

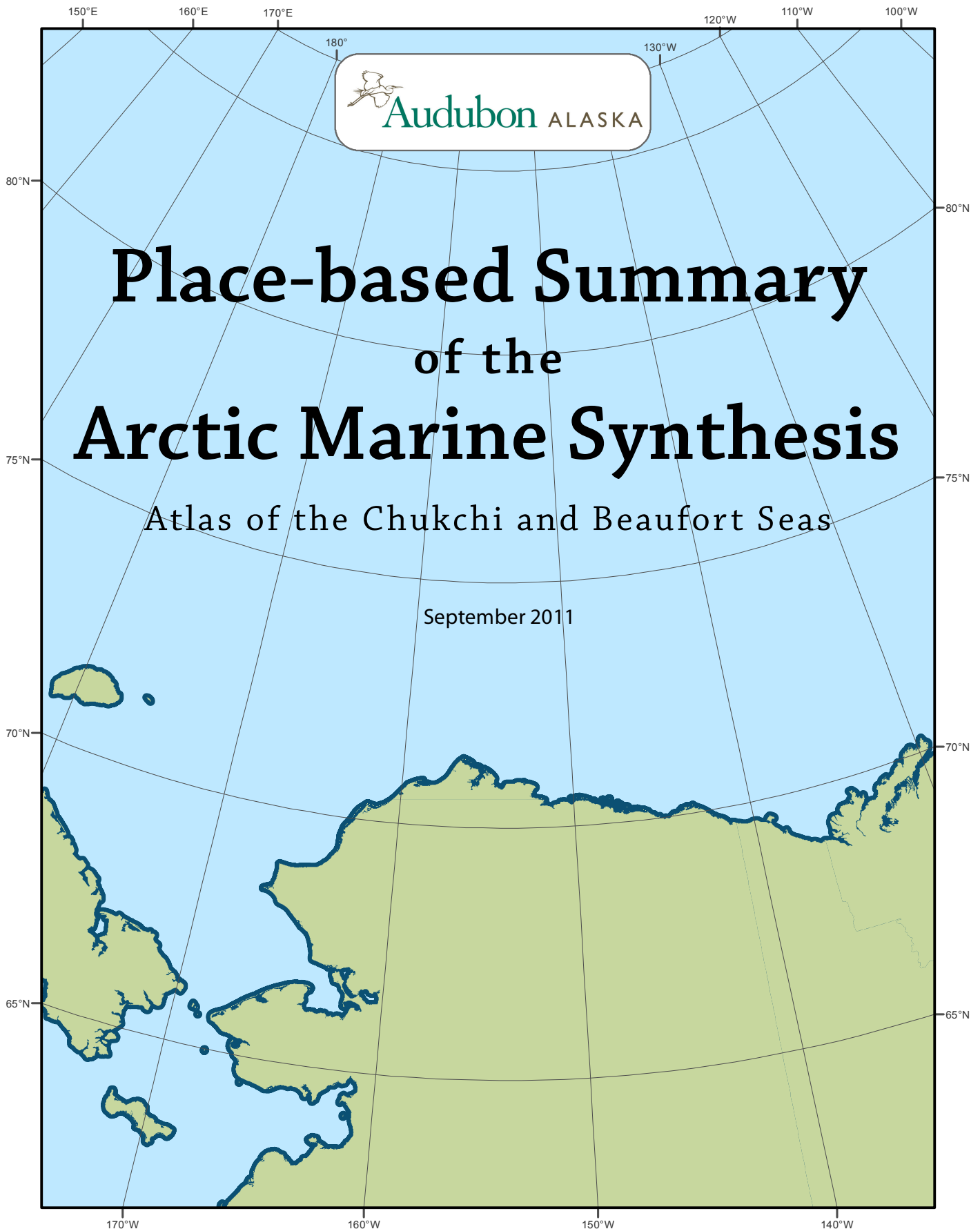


Audubon ALASKA

# Place-based Summary of the Arctic Marine Synthesis

Atlas of the Chukchi and Beaufort Seas

September 2011





# Place-based Summary of the Arctic Marine Synthesis

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## INTRODUCTION

In early 2010, Audubon Alaska, in cooperation with Oceana, completed the [Arctic Marine Synthesis: Atlas of the Chukchi and Beaufort Seas](#). The project area included the southern Beaufort, southern Chukchi, and northern Bering seas. The atlas provided a holistic look at the dynamic Arctic Ocean ecosystem through 44 maps describing the region's physical oceanography, water column and benthic life, fish, birds, mammals, and human influences.

The Arctic Marine Synthesis has become a valuable tool for scientists and policymakers seeking to better understand the region's physical attributes, ecological interactions, and the distribution and concentration of marine wildlife. Other organizations have also found this useful for setting conservation priorities and providing information for designing balanced management plans in the Arctic region. The US Geological Survey also featured information from the Synthesis in a recent [report on scientific research needed to inform decisions about leasing](#) the Outer Continental Shelf (OCS).

This document builds upon the original synthesis, which was organized by topics, each presented on a map covering the whole project area. In the Place-based Summary of the Arctic Marine Synthesis, the information has been reorganized into "factsheets" that tell how the ecological layers fit together for each area described. Current uses, conservation status, and threats are all discussed. Each factsheet summarizes the important physical and biological attributes in the area, forming a base for more in-depth research. This new document was developed to highlight important information and to make that information even more user-friendly.

Through the process of collecting and mapping data for the original Arctic Marine Synthesis, certain patterns and places became evident as important to the marine ecosystem. With the available information we attempted to identify and draw boundaries around those places, then summarize the physical and biological setting within those boundaries. Not every place mapped is of equal ecological significance. Likewise, places not mapped are not intended to be construed as unimportant. Some places were not included where there are major data deficiencies and the true importance of the area is not yet known (for example, the Chukchi Sea OCS Program Area between Hanna and Herald Shoals, and the Canada Basin). Drawing boundaries for each place was done using professional judgment informed by the approximately 125 spatial data layers and 400 articles and reports collected for the Arctic Marine Synthesis. Boundaries reflect a blending of various attributes: bathymetry, location of the ice edge throughout the year, ocean currents, pelagic and benthic productivity hotspots, migration corridors, haulout areas, nesting colonies, and foraging areas.

While there are significant limitations on the quality and quantity of data available to describe the Arctic marine ecosystem, this document summarizes what is known and provides the type of information that can be useful when identifying important places of conservation concern. Several such projects are currently underway. The International Union for the Conservation of Nature (IUCN) and the Natural Resources Defense Council (NRDC) recently released their report on [Ecologically and Biologically Significant Areas \(EBSAs\) in the Arctic Ocean](#). Audubon participated in that effort, and this Place-based Summary of the Arctic Marine Synthesis provides finer-scale boundaries and a deeper level of ecological

information for EBSAs identified in the Chukchi, Beaufort, and northern Bering seas. Audubon Alaska, Audubon California, BirdLife International, and Bird Studies Canada are using the latest pelagic survey and seabird colony data for the North Pacific to identify marine [Important Bird Areas](#) from Alaska's Beaufort Sea to Baja California in Mexico. Oceana continues to work with Native communities to map local and traditional knowledge and subsistence areas, and to use Marxan modeling to identify [Important Ecological Areas](#).

We encourage others to use these place-based summaries for planning and education, and to help guide additional scientific data collection and analysis for the extraordinary resources in this region. From shipping, to energy development, to fisheries management, to climate change, exceptional pressures are anticipated in the Arctic marine environment. We created the original Arctic Marine Synthesis and this Place-based Summary to provide scientists, educators, policymakers, and land managers with information they need to make sound, science-based decisions for management and conservation of the Arctic Ocean.

**Table 1 Places Described**

Place Name	Location	Ownership
St. Lawrence Island	Bering Sea	US, Russia
Chirikov Basin	Bering Sea	US, Russia
Norton Sound	Bering Sea	US
Southeastern Chukotka Peninsula <sup>1</sup>	Bering Sea	Russia
Bering Strait	Bering Sea, Chukchi Sea	US, Russia
Diomed Islands	Bering Sea, Chukchi Sea	US, Russia
Seward Peninsula	Bering Sea, Chukchi Sea	US
Kotzebue Sound	Chukchi Sea	US
Hope Basin	Chukchi Sea	US, Russia
Northern Chukotka Peninsula <sup>1</sup>	Chukchi Sea	Russia
Wrangel & Herald Islands <sup>1</sup>	Chukchi Sea	Russia
Herald Shoal <sup>1</sup>	Chukchi Sea	Russia, US
Cape Thompson & Cape Lisburne	Chukchi Sea	US
Ledyard Bay	Chukchi Sea	US
Kasegaluk Lagoon	Chukchi Sea	US
Chukchi Lead System	Chukchi Sea	US
Hanna Shoal	Chukchi Sea	US
Peard Bay	Chukchi Sea	US
Barrow Canyon	Beaufort Sea, Chukchi Sea	US
Dease Inlet & Elson Lagoon	Beaufort Sea	US
Smith & Harrison Bays	Beaufort Sea	US
Western Beaufort Shelf & Lead System	Beaufort Sea	US
Beaufort Lagoons & Barrier Islands	Beaufort Sea	US, Canada
Eastern Beaufort Shelf & Lead System <sup>1</sup>	Beaufort Sea	Canada
MacKenzie River Delta <sup>1</sup>	Beaufort Sea	Canada

<sup>1</sup>Factsheets describing areas in non-US waters have not yet been completed.

## **ARCTIC MARINE SYNTHESIS: ATLAS OF THE CHUKCHI AND BEAUFORT SEAS**

(Click on text below to hyperlink to report chapters and maps)

Cover, Title Page

### **INTRODUCTION**

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20. Red-throated Loon
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35. Ribbon Seal
36. Spotted Seal
37. Ringed Seal
38. Bearded Seal

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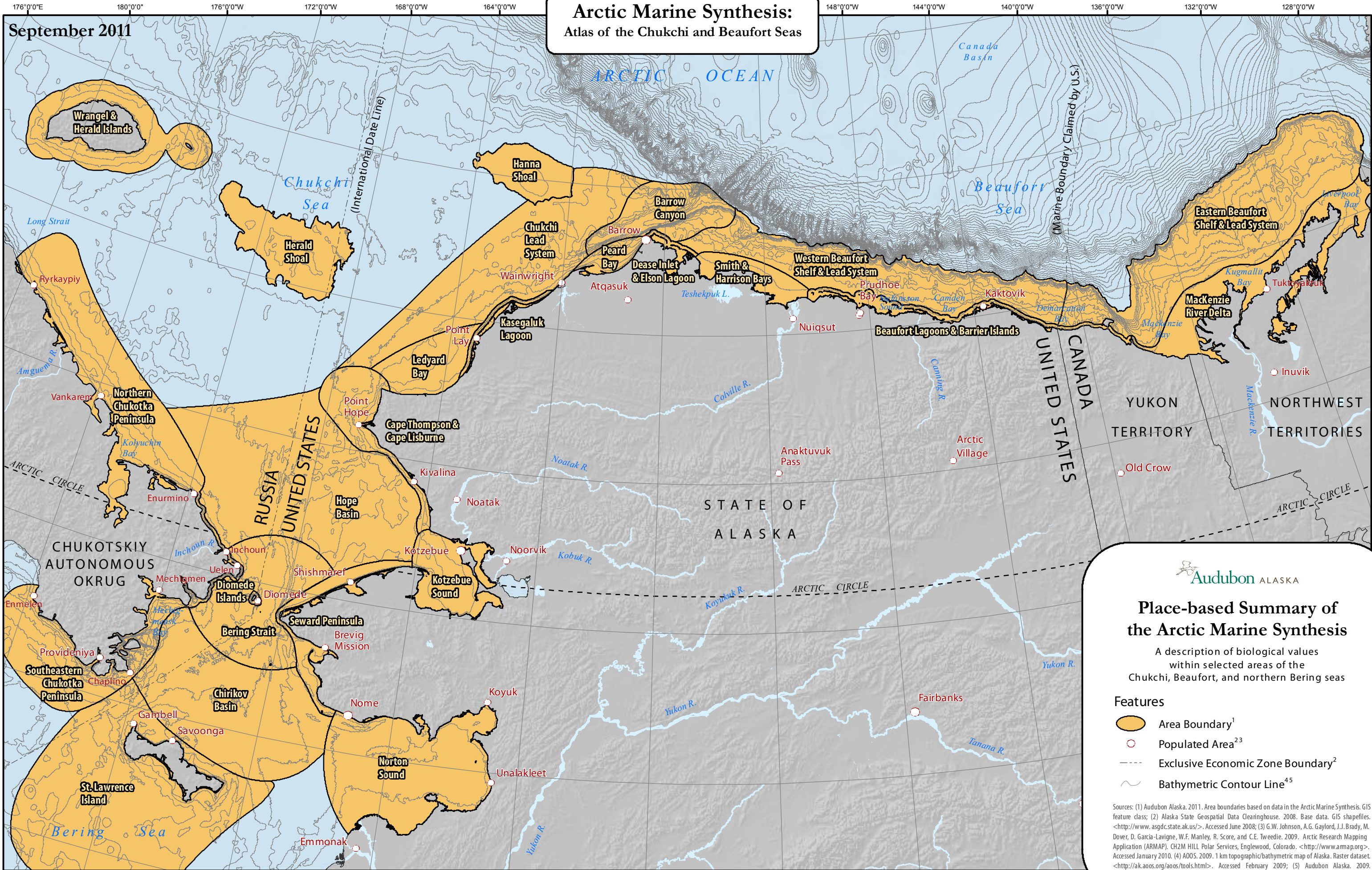
39. Bowhead Whale
40. Beluga Whale
41. Gray Whale


