breeding, that would result in significantly altered or abandoned behavior patterns. Pursuant to NEPA, acoustic transmissions associated with the Proposed Action is not likely to significantly impact marine mammals. Pursuant to EO 12114, acoustic transmissions associated with the Proposed Action is not likely to significantly harm marine mammals. Since the acoustic transmissions from the Proposed Action may cause a behavioral effect (e.g., seal temporarily avoiding an area or using a different subnivean lair farther away from acoustic transmissions) the Navy applied and received an Incidental Harassment Authorization from NMFS for Level B take of bearded and ringed seals in accordance with MMPA. Given this, in accordance with the ESA, the acoustic transmissions in the Proposed Action may adversely affect the bearded seal and ringed seal, but is not likely to jeopardize the existence of either species.

4.2 SUMMARY OF ANALYSIS

The Proposed Action would not impact subsistence hunting as hunting does not occur within the Study Area during the timeframe of the Proposed Action for bearded and ringed seals.

The analysis provided in Chapter 3 and Chapter 4, describes how the Proposed Action under NEPA would not result in significant impacts to the physical or biological environment. In accordance with E.O. 12114, the Proposed Action as analyzed above would have not cause significant harm to the human or biological environment.

CHAPTER 5 CUMULATIVE IMPACTS

Chapter 5 in the ICEX EA/OEA: (1) defines cumulative impacts, (2) describes past, present, and reasonably foreseeable future actions relevant to cumulative impacts, (3) analyzes the incremental interaction the Proposed Action may have with other actions, and (4) evaluates cumulative impacts potentially resulting from these interactions. Based on the analysis in the ICEX EA/OEA and the past, present, and reasonably foreseeable future actions within the Study Area, ICEX was not be expected to considerably contribute to any cumulative impacts from all other actions and activities in the Beaufort Sea. As the Proposed Action is nearly identical to that described for ICEX, and other activities within the Study Area have not dramatically changed, the analysis for ICEX remains consistent with that in the ICEX EA/OEA.

CHAPTER 6 STANDARD OPERATING PROCEDURES AND MITIGATION MEASURES

The Navy has identified multiple measures that would further reduce and avoid potential impacts resulting from the Proposed Action. Both standard operating procedures and mitigation measures would be implemented during the Proposed Action. Standard operating procedures serve the primary purpose of providing for safety and mission success, and are implemented regardless of their secondary benefits (e.g., to a resource), while mitigation measures are used to avoid or reduce potential impacts.

Though the Proposed Action would utilize both standard operating procedures and mitigation measures in a variety of manners, the activities using active acoustics would utilize passive acoustic listening. Submarines conducting training activities would utilize passive acoustic sensors to listen for vocalizing marine mammals, and active transmissions would be halted in the event that vocalizing marine mammals are detected.

Additional mitigations were considered for research activities, however, because those activities that result in exposures to marine mammals occur under the ice, there are no methods to visually or acoustically monitor the area, therefore no additional mitigation is feasible.

6.1 STANDARD OPERATING PROCEDURES

The following procedures would be implemented:

- Ice camp activities and personnel movement within the camp will only occur during daylight hours to the maximum extent possible.
- 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.
- The location for any air-dropped equipment and material would be visually surveyed prior to release of the equipment/material to ensure the landing zone is clear. Equipment and materials would not be released if any animal is observed within the landing zone.
- Air drop bundles would be packed within a plywood structure with honeycomb insulation to protect the material from damage.
- Spill response kits/material would be on-site prior to the air-drop of any hazardous material (e.g. fuel).

6.2 MITIGATION MEASURES

In addition to the standard operating procedures above, the following mitigation measures would be implemented to reduce or avoid potential harm to marine resources.

- 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 observed on the ice.

- Submarines would utilize passive acoustic sensors to listen for vocalizing marine mammals. Submarine active transmissions would be halted in the event vocalizing marine mammals are detected.
- Passengers on all on-ice vehicles would observe for marine and terrestrial animals; any marine or terrestrial animal observed on the ice would be avoided by 100 m. On-ice vehicles would not be used to follow any animal, with the exception of actively deterring polar bears if the situation requires.
- Personnel operating on-ice vehicles would avoid areas of deep snow drifts near pressure ridges, which are preferred areas for subnivean lair development.
- Camp development is scheduled to begin mid-February and would be completed well before ringed seal pupping season begins. This allows ringed seals to avoid the camp area prior to pupping, further reducing potential impacts.
- All material (e.g., shelters, unused food, excess fuel) and wastes (e.g., solid waste, hazardous waste) would be removed from the ice floe upon completion of ICEX.
- Dish and hand soap would be selected from the U.S. Environmental Protection Agency's "Safer Choice" list.
- All cooking and food consumption would occur within designated facilities to minimize attraction of nearby animals.
- All personnel will be required to complete environmental compliance training including environmental health and safety procedures.

APPENDIX A SUBMARINE TRAINING AND TESTING ACTIVITIES

Details on the activities conducted by the participating submarines are classified. This appendix will be provided to authorized personnel upon request.

APPENDIX B PREPARERS

Name	Role	Education and Experience
Naval Undersea Warfare Center, Division Newport		
Code 1023, Environmental Branch, Mission Environmental Planning Program		
Jen James	Project Lead, Project Coordination, Document Development	MESM Wetlands Biology, B.S. Wildlife Biology and Management. Experience: 15 years Environmental Planning, Biological Research 18 years.
Emily Robinson	Document Development	Masters of Environmental Science and Management, B.S. Integrated Science and Technology. Experience: 5 years Environmental Planning
Laura Sparks	GIS Support	Masters of Environmental Science and Management, B.A. Political Science, B.A. Marine Affairs. GIS Experience: 6 years

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