### **PEOPLE**

42. Energy Development and Protected Areas
43. Human Impact
44. Predicted Climate Change

### **REFERENCES**











### Place-based Summary of the Arctic Marine Synthesis

A description of biological values within selected areas of the Chukchi, Beaufort, and northern Bering seas

**Features**

-  Area Boundary<sup>1</sup>
-  Populated Area<sup>2,3</sup>
-  Exclusive Economic Zone Boundary<sup>2</sup>
-  Bathymetric Contour Line<sup>4,5</sup>

Sources: (1) Audubon Alaska. 2011. Area boundaries based on data in the Arctic Marine Synthesis. GIS feature class; (2) Alaska State Geospatial Data Clearinghouse. 2008. Base data. GIS shapefiles. <<http://www.asgdc.state.ak.us/>>. Accessed June 2008; (3) G.W. Johnson, A.G. Gaylord, J.J. Brady, M. Dover, D. Garcia-Lavigne, W.F. Manley, R. Score, and C.E. Tweedie. 2009. Arctic Research Mapping Application (ARMAP). CH2M HILL Polar Services, Englewood, Colorado. <<http://www.amap.org>>. Accessed January 2010. (4) AOS. 2009. 1 km topographic/bathymetric map of Alaska. Raster dataset <<http://ak.aos.org/aos/tools.html>>. Accessed February 2009; (5) Audubon Alaska. 2009. Bathymetric contour lines. GIS feature class (based on AOS 2009).

This map is based on the best available data, which varies in quality across the project area. Areas not included generally have less available information. For more information on data quality and knowledge gaps, see the *Arctic Marine Synthesis* and the factsheets associated with this map.



## ST. LAWRENCE ISLAND MARINE

### Description of Area

St. Lawrence Island is located in the northern Bering Sea south of the Bering Strait, between Norton Sound and the Chukotka Peninsula. The two largest communities are Gambell and Savoonga, with about 650 residents each (Map 1). Marine waters surrounding the island average about 40 to 60 meters deep (Map 2). The island is an important meeting place for wildlife moving between the Bering Sea and the Arctic Ocean.

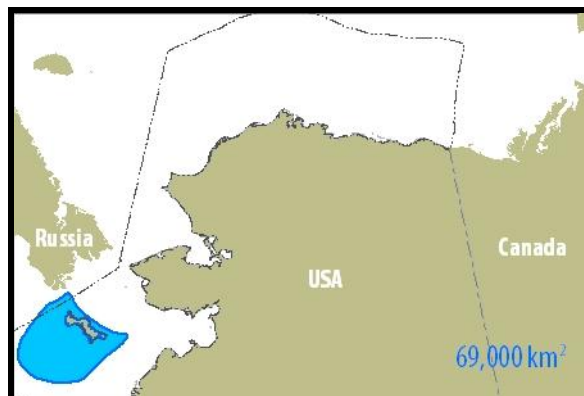
Three major ocean currents flow past St. Lawrence Island before flowing north through the Bering Strait (Map 4). Salty, nutrient-rich Anadyr Water flows along the Russian coast on the west edge of the island. Low-salinity, nutrient-poor Alaska Coastal Current water and nutrient rich Bering Shelf Water pass the east side of the island.

Beginning in December, wind-driven winter sea ice flows southward around St. Lawrence Island, creating an open water polynya and associated leads on the south side (Map 5). This lasts until April or May when the ice pack begins to break up.

The seafloor is made up of primarily mud and muddy sand, sometimes mixed with gravel (Map 6). Sea surface temperatures range from 4–6°C during the ice-free period (Map 7). Climate change is already being observed in this area; in recent decades, sea surface temperature has increased as much as 1°C (Map 8).

### Outstanding Biological Features

These waters support above-average primary and benthic productivity (Maps 9, 10, and 12). This is an important area for zooplankton such as *Pseudocalanus* copepods and euphausiids (Map 11) that birds and marine



mammals feed on, and is a concentration area for Opilio crab (Map 13). Forage fish are abundant here; Pacific herring adults and juveniles use these waters, and capelin and saffron cod spawn in the nearshore waters surrounding the island (Maps 14–16). Pink salmon are here in summer, as well as chum salmon concentrating in these waters from May to August (Map 18).

Species using the Chukchi and Beaufort seas in summer pass St. Lawrence Island twice per year. Many species of migratory birds and mammals following along the moving ice edge stop on the island or in the adjacent waters during migration.

Yellow-billed Loons migrate past the west side of the island, some stopping to spend the summer to breed and nest (Map 19). Some Red-throated Loons also stop here to nest while many more fly past and nest on the Seward Peninsula or North Slope (Map 20).

St. Lawrence Island is best known for its use by Spectacled Eiders (Map 21). In the winter, what is believed to be the global population of about 350,000 birds congregates in the polynya and lead system south of the island. This area is designated critical habitat for Spectacled Eiders by the U.S. Fish and Wildlife Service.

These waters are used by molting and staging King Eiders (Map 23); and Common Eiders breed in large numbers on the south side of the island, and the surrounding waters are

important year-round for foraging (Map 24). The island is an important molting and staging area for Long-tailed Ducks that breed in the Yukon-Kuskokwim Delta in Western Alaska (Map 25). This is one of the few places in the study area where Ivory Gulls are known to occur in abundance, often found on the shores of the island near Gambell in late April to early June (Map 26). Northern Fulmars that breed on the southeastern coast of Chukotka are abundant foragers in the waters around St. Lawrence Island from April to December (Map 28). Short-tailed Shearwaters are likewise found foraging in very high numbers here from June to September (Map 29). The island is a major area for colonial nesting seabirds (Map 30). There are 27 colonies of substantial size, some with as many as 13 breeding species. Six colonies have over 100,000 birds, and the largest has about 1.2 million birds. Consequently, this area is home to two globally significant Important Bird Areas (Map 31).

St. Lawrence Island is regularly used by polar bears for feeding and denning (Map 32). The waters are designated critical feeding habitat by the U.S. Fish and Wildlife Service, and much of the island's coastline is no disturbance zone critical habitat. This is a haulout for tens of thousands of Pacific walrus, which concentrate at the east end of the island and at Gambell (Map 34). Surrounding waters are used year-round by walrus that are feeding, courting, or migrating. All four species of ice seals—ribbon, spotted, ringed, and bearded—concentrate here. Ribbon seals are present from January to June, and in higher concentration from May to June (Map 35). There are three known spotted seal haulouts on the south end of the island; these seals are found in surrounding waters year-round, but in higher concentration in May and June (Map 36). Ringed and bearded seals are present November to June; bearded seals are highly

concentrated in these waters in winter, from October to April (Maps 37–38).

Bowhead whales (Map 39) occur in high numbers near the island in winter (November to April) and this is an Alaska Eskimo whaling community sensitive bowhead whale quiet area. Beluga whales concentrate in waters along the west and south side of the island from January to April (Map 40). This is the heart of the feeding grounds of gray whales that migrate more than 16,000 kilometers from northern Mexico each year to feed in these Arctic waters. They occur in high concentrations here from May to November (Map 41).

### Current Resource Use

Subsistence uses include hunting for bowhead whales, walrus, seals, Steller sea lions, polar bears, and seabirds. Fishing is also important, including a small commercial halibut fishery based on St. Lawrence Island. Hunting and fishing occur all around St. Lawrence Island, with boat journeys more than 80 kilometers from shore.

### Conservation Status

- Bowhead whale subsistence hunting quiet area designated by Alaska's North Slope Borough (Map 39).
- Designated critical habitat for Spectacled Eiders by the U.S. Fish and Wildlife Service (Map 21).
- Saint Lawrence Island and Saint Lawrence Island Marine are globally significant Important Bird Areas designated by the National Audubon Society and BirdLife International (Map 31).
- Not currently open to oil and gas leasing by the U.S. Bureau of Ocean Energy Management or the State of Alaska (Map 42).



- The St. Lawrence Island Habitat Conservation Area is indefinitely closed to bottom trawling, and adjacent waters surrounding the Habitat Conservation Area are part of the Northern Bering Sea Research Area, which is currently closed to bottom trawling by the U.S. North Pacific Fishery Management Council.
- Designated no disturbance zone critical denning and feeding habitat for polar bears by the U.S. Fish and Wildlife Service (Map 32).

### Current and Future Threats

- Possibility of flatfish fishery in the Northern Bering Sea Research Area (outside the Habitat Conservation Area) following approval of modified bottom trawling gear by the U.S. North Pacific Fishery Management Council.
- Disturbance or pollution from shipping traffic (Map 43).
- Future increased vessel traffic due to shipping, tourism, or fishing as the ice-free season continues to lengthen.
- High air temperature increases (up to 3.8° C) projected by the end of the century (Map 44).
- Expected, but not well understood, changes in marine productivity due to changes in timing and extent of sea ice.



## CHIRIKOV BASIN

### Description of Area

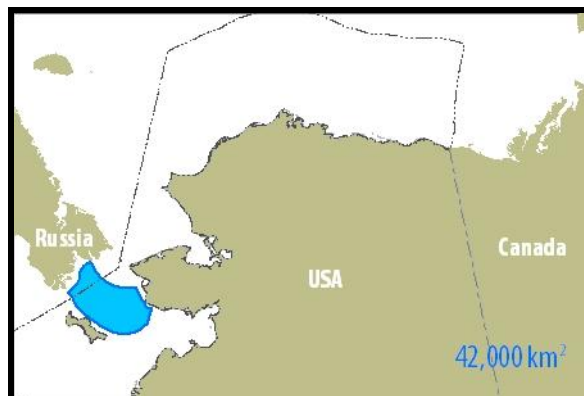
The Chirikov Basin is located in the northern Bering Sea south of the Bering Strait, north of St. Lawrence Island, and west of Norton Sound, covering both U.S. and Russian waters. The shallow basin ranges from about 25 to 50 meters deep (Map 2).

Three major ocean currents meet here before flowing north through the Bering Strait (Map 4). Salty, nutrient-rich Anadyr Water flows along the Russian coast on the west edge of the basin. Low-salinity, nutrient-poor Alaska Coastal Current, heavily influenced by freshwater from the Yukon and Kuskokwim Rivers, flows along the east side of the basin along the Alaska coast. The main current moving through the center of Chirikov Basin is Bering Shelf Water, which is relatively nutrient rich, although lower-salinity and lower-nutrient than Anadyr Water.

Pack ice covers this area approximately six months each year, from December to April, and ice floes are present during adjacent months. (Map 5). The Chirikov Basin seafloor is made up of primarily muddy sand mixed with gravel (Map 6). Sea surface temperatures range from 3–6°C during the ice-free period, increasing across the basin from west to east (Map 7). Climate change is already being observed in this area; in recent decades, sea surface temperature has increased here as much as 1°C (Map 8).

### Outstanding Biological Features

The north-central area of the basin is a primary productivity hotspot (Maps 9–10) and a major area for zooplankton such as *Pseudocalanus* copepods—a critical food source for many species in the Arctic marine ecosystem (Map 11). Chirikov Basin is a benthic foraging hotspot, having the highest



benthic biomass known in the project area (Map 12). Along with the Bering Strait and Hope Basin, the larger area is of global significance, important to outstanding numbers of ice-associated bird and mammal species.

This area is highly important for migration for virtually every species addressed in the Arctic Marine Synthesis. Species using the Chukchi and Beaufort seas in summer pass through the Chirikov Basin and Bering Strait twice per year during migration. Migratory birds and mammals following the ice edge gather here in the spring before moving through the Bering Strait, which is relatively ice-free in early June.

This is a migration area for prespawning adult pink salmon (Map 17), and a major adult area for chum salmon (Map 18). Chirikov Basin is used as a winter staging area by King Eiders (Map 23), is a high abundance area for Northern Fulmars from April to December (Map 28), and is a major adult concentration area for Short-tailed Shearwaters from June to September (Map 29).

Chirikov Basin is regularly used by polar bears (Map 32), and is designated critical habitat by the U.S. Fish and Wildlife Service. Male, female, and young Pacific walrus are present in the basin from November to May, and are more concentrated in fall and early winter, from about October to December (Map 34). All four species of ice seals—ribbon, spotted,

ringed, and bearded—concentrate in Chirikov Basin in May and June before the ice recedes into the Chukchi Sea (Maps 35–38). This is an Alaska Eskimo whaling community sensitive bowhead whale quiet area during spring and fall migration. Beluga whales concentrate along the west side of the basin in January to April, and migrate south through the area in September and October (Map 40). Chirikov Basin is the heart of the feeding grounds of gray whales that migrate more than 16,000 kilometers from northern Mexico each year to feed in these Arctic waters. They occur in high concentration here from May to November (Map 41).

### Current Resource Use

Subsistence uses from St. Lawrence Island include hunting for walrus, and for bowhead whales in fall and winter. From mainland Alaska, seal and walrus hunting also take place in the Chirikov Basin area.

### Conservation Status

- Bowhead whale subsistence hunting quiet area designated by Alaska's North Slope Borough (Map 39).
- Designated no disturbance zone critical denning and feeding habitat for polar bears by the U.S. Fish and Wildlife Service (Map 32).
- The St. Lawrence Island Habitat Conservation Area is indefinitely closed to bottom trawling, and adjacent waters surrounding the Habitat Conservation Area are part of the Northern Bering Sea Research Area, which is currently closed to bottom trawling by the U.S. North Pacific Fishery Management Council.
- Not currently open to oil and gas leasing by the U.S. Bureau of Ocean Energy Management (Map 42).

### Current and Future Threats

- Disturbance or pollution from shipping traffic (Map 43).
- Future increased vessel traffic due to shipping, tourism, or fishing as the ice-free season continues to lengthen.
- High air temperature increases (up to 3.8° C) projected by the end of the century (Map 44).
- Expected, but not well understood, changes in marine productivity due to changes in timing and extent of sea ice.
- Possibility of flatfish fishery in the Northern Bering Sea Research Area following approval of modified bottom trawling gear by the U.S. North Pacific Fishery Management Council.



## NORTON SOUND

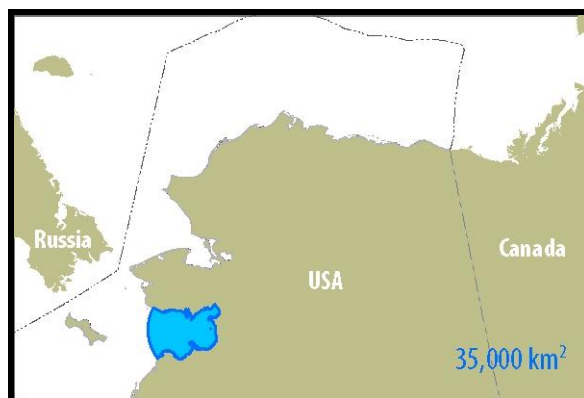
### Description of Area

Norton Sound lies between Nome, on the Seward Peninsula, and the village of Emmonak, located in the Yukon River Delta. Nome is the largest Bering Sea community within the project area, and is home to approximately 3500 residents. Emmonak is home to about 800 residents. Many other small Native communities dot the coast of Norton Sound.

The water here is very shallow, ranging from sea level to 25 meters deep, but averaging 15 meters deep (Map 2). The Alaska Coastal Current passes through the sound. This low-salinity, low-nutrient current is fed by freshwater from the Yukon and Kuskokwim Rivers (Map 4). Ice break-up begins in April, and the sound is generally ice free from May to November (Map 5). The seafloor substrate is mostly mud, gravelly mud, and muddy sand (Map 6). The water is the warmest in the project area, from 7–8.5°C during the ice-free period (Map 7). Climate change is already being observed in this area; in recent decades, sea surface temperature has increased here as much as 0.75°C (Map 8).

### Outstanding Biological Features

Norton Sound—especially the eastern waters—is the most productive area in the northern Bering Sea (Maps 9–10). These waters are very important fish habitat. Along the coast, this is the highest known concentration of spawning capelin in the project area, and the waters of the sound are a major adult area for this species (Map 14). This is a spawning and major juvenile use area for Pacific herring (Map 15); the sound is a major adult concentration area year-round, and a major spawning area from December to February (Map 16). A huge number of anadromous fish spawning streams flow into



the sound, which is a major adult area for pink and chum salmon (Maps 17–18).

The coast near Nome is a primary breeding and nesting area for Red-throated Loons, which migrate through the sound in autumn (Map 20). Norton Sound is designated critical habitat for Spectacled Eiders, which use the sound as a fall staging area in high numbers before migrating to the south of St. Lawrence Island (Map 21). The same area is a globally significant Important Bird Area (Map 31) for this species. Steller's Eiders also migrate through the sound in unknown abundance (Map 22). King and Common eiders and Long-tailed Ducks forage in nearshore waters in summer (Maps 23–25). The sound is a foraging area for Northern Fulmars, and is a major adult foraging area for Short-tailed Shearwater (Maps 28–29). There are more than a dozen seabird colonies on the coast of Norton Sound. The largest has about 65,000 birds of 8 species (Map 30).

Polar bear use of this area is irregular; however, the sound is designated critical feeding habitat and selected portions of the coast are designated no disturbance zone habitat (Map 32) by the U.S. Fish and Wildlife Service. Arctic fox are plentiful in terrestrial areas surrounding the sound; they likely use the sound itself for foraging during the ice-covered months, as they are known to do further north (Map 33). Pacific walrus are present from November to May, and three

haulouts are known to be used by up to 1,000 animals (Map 34).

All four species of ice seals—ribbon, spotted, ringed, and bearded—occur in the sound throughout the year. There are three known spotted seal haulouts here; the seals are highly concentrated in Golovin Bay (Map 36). Ringed seals concentrate in nearshore areas from February to June (Map 37). Beluga whales are highly concentrated throughout virtually the entire sound (Map 40). Gray whales can be found here from April to December (Map 41).

### Current Resource Use

Subsistence uses include hunting of seals, walrus, beluga whales, occasional polar bears, and seabirds from all the coastal and near-coastal communities along Norton Sound. Fishing is prevalent through the region for a variety of marine and anadromous species, including commercial salmon fishing conducted by small boats and the regional community development quota (CDQ) organization. Herring fishing used to take place in eastern Norton Sound, but the market has disappeared in recent years.

### Conservation Status

- East Norton Sound Marine is a globally significant Important Bird Area designated by the National Audubon Society and BirdLife International. Norton Bay, Golovin Lagoon, Bluff Colonies, Safety Sound, and Mouth of Yukon River Marine are state-significant Important Bird Areas (Map 31).
- Designated critical habitat for Spectacled Eiders by the U.S. Fish and Wildlife Service (Map 21).
- As part of the Northern Bering Sea Research Area, these waters are currently closed to bottom trawling by

the U.S. North Pacific Fishery Management Council.

- Yukon Delta National Wildlife Refuge is adjacent on the south side of Norton Sound (Map 42).
- Designated no disturbance zone critical denning and feeding habitat for polar bears by the U.S. Fish and Wildlife Service (Map 32).
- Not currently open to oil and gas leasing by the U.S. Bureau of Ocean Energy Management or the State of Alaska (Map 42).

### Current and Future Threats

- Disturbance or pollution from heavy shipping traffic to Nome and other communities (Map 43).
- Future increased vessel traffic due to shipping, tourism, or fishing as the ice-free season continues to lengthen.
- High air temperature increases (up to 3.8° C) projected by the end of the century (Map 44).
- Expected, but not well understood, changes in marine productivity due to changes in timing and extent of sea ice.
- Possibility of flatfish fishery in the Northern Bering Sea Research Area following approval of modified bottom trawling gear by the U.S. North Pacific Fishery Management Council.

## BERING STRAIT

### Description of Area

The Bering Strait is located at the narrowest point between Asia and North America, straddling both U.S. and Russian ownership (Map 1). The strait is about 90 kilometers wide and is the only marine corridor connecting the Pacific and Arctic oceans. The strait funnels millions of seabirds and hundreds of thousands of marine mammals between the Bering and Chukchi seas, making it one of the most important wildlife areas in the whole Arctic Ocean.

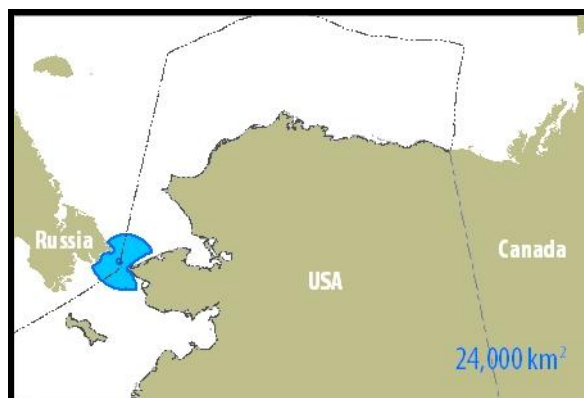
Typical of the area's shallow continental shelf, Bering Strait is about 60 meters at its deepest (Map 2), rising to above sea level in the center where the Diomed Islands emerge.

Here nutrient-rich Bering Sea waters flow north through the Bering Strait into the Chukchi Sea. Three major ocean currents meet: salty, nutrient-rich Anadyr Water; lower-salinity, lower-nutrient Bering Shelf Water; and warm, low-salinity, nutrient-poor Alaska Coastal Current, heavily influenced by freshwater from the Yukon and Kuskokwim rivers (Map 4).

Pack ice covers this area approximately six months each year (Map 5), from December to May, and ice floes are present during adjacent months. The Bering Strait seafloor is made up of mixed mud, gravel, and sand (Map 6). Sea surface temperatures are stratified into three distinct north-south columns reflecting the three ocean currents flowing through; temperatures increase across Bering Strait from west to east, averaging 4–6°C during the ice-free period (Map 7).

### Outstanding Biological Features

This is a primary productivity hotspot (Maps 9–10) and has some of the highest benthic biomass anywhere in the project area (Map



12), making this a highly important foraging hotspot for wildlife. Along with the Chirikov and Hope basins, the larger area is of global significance, important to outstanding numbers of ice-associated bird and mammal species.

The U.S. side of the strait falls within the National Marine Fisheries Service essential fish habitat for Opilio crab (Map 13) and saffron cod, which concentrate and spawn in the Bering Strait. (Map 16). Coastal waters are capelin spawning habitat, an important forage fish for marine birds (Map 14). This is also a major adult area for chum salmon (Map 18).

The Diomed Islands support over 4.5 million nesting seabirds, which forage in Bering Strait (Map 30). Colonial nesters of 11 different species include Black-legged Kittiwake, Common and Thick-billed murres, Parakeet Auklet, Least Auklet, Crested Auklet, and Horned Puffin. In addition to colonial nesters, multiple other seabird species visit these waters during migration through the Bering Strait. Those species include all four species of eider, Long-tailed Duck, Northern Fulmar, and Short-tailed Shearwater (Maps 21–25, 28–29). King Island is home to about 250,000 colonial nesting seabirds (Map 30).

This constricted waterway is a greatly important migration bottleneck. Seabirds that breed on the North Slope generally migrate around, rather than over, the Alaskan landmass, as of course do marine mammals.

Virtually every species addressed in the Arctic Marine Synthesis passes through the Bering Strait twice per year during migration to and from the Chukchi and Beaufort seas.

This is a polar bear denning and feeding area, and a U.S. Fish and Wildlife Service critical habitat area (Map 32). Tens of thousands of Pacific walrus haul out on the Diomed Islands, Fairway Rock, King Island, and coastal Russia, and concentrate in late fall to early winter in surrounding waters (Map 34). This is an Alaska Eskimo whaling community hunting and search area, and a sensitive bowhead whale quiet area during spring and fall migration. Bowhead whales pass by the Russian coast in both spring and fall, and concentrate there during fall feeding (Map 39). Beluga whales concentrate in Russian waters from January to April (Map 40), and gray whales that winter in northern Mexico concentrate across the area in summer (Map 41).

### Current Resource Use

Subsistence uses include hunting of bowhead whales, walrus, seals, polar bears, and seabirds. Fishing is also common.

### Conservation Status

- Bowhead whale subsistence hunting quiet area designated by Alaska's North Slope Borough (Map 39).
- Designated essential fish habitat for Opilio crab and saffron cod by the U.S. National Marine Fisheries Service (Map 13).
- Much of the Russian portion of the Bering Strait is a national zakaznik, or wildlife sanctuary (Map 42).
- The Bering Strait is an Important Bird Area designated by the National Audubon Society and BirdLife International; King Island is a state-

significant Important Bird Area (Map 31).

- Designated no disturbance zone critical denning and feeding habitat for polar bears by the U.S. Fish and Wildlife Service (Map 32).
- As part of the Northern Bering Sea Research Area, U.S. waters are currently closed to bottom trawling by the U.S. North Pacific Fishery Management Council.
- Not currently open to oil and gas leasing by the U.S. Bureau of Ocean Energy Management or the State of Alaska (Map 42).

### Current and Future Threats

- A proposed Bering Strait Bridge connecting Russia and the U.S.
- Disturbance or pollution from shipping traffic (Map 43).
- Future increased vessel traffic due to shipping, tourism, or fishing as the ice-free season continues to lengthen.
- High air temperature increases (up to 3.8° C) projected by the end of the century (Map 44).
- Expected, but not well understood, changes in marine productivity due to changes in timing and extent of sea ice.
- Possibility of flatfish fishery in the Northern Bering Sea Research Area following approval of modified bottom trawling gear by the U.S. North Pacific Fishery Management Council.



## DIOMEDE ISLANDS

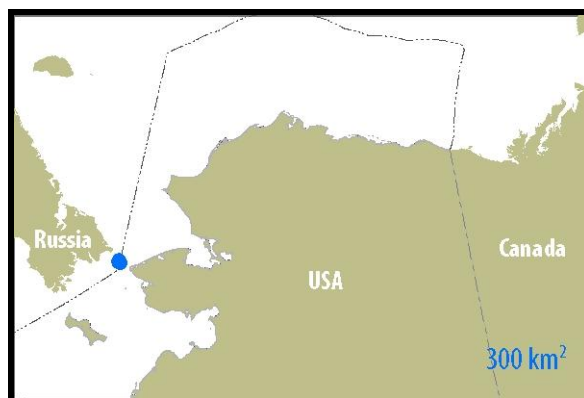
### Description of Area

The Big and Little Diomed Islands are located in the Bering Strait between mainland Russia and Alaska. Only about 3 kilometers apart, Big Diomed Island is owned by Russia and Little Diomed Island is owned by the U.S. This is the closest point between Asia and North America. Constricted, nutrient-rich Bering Sea waters flow north past these small, mountainous islands at the gateway to the Chukchi Sea (Map 4). Big Diomed Island is uninhabited except for a limited Russian military presence. Little Diomed Island is home to approximately 170 Inuit residents in the village of Diomed.

### Outstanding Biological Features

Marine waters surrounding these islands are a hotspot for phytoplankton (Maps 9–10), and the seafloor is high in benthic biomass (Map 12), making this an excellent foraging area for seabirds and other wildlife.

Little Diomed Island falls within the National Marine Fisheries Service essential fish habitat zone for Opilio crab (Map 13) and saffron cod (Map 16). This is home to the largest seabird colony in the project area. There are approximately 4.1 million nesting seabirds of 11 different species nesting on Big Diomed Island, and another 500,000 colonial nesters on Little Diomed Island (Map 30). Dominant species at both sites include Black-legged Kittiwake, Common and Thick-billed murre, Parakeet Auklet, Least Auklet, Crested Auklet, and Horned Puffin. In addition to colonial nesters, multiple other seabird species visit adjacent waters during migration through Bering Strait. Some of those species include all four species of eider, Long-tailed Duck, Northern Fulmar, and Short-tailed Shearwater (Maps 21–25, 28–29).



This island is also a polar bear denning and feeding area, and a U.S. Fish and Wildlife Service critical habitat no disturbance zone (Map 32). Thousands of Pacific walrus use the two islands as haulouts, and concentrate in late fall to early winter in surrounding waters (Map 34). This is an Alaska Eskimo whaling community hunting and search area, and a sensitive bowhead whale quiet area during spring and fall migration (Map 39).

### Current Resource Use

Subsistence uses include hunting of bowhead whales, walrus, seals, polar bears, and seabirds. Coastal fishing is also practiced.

### Conservation Status

- Bowhead whale subsistence hunting quiet area designated by Alaska's North Slope Borough (Map 39).
- Designated essential fish habitat for Opilio crab and saffron cod by the U.S. National Marine Fisheries Service (Map 13).
- Russian waters surrounding Big Diomed Island are a national zakaznik, or wildlife sanctuary (Map 42).
- Little Diomed Island & Fairway Rock as well as Ratmanov Island (Big Diomed) are globally significant Important Bird Areas designated by

the National Audubon Society and BirdLife International (Map 31).

- Designated no disturbance zone critical denning and feeding habitat for polar bears by the U.S. Fish and Wildlife Service (Map 32).
- As part of the Northern Bering Sea Research Area, U.S. waters are currently closed to bottom trawling by the U.S. North Pacific Fishery Management Council.
- Not currently open to oil and gas leasing by the U.S. Bureau of Ocean Energy Management or the State of Alaska (Map 42).

### Current and Future Threats

- A proposed Bering Strait Bridge connecting Russia and the U.S.
- Disturbance or pollution from shipping traffic (Map 43).
- Future increased vessel traffic due to shipping, tourism, or fishing as the ice-free season continues to lengthen.
- High air temperature increases (up to 3.8° C) projected by the end of the century (Map 44).
- Expected, but not well understood, changes in marine productivity due to changes in timing and extent of sea ice.
- Possibility of flatfish fishery in the Northern Bering Sea Research Area following approval of modified bottom trawling gear by the U.S. North Pacific Fishery Management Council.

## SEWARD PENINSULA

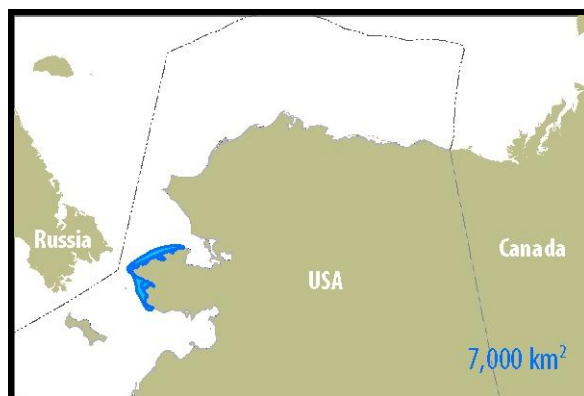
### Description of Area

Guarded by low lying spits and barrier islands, the northern coast of the Seward Peninsula is home to the community of Shishmaref, with approximately 550 residents. Between Cape Prince of Wales (at Bering Strait) and Nome is the town of Brevig Mission with approximately 275 residents. Many other small Native communities dot the coast of the peninsula. These waters are characterized by shallow (less than 10 meters deep) brackish lagoons and inlets, and shallow (less than 20 meters deep) marine waters (Map 2). The Alaska Coastal Current passes through this area, bringing low-nutrient, low-salinity water that is a mix of Bering Shelf Water and the Yukon and Kuskokwim Rivers (Map 4). Most of the marine waters near the Seward Peninsula are covered by landfast ice for several months of the year; a polynya sometimes forms off the west end (Map 5). The seafloor here is sand and muddy sand and sea surface temperatures average 4–6°C during ice-free months (Maps 6–7).

### Outstanding Biological Features

Seward Peninsula nearshore marine waters are very productive, with some of the highest primary productivity values in the Chukchi Sea occurring in Shishmaref Inlet and Port Clarence (Map 9). Little is known about benthic resources in this area, although very limited data seems to indicate that benthic resources are low to moderate compared to the nearby waters of the Bering Strait and Hope Basin (Map 12).

These waters are very important for fish; this is a spawning area for capelin, Pacific herring, and saffron cod, as well as essential fish habitat for saffron cod (Maps 14–16). Anadromous streams flowing from the Seward Peninsula are spawning areas for pink and chum salmon (Maps 17–18).



The area is one of two places in Alaska where Yellow-billed Loons nest in high densities; and those that migrate on to the North Slope likely pass through this area on their way (Map 19). The same is true for Red-throated Loons (Map 20). Threatened Spectacled Eiders are found in these waters as they move between their wintering area south of St. Lawrence Island and their summer breeding area on the North Slope (Map 21). Limited data indicates that Steller's Eiders also stop in the northern Seward Peninsula lagoons during migration (Map 22). King and Common eiders feed in the nearshore waters, as do Long-tailed Ducks, which are found in high concentrations in the lagoons (Maps 23–25). Adjacent terrestrial areas are some of the only known Kittlitz's Murrelet nesting areas in the Arctic. It is expected, but not known, that they forage in these waters (Map 26). There are three seabird colonies along the western coast of the peninsula. Sledge Island is home to nearly 5000 birds, primarily Common and Thick-billed murre, Black-legged Kittiwakes, and Pelagic Cormorants (Map 30).

This is no disturbance zone critical habitat for the polar bear, which dens and feeds in these waters, but in much lower numbers than areas farther north (Map 32). Several thousand Pacific walrus haul out on Sledge Island, which is part of the Alaska Maritime National Wildlife Refuge (Map 34). All four species of ice seals live here. The most abundant are spotted seals, which haul out in several

locations along the Seward Peninsula and concentrate in large numbers in the inlets and lagoons; they are generally present from June to December (Map 36). This is a ringed seal concentration area in spring and early summer, from February to June (Map 37). Large numbers of bearded seals can be found in Shishmaref Inlet and associated lagoons during winter, approximately October to April (Map 38). Beluga whales use these waters occasionally; this is a gray whale concentration area in summer and fall, from May to November (Maps 39–40).

### Current Resource Use

Subsistence uses include hunting of walrus, seals, polar bears, and seabirds, as well as fishing for anadromous fishes.

### Conservation Status

- Ikpekk Lagoon is part of the Bering Land Bridge National Preserve managed by the U.S. National Park Service (Map 42).
- Small portions of the Seward Peninsula coast and Sledge Island are part of the Alaska Maritime National Wildlife Refuge (Map 42).
- Not currently open to oil and gas leasing by the U.S. Bureau of Ocean Energy Management or the State of Alaska (Map 42).
- Currently closed to commercial fishing by the U.S. North Pacific Fishery Management Council.
- Shishmaref Inlet is a state-significant Important Bird Area designated by the National Audubon Society and Bird Life International (Map 31).
- Designated no disturbance zone critical denning and feeding habitat for

polar bears by the U.S. Fish and Wildlife Service (Map 32).

### Current and Future Threats

- The area is heavily traveled by ships rounding the peninsula from the Bering Strait, headed to Kotzebue and other points north (Map 43).
- Future increased vessel traffic due to shipping, tourism, or fishing as the ice-free season continues to lengthen.
- High air temperature increases (up to 3.8° C) projected by the end of the century (Map 44).



## KOTZEBUE SOUND

### Description of Area

Kotzebue Sound is a shallow marine area bounded by the Seward Peninsula to the south, the Baldwin Peninsula and Kobuk River delta to the east, and the Noatak River delta and Krusenstern Lagoon to the north (Map 1). The sound is home to the city of Kotzebue, the largest community on Alaska's Chukchi Sea coast. A few other small Native communities line the coast.

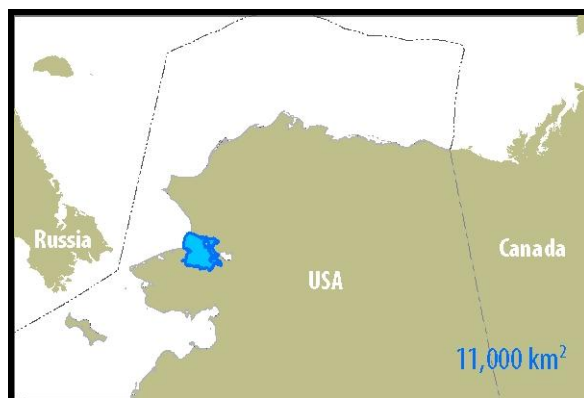
The sound averages less than 20 meters deep (Map 2). Marine waters here are part of the Alaska Coastal Current, which travels north from the Bering Sea, through the sound, and then north along the Chukchi and Beaufort coasts (Map 4). Kotzebue Sound is filled with landfast ice many months of the year, approximately November to May (Map 5). The seafloor is mostly gravelly mud with some sandy mud (Map 6). Temperatures in the sound are some of the warmest in the Chukchi Sea, averaging 5–7°C during the ice-free months (Map 7).

### Outstanding Biological Features

Phytoplankton is very concentrated in Kotzebue Sound compared to other Arctic waters, making this a primary productivity hotspot (Maps 9–10). Benthic resources values are not known, but near the coast where surveys have been done, the values are very low (Map 12).

The sound is very important for fish; this is a spawning area for capelin, Pacific herring, and saffron cod, and is home to adult herring and cod year-round (Maps 14–16). Pink and chum salmon feed in the sound, and migrate up the Noatak and Kobuk rivers to spawn (Maps 17–18). The area is essential fish habitat for Opilio crab and saffron cod (Maps 13, 16).

Yellow-billed Loons nest along the entire coast of Kotzebue Sound, as do Red-throated



Loons, which are particularly concentrated in the sound compared to other parts of the project area (Maps 19–20). Populations of King and Common eiders and Long-tailed Ducks also nest and feed here (Maps 23–25). There are 13 seabird colonies along the coast, the largest with 24,000 nesting birds present. Species include Common Eiders, Glaucous Gulls, Black-legged Kittiwakes, Arctic and Aleutian terns, Common and Thick-billed murre, and Tufted and Horned puffins (Map 30). Five state-level Important Bird Areas are identified along the coast, which are important for Common Eider, Dunlin, Brant, Black-legged Kittiwake, Horned Puffin, and Aleutian Tern (Map 31).

Much of the Kotzebue Sound coastline is designated no disturbance zone critical habitat for polar bears (Map 32), including all of the Baldwin Peninsula; the area is suitable denning habitat but may not be used for denning except on occasion. All four species of ice seals are present in the sound. Spotted seals haul out along Krusenstern Lagoon, the Noatak River delta, the tip of the Baldwin Peninsula, and Cape Espenberg between June and December (Map 36). Ringed and bearded seals are concentrated here in October and November (Maps 37–38). The sound is a high concentration area for beluga whales between May and September (Map 40). Gray whales also feed in the area from May to November (Map 41).

## Current Resource Use

Subsistence uses include hunting of seals, beluga whales, some walrus and polar bears, and seabirds. Fishing is common, including a sporadic commercial salmon fishery based out of Kotzebue, as well as subsistence fisheries for a variety of species.

## Conservation Status

- Five state-significant Important Bird Areas designated by the National Audubon Society overlap the land-water interface in Kotzebue Sound: Krusenstern Lagoon, Noatak River Delta, Puffin Island, Nugnugalurtuk River Mouth, and Cape Espenberg (Map 31).
- Kotzebue Sound is bordered by the Cape Krusenstern National Monument and the Bering Land Bridge National Preserve which are managed by the U.S. National Park Service, and the Selawik National Wildlife Refuge, managed by the U.S. Fish and Wildlife Service (Map 42).
- Designated essential fish habitat for Opilio crab and saffron cod by the U.S. National Marine Fisheries Service (Maps 13, 16).
- Designated no disturbance zone critical denning and feeding habitat for polar bears by the U.S. Fish and Wildlife Service (Map 32).
- Currently closed to commercial fishing by the U.S. North Pacific Fishery Management Council.
- Not currently open to oil and gas leasing by the U.S. Bureau of Ocean Energy Management or the State of Alaska (Map 42).

## Current and Future Threats

- Disturbance or pollution from shipping traffic (Map 43).
- Future increased vessel traffic due to shipping, tourism, or fishing as the ice-free season continues to lengthen.
- High air temperature increases (up to 3.8° C) projected by the end of the century (Map 44).
- Expected, but not well understood, changes in marine productivity due to changes in timing and extent of sea ice.

## HOPE BASIN

### Description of Area

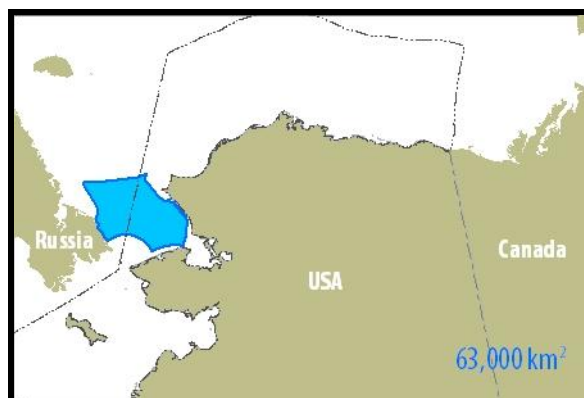
Hope Basin is a wide, shallow basin in the southern Chukchi Sea that straddles the U.S.–Russia border. Seafloor depth ranges from 20 to 60 meters deep (Map 2). The area is known for its very high pelagic and benthic productivity.

Four major ocean currents meet in Hope Basin (Map 4). Low-salinity, nutrient-poor Alaska Coastal Water flows along the east side of the basin. Relatively nutrient-rich Bering Shelf Water flows through central Hope Basin. Salty, nutrient-rich Anadyr Water flows through the west edge of the basin. Alaska Coastal Current, Bering Shelf Water, and Anadyr Water all flow from the Bering Sea. A fourth water mass, the Siberian Coastal Current, flows east along the northern Chukotka coast from the East Siberian Sea, eventually meeting up with these other currents in the basin.

Pack ice is present about six months per year, from December to May (Map 5). Three polynyas regularly occur: one in western Kotzebue Sound, another near Cape Thompson, and offshore along the northern Chukotka coast. The seafloor is made up of several substrates which are a mix of sand, mud, and gravel (Map 6). The multiple ocean currents vary in temperature; the Basin is coldest in the west where it averages 3°C and warmest in the east, up to 6°C (Map 7). Climate change is already being observed in this area; in recent decades, sea surface temperature has increased here as much as 0.75–1°C (Map 8).

### Outstanding Biological Features

Hope Basin is highly productive throughout the summer season as the phytoplankton bloom follows the receding ice edge (Maps 9–10). This is a major area for zooplankton such



as *Pseudocalanus* copepods and euphausiids (Map 11) and essential fish habitat for Opilio crab (Map 13). Benthic food resources are very high here (Map 12). Hope Basin makes up the highest productivity benthic foraging hotspot in the Chukchi Sea. Along with the Bering Strait and Chirikov Basin, the larger area is of global significance, important to outstanding numbers of ice-associated bird and mammal species.

This is National Marine Fisheries Service essential fish habitat for saffron cod, which are found in concentrated adult groups in the eastern basin and spawn at both the eastern and western edges of the basin (Map 16). Capelin, an important forage fish, are present here from June to September (Map 14). Pacific herring reach their typical northern range limit in Hope Basin (Map 15). Pink and chum salmon are also present (Maps 17–18).

Hope Basin is a major migration corridor for birds and mammals moving from the Bering Sea into the Chukchi Sea in spring, and from the Chukchi Sea back into the Bering Sea in the fall. At least two species of loons and all four species of eiders migrate across the basin twice per year (Maps 19–24). Northern Fulmars and Short-tailed Shearwaters forage in large concentrated groups during summer months, from about June to October (Maps 28–29). A globally significant Important Bird Area in the basin is home to significant numbers of Kittlitz's Murrelets, Black-legged

Kittiwakes, and Short-tailed Shearwaters (Map 31).

The area has been identified by local hunters as a feeding area for polar bears; on the U.S. side of the border, the basin is designated critical feeding habitat, and is part of the core use area identified for the Chukchi/Bering Sea population (Map 32). Arctic foxes satellite-collared at Teshekpuk Lake on Alaska's North Slope have been observed traveling as far away as Hope Basin to scavenge atop the winter sea ice (Map 33).

The area is a destination for benthic foraging Pacific walrus as they follow the ice edge northward in spring and south in fall (Map 34). All four species of ice seals live in Hope Basin. Ribbon seals concentrate here from June to December (Map 35), and bearded seals are more concentrated from March to June (Maps 35, 38). Spotted seals forage from August to December, and ringed seals are present all year (Maps 36–37).

This is an important migration and feeding area for bowhead whales (Map 39). The whales migrate north from the Bering Strait past Point Hope in the spring, and south along the Chukotka coast in the fall, stopping to feed along the way. Similarly, beluga whales also migrate through and feed in the area from May to November (Map 40). Hope Basin is an important benthic feeding area for gray whales, which migrate from Mexico and California each year to feed in these waters (Map 41).

### Current Resource Use

Subsistence uses include hunting of bowhead whales, walrus, and seals by communities located near the area (Shishmaref, Kivalina, Point Hope).

### Conservation Status

- Much of the U.S. part of Hope Basin is a bowhead whale subsistence

hunting quiet area designated by Alaska's North Slope Borough (Map 39).

- Cape Lisburne–Thompson Marine is a globally significant Important Bird Area designated by the National Audubon Society and BirdLife International (Map 31).
- Designated essential fish habitat for Opilio crab and saffron cod by the U.S. National Marine Fisheries Service (Maps 13, 16).
- Designated no disturbance zone critical denning and feeding habitat for polar bears by the U.S. Fish and Wildlife Service (Map 32).
- Currently closed to commercial fishing by the U.S. North Pacific Fishery Management Council.
- Not currently open to oil and gas leasing by the U.S. Bureau of Ocean Energy Management (Map 42).

### Current and Future Threats

- Disturbance or pollution from shipping traffic (Map 43).
- Future increased vessel traffic due to shipping, tourism, or fishing as the ice-free season continues to lengthen.
- High air temperature increases (up to 3.8° C) projected by the end of the century (Map 44).
- Expected, but not well understood, changes in marine productivity due to changes in timing and extent of sea ice.

## CAPE THOMPSON & CAPE LISBURNE

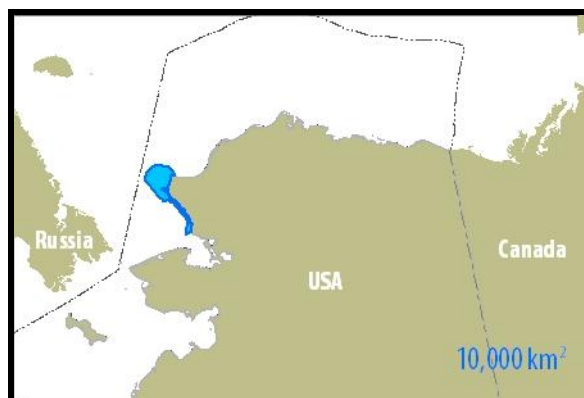
### Description of Area

The Lisburne Peninsula extends westward into the Arctic Ocean at the base of the Brooks Range. Cape Lisburne is the rugged northern extent of the peninsula, while Cape Thompson is a low-lying wetland area forming the south end of the peninsula. Between these two capes lies Point Hope, a significant geographic feature, and a Native village which is home to about 850 residents (Map 1). The Kukpuk and Ipewik rivers join just before Aiautak Lagoon, then drain into the Arctic Ocean near Point Hope. A couple of other small settlements and the town of Kivalina, with about 375 residents, also line the coast in this area.

Marine waters around the Lisburne Peninsula are primarily of the Alaska Coastal Current, which carries low-salinity water north from coastal areas in the Bering Sea (Map 4). Shallow coastal waters are covered in landfast ice several months per year, from about December to June, while somewhat deeper waters (less than 50 meters) are covered by pack ice from about December to May. In winter, two polynyas form along the peninsula, one between Point Hope and Cape Lisburne, and one offshore of Cape Thompson (Map 5). The nearshore seafloor is made up of muddy gravel with relatively low benthic food resources (Maps 6, 12). Water temperatures average 4–6° C during the ice free season (Map 7). Marine waters around the Lisburne Peninsula are a migration bottleneck for marine mammals and birds.

### Outstanding Biological Features

The warm coastal waters that surround the Lisburne Peninsula have relatively high pelagic productivity compared to offshore areas (Maps 9–10). This is the northern extent of the National Marine Fisheries Service essential



fish habitat identified for *Opilio* crab (Map 13). Capelin spawn in the shallow coastal water (Map 14). Saffron cod spawn here in large numbers, and this area is identified as the National Marine Fisheries Service essential fish habitat for them as well (Map 16). Pink and chum salmon are present; pink salmon are also present in the Kukpuk and Kivalina rivers, and spawn in the Wulik River (Maps 17–18).

Nearly all bird species that migrate to the North Slope for summer breeding migrate around Point Hope and north toward Barrow. This is primary breeding range for Red-throated Loons (Map 20), and overlaps part of the Spectacled Eider critical habitat in Ledyard Bay (Map 21). The Lisburne Peninsula is one of only two known breeding areas in the Alaskan Arctic for Kittlitz's Murrelet (Map 27). They have been observed in the waters around Cape Lisburne and Point Hope. Of the three globally significant Important Bird Areas here, Cape Lisburne–Thompson Marine is designated for the Kittlitz's Murrelet (Map 31). The Cape Lisburne and Cape Thompson terrestrial IBAs are designated for the several hundred thousand Thick-billed and Common murre nesting there. Shearwaters and fulmars also congregate to feed on abundant forage fish in these waters (Maps 28–29).

There are five seabird colonies between Cape Lisburne and Point Hope, another five at Cape Thompson, and another three at Cape

Krusenstern (Map 30). At Cape Lisburne (about 40 kilometers north of Point Hope), habitat for cliff-nesting seabirds consists of about 7 kilometers of limestone and shale sea-cliffs south of the cape. The cliffs range from about 15 to 200 meters high. Similar cliffs make up the coastline at Cape Thompson. Over 800,000 seabirds of ten different species nest along these cliffs.

Polar bears den and feed along the whole coast of the Lisburne Peninsula, with designated critical habitat from Point Hope to Cape Thompson (Map 32). Arctic foxes satellite-collared at Teshekpuk Lake on the North Slope have been observed traveling as far as the Lisburne Peninsula (Map 33). The peninsula is a major Pacific walrus haulout (Map 34). Five known haulouts are used, with 10 to 10,000 animals present. All four species of ice seals use the nearshore waters around the peninsula, with ringed and bearded seals concentrating in the open waters in the spring, generally March to June (Maps 35–38).

Point Hope is a spring whaling community (Map 39); nearly the entire Bering-Chukchi-Beaufort bowhead whale stock passes by Point Hope each spring. Waters within 40 kilometers of the village are a designated quiet zone for these whales. Likewise, this is a concentration area for gray whales and a high concentration area for beluga whales (Maps 40–41).

### Current Resource Use

Subsistence uses include hunting of bowhead and beluga whales, seals, walrus, polar bears, and seabirds. Fishing is also practiced along the coast.

### Conservation Status

- Cape Thompson, Cape Lisburne, and Cape Lisburne–Thompson Marine are three globally significant Important Bird Areas designated by the National

Audubon Society and BirdLife International (Map 31).

- Cape Lisburne and Cape Thompson are part of the Alaska Maritime National Wildlife Refuge–Chukchi Sea Unit, which is managed by the U.S. Fish and Wildlife Service (Map 42).
- Bowhead whale subsistence hunting quiet area designated by Alaska’s North Slope Borough (Map 39).
- Designated essential fish habitat for Opilio crab and saffron cod by the U.S. National Marine Fisheries Service (Maps 13, 16).
- Designated no disturbance zone critical denning and feeding habitat for polar bears by the U.S. Fish and Wildlife Service (Map 32).
- Not currently open to oil and gas leasing by the U.S. Bureau of Ocean Energy Management or the State of Alaska (Map 42).
- Currently closed to commercial fishing by the U.S. North Pacific Fishery Management Council.

### Current and Future Threats

- Expected, but not well understood, changes in marine productivity due to changes in timing and extent of sea ice.
- Future increased vessel traffic due to shipping, tourism, or fishing as the ice-free season continues to lengthen.
- High air temperature increases (up to 3.0° C) projected by the end of the century (Map 44).
- Disturbance or pollution from shipping traffic (Map 43).



## LEDYARD BAY

### Description of Area

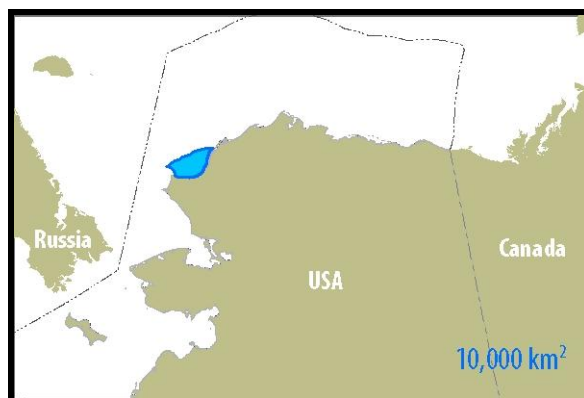
Stretching from Cape Lisburne to central Kasegaluk Lagoon, Ledyard Bay is the largest bay on Alaska's Chukchi Sea coast (Map 1). This area is also part of the greater Chukchi Sea lead system. The bay is very shallow, even by Chukchi Sea standards, averaging 15–25 meters depth (Map 2). The main ocean current in Ledyard Bay is the Alaska Coastal Current, which carries low-salinity water north from coastal areas in the Bering Sea (Map 4). The bay is not often covered in pack ice; instead, the nearshore areas are covered in landfast ice several months per year, while farther offshore is a recurring system of polynyas and leads (Map 5).

The seafloor is made up mostly of muddy gravel (Map 6). Sea surface temperatures range from 3–5° C during ice-free months (Map 7). Analysis of sea surface temperature anomalies in recent decades indicates the bay has not been affected by climate change as drastically as other Chukchi Sea waters (Map 8).

### Outstanding Biological Features

The nearshore area of Ledyard Bay is very productive—with large phytoplankton blooms similar to the Bering Strait region (Maps 9–10). Benthic productivity appears to be fairly average for the Chukchi Sea, which could be misleading since only a couple of survey points have been sampled in this area (Map 12).

These waters are home to capelin from June to September, and coastal waters are a capelin spawning area (Map 14). Ledyard Bay is also National Marine Fisheries Service essential fish habitat for saffron cod, which occur year-round (Map 16). Both pink and chum salmon are also present (Maps 17–18).



Ledyard Bay is very important for birds, especially eiders. This is critical habitat for migrating, staging and foraging Spectacled Eiders (Map 21). The area is also a concentrated staging area for King Eiders during spring and fall migration. The entire breeding population of King Eiders in western North America—about half of a million birds—is believed to use this area (Map 23). The bay is a staging area for Common Eiders as well, which breed along the coastline leading to Kasegaluk Lagoon (Map 24). Steller's Eiders migrate through the bay in unknown numbers (Map 22). All four eider species breed just inland of the bay and northward, as do Yellow-billed Loons, Red-throated Loons, and Long-tailed Ducks (Maps 19–20, 25). All of these species migrate through and forage in the bay on the way to their breeding grounds. Kittlitz's Murrelets are present, but abundance data in this region is very poor (Map 27). Fulmars and shearwaters forage in the offshore waters of the bay (Maps 28–29). Because of these spectacular bird values, this is designated as a globally significant Important Bird Area (Map 31).

The bay is also home to significant mammal populations. Polar bears regularly den and feed in Ledyard Bay (Map 32). Arctic foxes forage atop the landfast ice in winter (Map 33). Pacific walrus migrate through, and also haul out in small numbers (Map 34). All four species of ice seals are present (Maps 35–38). Spotted seals use the coastal waters and

haulouts in summer and fall, from about June to December. Ringed and bearded seals concentrate in the bay in winter and spring, from about February to June.

The bay is a spring migration area for bowhead whales (Map 39), a migration and nearshore concentration area for beluga whales (Map 40), and is also a feeding area for gray whales (Map 41).

### Current Resource Use

Subsistence uses include hunting of seals, walrus, and seabirds, as well as bowhead whales at times.

### Conservation Status

- Ledyard Bay is a globally significant Important Bird Area designated by the National Audubon Society and BirdLife International (Map 31).
- Designated critical habitat for Spectacled Eiders by the U.S. Fish and Wildlife Service (Map 21).
- Designated essential fish habitat for saffron cod by the U.S. National Marine Fisheries Service (Map 16).
- Designated critical feeding habitat for polar bears by the U.S. Fish and Wildlife Service (Map 32).
- Bowhead whale subsistence hunting quiet area designated by Alaska's North Slope Borough (Map 39).
- Currently closed to commercial fishing by the U.S. North Pacific Fishery Management Council.
- Waters within 40 kilometers of the Chukchi coast and Point Barrow are not currently open to oil and gas leasing by the U.S. Bureau of Ocean Energy Management or the State of Alaska (Map 42).

### Current and Future Threats

- Disturbance or pollution from shipping traffic (Map 43).
- Future increased vessel traffic due to shipping, tourism, or fishing as the ice-free season continues to lengthen.
- High air temperature increases (up to 3.0° C) projected by the end of the century (Map 44).
- Expected, but not well understood, changes in marine productivity due to changes in timing and extent of sea ice.

## KASEGALUK LAGOON

### Description of Area

This 200-kilometer-long lagoon on the Chukchi Sea coast is a gathering place for a diverse set of wildlife. The lagoon is about 6 kilometers across at its widest point. The spits and barrier islands that enclose these shallow (less than 4 meters), brackish waters are nesting, denning, and haulout areas for many species. Two communities are associated with the lagoon: Point Lay (population ~250) at the southern end, and Wainwright (population ~550) just past the far north end.

Part of the regularly occurring landfast ice-pack, the shallow water here is frozen in winter for several months (Map 5). Gravel and muddy gravel make up the bottom (Map 6). Sea surface temperatures average 2–4° C during ice-free months (Map 7).

### Outstanding Biological Features

Primary productivity is very high compared to nearby waters (Map 11), although limited benthic sampling seems to indicate lower values than waters outside the lagoon (Map 12).

Kasegaluk Lagoon is essential fish habitat for saffron cod (Map 15). At least three anadromous rivers flow into the lagoon, which are used by pink and chum salmon (Maps 17–18).

These waters are summer marine feeding or migration stopover sites for a long list of bird species. Yellow-billed and Red-throated Loons; Spectacled, Steller's, King, and Common eiders; and Long-tailed Ducks all breed in medium to high densities near the lagoon (Maps 19–25). Common Eiders nest in colonies of up to 500 birds on the spits and barrier islands (Map 24). This is a particularly important area for King Eiders, which concentrate both in and outside of the lagoon. Nearly all of the Western North



American breeding population of these birds stops here and in Ledyard and Peard bays during spring and fall migrations (Map 23). Because of the diversity and abundance of birds here, Kasegaluk Lagoon is a globally significant Important Bird Area (Map 31).

This is U.S. Fish and Wildlife Service no disturbance zone critical habitat for polar bears, which den and feed along the barrier islands, coast, and landfast ice (Map 32). Arctic foxes captured at Teshekpuk Lake traveled to Kasegaluk Lagoon and beyond in winter months (Map 33). Pacific walrus use the barrier islands as a haulout, particularly at Wainwright, Point Lay, and Icy Cape; their use of this area has increased in recent years as the minimum sea ice extent continues to move north due to climate change (Map 34). Ribbon and bearded seals can be found in the lagoon (Maps 35, 38), but only spotted and ringed seals occur in large numbers. This is a major spotted seal haulout along nearly the entire length of the lagoon (Map 36). Ringed seals are found in high concentrations in the winter and spring, from approximately October to July (Map 37). These shallow brackish waters are an important concentrated calving and molting area for beluga whales (Map 40).

### Current Resource Use

Subsistence uses include hunting of beluga whales, seals, polar bears, and seabirds. Fishing is also practiced in the lagoon system.

## Conservation Status

- Kasegaluk Lagoon is a globally significant Important Bird Area designated by the National Audubon Society and BirdLife International (Map 31).
- Designated Special Area within the National Petroleum Reserve–Alaska which is managed by the U.S. Bureau of Land Management.
- Designated essential fish habitat for saffron cod by the U.S. National Marine Fisheries Service (Map 16).
- Designated no disturbance zone critical denning and feeding habitat for polar bears by the U.S. Fish and Wildlife Service (Map 32).
- Waters within 40 kilometers of the Chukchi coast and Point Barrow are not currently open to oil and gas leasing by the U.S. Bureau of Ocean Energy Management or the State of Alaska (Map 42).
- Currently closed to commercial fishing by the U.S. North Pacific Fishery Management Council.

## Current and Future Threats

- Potential for development of a port for bringing offshore oil to a future pipeline across the National Petroleum Reserve.
- High air temperature increases (up to 3.0° C) projected by the end of the century (Map 44).

## CHUKCHI LEAD SYSTEM

### Description of Area

Along the entire Alaskan Chukchi Sea coast is a system of open water leads and polynyas that are critical for migrating wildlife and, in turn, subsistence hunters. These shallow waters range from 5 to 50 meters deep (Map 2), made up primarily of the relatively warm Alaska Coastal Current, and also the nutrient-rich Bering Shelf Water (Map 4). Winds and currents push the shifting sea ice offshore, as well as create a flaw zone between the landfast ice and the pack ice, creating open water areas—leads and polynyas—that allow wildlife to migrate up and down the coast in spring and fall when other areas are frozen solid (Map 5).

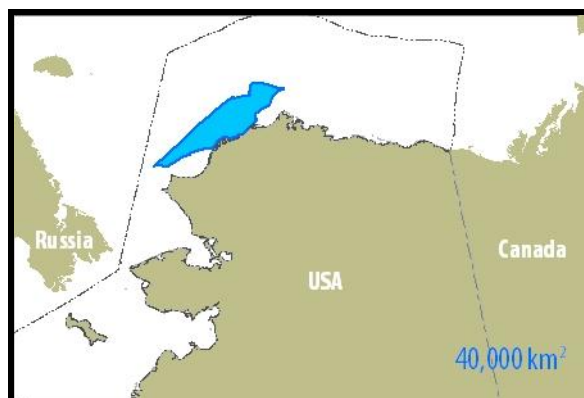
The seafloor is a mixture of gravel, mud, and sand (Map 6). Water temperatures range from 1–5° C during ice-free months (Map 7).

### Outstanding Biological Features

The area has moderate to high water column and benthic productivity (Maps 9–10, 12). Zooplankton such as euphausiids and *Pseudocalanus* copepods, concentrated in these waters, provide an important foraging resource (Map 11). Opilio crab are present but their range has been only partially mapped and their abundance is unknown (Map 13).

Capelin are present and spawn near shore (Map 14). Saffron cod are abundant, so this is National Marine Fisheries Service essential fish habitat for this species (Map 16). Pink and chum salmon are also present (Maps 17–18).

Most bird species that breed on Alaska's North Slope migrate along the lead system in spring and fall when heading to their breeding or wintering grounds. Two species of loons, all four species of eiders, other waterfowl such as Long-tailed Ducks, and Ivory Gulls pass through and forage in these open waters



(Maps 19–26). Kittlitz's Murrelets are believed to use these waters as well when migrating to breeding areas inland of Peard Bay, but their use here is not well documented (Map 27). Groups of hundreds to thousands of Short-tailed Shearwaters are found foraging in these waters (Map 29). Portions of the lead system are designated globally significant Important Bird Areas (Map 31).

This is a prominent polar bear feeding and denning area (Map 32). The area is frequented by ringed seals using breathing holes and haulouts in winter (Map 37). The bears hunt seals along the open leads and den on the pack ice in this critical habitat area. Pacific walrus are concentrated in summer and fall in this area, offshore of Icy Cape past Point Barrow (Map 34); their use of these waters has increased in recent years as they spend more time in the fall at haulouts on the Chukchi coast. All four species of ice seals are present (Maps 35–38). Ringed and bearded seals are present year-round, and are particularly concentrated from February to June.

This is a major bowhead whale area where virtually the entire stock moves through in spring (March to June). Areas offshore of Point Lay, Wainwright, and Barrow are whaling community hunting areas, and this is a North Slope Borough-designated quiet area for this species (Map 39). Beluga whales migrate through in May and June (Map 40); gray whales are present in summer and fall (Map 41).

## Current Resource Use

Subsistence uses include hunting of bowhead whales, occasional beluga whales, walrus, seals, polar bears, and seabirds. Fishing occurs along the coast or in estuaries.

## Conservation Status

- The Chukchi Lead System intersects the Ledyard Bay and Kasegaluk Lagoon globally significant Important Bird Areas, designated by the National Audubon Society and BirdLife International (Map 31).
- Designated critical habitat for Spectacled Eiders by the U.S. Fish and Wildlife Service (Map 21)
- Designated essential fish habitat for saffron cod by the U.S. National Marine Fisheries Service (Map 16).
- Designated no disturbance zone critical denning and feeding habitat for polar bears by the U.S. Fish and Wildlife Service (Map 32).
- Bowhead whale subsistence hunting quiet area designated by Alaska's North Slope Borough (Map 39).
- Currently closed to commercial fishing by the U.S. North Pacific Fishery Management Council.
- A portion of this area—waters within 40 kilometers of the Chukchi coast and Point Barrow—is not currently open to oil and gas leasing by the U.S. Bureau of Ocean Energy Management or the State of Alaska (Map 42).
- Disturbance or pollution from shipping traffic (Map 43).
- Future increased vessel traffic due to shipping, tourism, or fishing as the ice-free season continues to lengthen.
- High air temperature increases (up to 3.0° C) projected by the end of the century (Map 44).
- Expected, but not well understood, changes in marine productivity due to changes in timing and extent of sea ice.

## Current and Future Threats

- Oil and gas seismic exploration, exploratory drilling, production well development, and/or oil spills (Map 42).



## HANNA SHOAL

### Description of Area

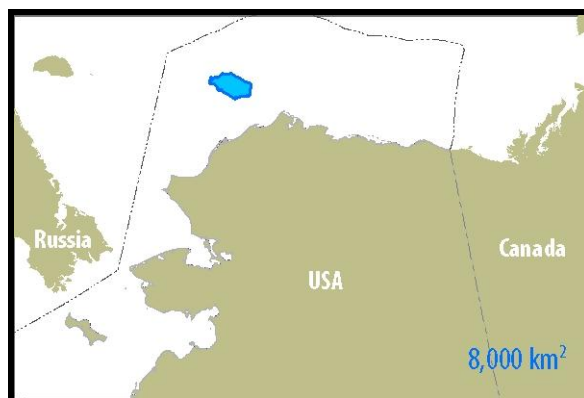
Hanna Shoal is located approximately 125 kilometers northwest of Barrow. The shoal sits between 15 to 40 meters below the surface. (Map 2).

This shallow topographic feature diverts large, warm water masses flowing northward from the Bering Sea, thereby holding onto colder water long into the summer season. As a result, sea ice persists there longer into the season as well (Maps 2, 4–5). A pack ice feature near Hanna Shoal called Post Office Point was historically known for its reliable ice all summer long. Recent decades of warming have changed this persistent lobe of ice, and the minimum September sea ice extent has come this far south only once in the last decade (Map 5). Although no longer known for reliable, summer-long pack ice, today Hanna Shoal is an area of broken ice and persistent ice floes, which are relied on by ice-associated wildlife through late summer.

Water temperatures over the shoal are generally 0–2° C during ice-free months (Map 7). Climate change has affected the shoal greatly; the minimum sea ice extent historically was just south of, and included, the shoal. Today the minimum extent is far north and east over the 4000 meter deep Canada Basin (Map 8).

### Outstanding Biological Features

Hanna Shoal has low primary productivity (Maps 9–10) but concentrated zooplankton (Map 11). The area is thought to have only moderate benthic productivity (Map 12); however, likely because of the persistent ice, this area has almost no direct sampling of benthic fauna—a significant data gap for an area so intensively used by ice-dependent wildlife. Likewise, there is no comprehensive data mapped for fish in this area.



Some bird species such as Steller's and King eiders are known to migrate through the area when passing from Alaska to Chukotka, but similar migration pathway information for many other Arctic bird species is not known. The area appears to be significant for Ivory Gulls—one of the only documented concentration areas for this species in U.S. waters. These birds were observed in groups of up to 30 individuals in surveys completed 30 years ago (Map 26). Northern Fulmars and Short-tailed Shearwaters forage in the area in summer and fall months in unknown numbers (Maps 28–29).

The shoal is part of the core use area of polar bears, as well as a documented denning area (Map 32). Satellite-collared Arctic foxes have been tracked wandering as far offshore as Hanna Shoal to forage atop the winter pack ice (Map 33).

This is a very important area for pinnipeds. Ice-dependent Pacific walrus rely on the late-summer persistent ice at Hanna Shoal as the last ice haulout after all other Chukchi Sea waters are ice-free (Map 34). When Hanna Shoal ice melts in August the walrus are forced to haul out on land and forage from shore. Ringed and bearded seals concentrate at Hanna Shoal in late summer, from July to September (Maps 37–38). Ribbon seals are also present (Map 35).

The shoal is an important, regularly-used migration area for bowhead and beluga whales

in the fall (September to November) when moving from Alaskan to Russian waters (Maps 39–40). This is also the northern extent of gray whales which migrate to the Chukchi Sea from Mexico each year (Map 41).

### **Current Resource Use**

The area is leased for oil exploration and development.

### **Conservation Status**

- Currently closed to commercial fishing by the U.S. North Pacific Fishery Management Council.

### **Current and Future Threats**

- Oil and gas seismic exploration, exploratory drilling, production well development, and/or oil spills (Map 42).
- Future increased vessel traffic due to shipping, tourism, or fishing as the ice-free season continues to lengthen.
- High air temperature increases (up to 2.0° C) projected by the end of the century (Map 44).
- Expected, but not well understood, changes in marine productivity due to changes in timing and extent of sea ice.

## PEARD BAY

### Description of Area

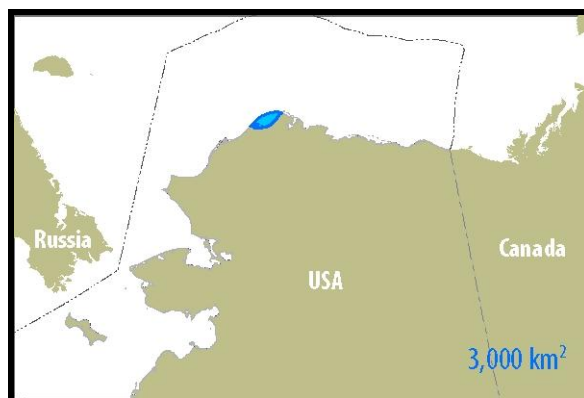
Peard Bay is located on the northern Chukchi Sea coast near Barrow (Map 1). This area is also part of the greater Chukchi Sea lead system. The bay runs from the coast to the edge of Barrow Canyon at about 50 meters depth (Map 2). The Alaska Coastal Current is the main water mass moving through the bay (Map 3). Water temperatures range from 0–2° C during ice-free months (Map 7). The area is characterized by landfast ice from Point Franklin inland (from November through May), and a system of open leads farther offshore (Map 5). The seafloor substrate here is unmapped, but it is speculated that a boulder patch may be present (Map 6). Boulder patches are a type of biodiversity hotspot that is rare on this otherwise muddy, gravelly, and sandy sea bottom; large rock substrate provides a stable area for kelp and associated wildlife to take hold.

### Outstanding Biological Features

Peard Bay waters have low to moderate water column and benthic productivity (Maps 9–10, 12). Opilio crab are present but their range has been only partially mapped and their abundance is unknown (Map 13).

Capelin live in the bay from June to September, and spawn in high numbers along the coast, particularly near Barrow where more detailed surveys exist (Map 14). The bay is also National Marine Fisheries Service essential fish habitat for saffron cod which are present year-round (Map 16). Pink and chum salmon are present from approximately May to August; these salmon spawn in the Kugrua River which drains into Peard Bay (Maps 17–18).

The bay is a key migration route and stopover site for many bird species migrating to and from breeding grounds on Alaska's North Slope. Two species of loons, all four species



of eiders, other waterfowl such as Long-tailed Ducks, and Ivory Gulls pass through and forage in these waters (Maps 19–26). Red-throated and Yellow-billed Loons breed in small but highly concentrated areas just inland of the bay (Maps 19–20). This is a continentally significant Important Bird Area for Spectacled Eiders, which have their highest known breeding concentration in Alaska just inland of the Peard Bay coastline, and forage in the adjacent marine waters (Map 21). Steller's Eider aerial surveys and satellite tag tracking data shows significant use of the Peard Bay coast and spits during migration (Map 22). The bay is a highly concentrated staging area for King Eiders, used by possibly the entire western North America breeding population as they migrate up the Chukchi coast to their breeding grounds on Alaska's North Slope and in Canada (Map 23). Common Eiders also breed along the coastline and spits (Map 24). From Point Franklin to Kugrua Bay is a marine concentration area for Long-tailed Ducks, which also breed all along the coast in very high numbers (Map 25). Kittlitz's Murrelets are believed to use these waters as well when migrating to breeding areas inland of Peard Bay, but their use here is not well documented (Map 27).

This is a very prominent polar bear feeding and denning area (Map 32) which is frequented by ringed seals in late winter and spring (Map 37). The spits of Peard Bay,

including Point Franklin, are designated U.S. Fish and Wildlife Service no disturbance zone critical habitat for polar bears. Pacific walrus are concentrated here in summer and fall; their use of this area (especially around Point Franklin) has increased in recent years as the minimum sea ice extent continues to move north due to climate change (Map 34). All four species of ice seals are present (Maps 35–38). Point Franklin is a spotted seal haulout (Map 36). Ringed and bearded seals are present year-round; this is a bearded seal concentration area from March to September (Map 38).

Peard Bay is a bowhead whale spring migration and concentration area. Waters offshore of Wainwright and Barrow are whaling community hunting areas, and this is a North Slope Borough–designated quiet area for this species (Map 39). Beluga whales migrate through in May and June (Map 40); gray whales are present in summer and fall (Map 41).

### Current Resource Use

Subsistence uses include hunting of bowhead whales, seals, walrus, polar bears, and seabirds.

### Conservation Status

- Peard Bay is a continentally significant Important Bird Area designated by the National Audubon Society and Bird Life International (Map 31).
- Designated essential fish habitat for saffron cod by the U.S. National Marine Fisheries Service (Map 16).
- Designated no disturbance zone critical denning and feeding habitat for polar bears by the U.S. Fish and Wildlife Service (Map 32).
- Bowhead whale subsistence hunting quiet area designated by Alaska’s North Slope Borough (Map 39).
- Currently closed to commercial fishing by the U.S. North Pacific Fishery Management Council.
- Waters within 40 kilometers of the Chukchi coast and Point Barrow are not currently open to oil and gas leasing by the U.S. Bureau of Ocean Energy Management or the State of Alaska (Map 42).

### Current and Future Threats

- Oil spills or seismic exploration disturbance from nearby energy development areas (Map 42).
- Disturbance or pollution from shipping traffic (Map 43).
- Future increased vessel traffic due to shipping, tourism, or fishing as the ice-free season continues to lengthen.
- High air temperature increases (up to 3.8° C) projected by the end of the century (Map 44).
- Expected, but not well understood, changes in marine productivity due to changes in timing and extent of sea ice.

## BARROW CANYON

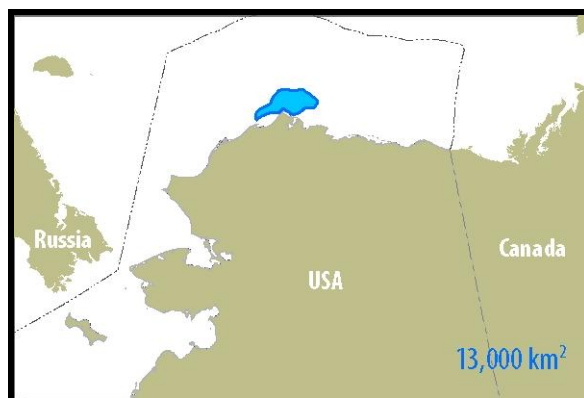
### Description of Area

Barrow Canyon is a canyon and upwelling area which influences the marine ecosystem dynamics offshore of Point Barrow. The canyon itself runs along the Chukchi Sea coast, approximately 10 to 25 kilometers offshore, from Point Franklin to Point Barrow, then cuts through the shelf break and drains into the Canada Basin (Map 2). The low-salinity Alaska Coastal Current follows the Alaska coast, eventually through Barrow Canyon and around Point Barrow, and finally disperses into the Beaufort Gyre and through Amundsen Gulf and M'Clure Strait in the Beaufort Sea (Map 4).

Much of the southern nearshore canyon is open water through the winter due to persistent leads, and the northern offshore portion has concentrated ice present for about nine months (November–July), making this area accessible to migrating wildlife most of the year (Map 5). The canyon bottom is classified as gravelly mud and gravelly muddy sand (Map 6). Temperatures in ice-free months average 0–2° C (Map 7).

### Outstanding Biological Features

Waters around Point Barrow are very productive compared to areas farther offshore (Maps 9 and 10). Zooplankton species such as *Pseudocalanus* copepods and euphausiids concentrate off Point Barrow to the shelf break (Map 11); these concentrated zooplankton are a very important food source for bowhead whales feeding here in the fall. Benthic resources are not well known in this area (Map 12), but were dominated by brittle stars and *Opilio* crab in recent surveys (Map 13). Saffron cod are found throughout this area, and the southern canyon is considered essential fish habitat for this species (Map 16). Pink and chum salmon inhabit the area as well (Maps 17 and 18).



Barrow Canyon straddles the boundary between the Beaufort and Chukchi seas. As wildlife move from one sea to the other, they must round Point Barrow and pass through here. Therefore, the Barrow Canyon area is a migration bottleneck for birds and marine mammals—virtually all of which pass here during both spring and fall migration.

Nearshore areas by Point Barrow are marine feeding areas for many species of birds including Yellow-billed and Red-throated loons; Spectacled, Steller's, King, and Common eiders; Long-tailed Ducks; Northern Fulmars; and Short-tailed Shearwaters (Maps 19–25, 28–29). Like marine mammals, these and other bird species migrate through this area twice each year when moving between the Beaufort and Chukchi seas in spring and fall.

Barrow Canyon is a concentrated nearshore feeding area for polar bears, and is designated critical habitat by the U.S. Fish and Wildlife Service (Map 32). Ringed seals, the primary food source of polar bears, and bearded seals, a secondary food source, also concentrate in the Barrow Canyon area during the same period from about July to September (Maps 37–38). This is also a concentrated feeding area for female walrus and their young in June to October (Map 34). Ribbon seals and gray whales are present in the area in unknown numbers (Maps 35, 41).

Bowhead whales migrate northeast up the Chukchi coast in spring, passing Point Barrow and Barrow Canyon in April and May before heading far offshore on their way to the Canadian Beaufort Sea for summer feeding. In the fall they follow the Alaskan Beaufort Sea coast back west and stop at Barrow Canyon for fall feeding between late August and early November (Map 39). Much like bowhead whales, beluga whales pass through this area twice each year during migration, and concentrate in large numbers in the fall to feed on fish (Map 40).

### Current Resource Use

Subsistence uses include hunting of bowhead whales, occasional beluga whales, seals, walrus, polar bears, and seabirds.

### Conservation Status

- Waters within 40 kilometers of the Chukchi coast and Point Barrow are not currently open to oil and gas leasing by the U.S. Bureau of Ocean Energy Management or the State of Alaska (Map 42).
- Currently closed to commercial fishing by the U.S. North Pacific Fishery Management Council.
- Designated no disturbance zone critical denning and feeding habitat for polar bears by the U.S. Fish and Wildlife Service (Map 32).
- Bowhead whale subsistence hunting quiet area designated by Alaska's North Slope Borough (Map 39).

### Current and Future Threats

- Oil and gas seismic exploration, exploratory drilling, production well development, and/or oil spills (Map 42).

- Disturbance or pollution from shipping traffic (Map 43).
- Future increased vessel traffic due to shipping, tourism, or fishing as the ice-free season continues to lengthen.
- High air temperature increases (up to 2.5° C) projected by the end of the century (Map 44).
- Expected, but not well understood, changes in marine productivity due to changes in timing and extent of sea ice.



## DEASE INLET & ELSON LAGOON

### Description of Area

Dease Inlet and Elson Lagoon are protected by a series of barrier islands and spits that separate this brackish/estuarine area from the greater Beaufort Sea (Map 1). The sea bottom is less than 5 meters deep (Map 2), and summer water temperatures average 1–2° C (Map 7). Several low-elevation, slow-moving rivers, including the Meade, Topagoruk, Alaktak, Chipp, and Inaru, flow into the inlet. Landfast ice covers these waters about nine months per year (October to June), causing rivers flowing into the inlet to flood over the top of the ice when it is present (Map 5).

### Outstanding Biological Features

Dease Inlet has moderate to moderately high primary productivity (Maps 9–10), but low benthic productivity (Map 12). Capelin live in the inlet from June to September, and spawn in high numbers along the coast, particularly near Barrow where more detailed surveys exist (Map 14). Saffron cod, pink salmon, and chum salmon also inhabit the inlet (Maps 16–18). Salmon spawn in the Alaktak and Meade rivers which drain into Dease Inlet.

Yellow-billed and Red-throated loons, all four species of eiders, Long-tailed Ducks, and other waterfowl forage in this area in summer, approximately June to September, as well as breed in high concentrations near the coast of the inlet (Maps 19–25). King Eiders use Elson Lagoon as a summer staging area (Map 23). The lagoon is also a concentrated marine use area for Long-tailed Ducks (Map 25). Ivory Gulls and Kittlitz's Murrelets may occasionally visit these waters, but data for these species is very poor (Maps 26–27). Over 100 Arctic Terns and as many as 400 Black Guillemots nest in a colony on Cooper Island (Map 31), although polar bears have destroyed most guillemot nests in recent years.



Dease Inlet and Elson Lagoon are major maternal denning concentration areas for polar bears, and are designated critical habitat (Map 32). All four species of ice seals occur here, but only ringed and spotted occur in large concentrations. This is a spotted seal haulout in summer and fall, and a ringed seal concentration area in spring and summer (Maps 36–37). Beluga whales also can be found in the shallow lagoon (Map 40).

### Current Resource Use

Subsistence uses include fishing in Elson Lagoon and Dease Inlet, as well as seabird hunting.

### Conservation Status

- Elson Lagoon is a state-significant Important Bird Area designated by the National Audubon Society (Map 31).
- Currently closed to commercial fishing by the U.S. North Pacific Fishery Management Council.
- Designated no disturbance zone critical denning and feeding habitat for polar bears by the U.S. Fish and Wildlife Service (Map 32).

### Current and Future Threats

- Oil and gas seismic exploration, exploratory drilling, production well development, and/or oil spills (Map 42).

- High air temperature increases (up to 2.5° C) projected by the end of the century (Map 44).
- Expected, but not well understood, changes in marine productivity due to changes in timing and extent of sea ice.

## SMITH & HARRISON BAYS

### Description of Area

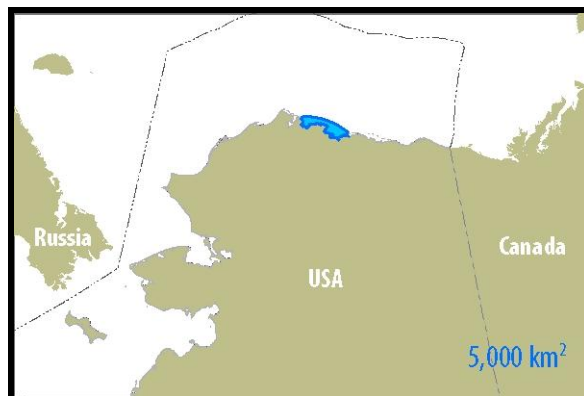
Smith and Harrison bays lie along the far western Beaufort Sea coast near the area of Teshekpuk Lake (Map 1). These two bays average less than 20 meters deep (Map 2), with summer water temperatures around 0–2° C (Map 7). The Alaska Coastal Current is the main water mass flowing across these bays (Map 4). Large freshwater inputs include the Ikpikpuk River which flows into Smith Bay and the Colville River which flows into Harrison Bay. Landfast ice covers these waters nine months of the year (October to June), causing rivers flowing into these bays to flood over the top of the ice when it is present (Map 5). The seafloor here is made of mud and sand, but the substrate is mostly unmapped in Smith Bay (Map 6).

### Outstanding Biological Features

Both bays have moderate to moderately high concentrations of phytoplankton, (Maps 9–10), but low benthic productivity (Map 12). Capelin are present from June to September, and spawn along the coast (Map 14). Saffron cod, pink salmon, and chum salmon also inhabit the bays (Maps 16–18). Both salmon species are present in the Ikpikpuk and Colville rivers; pink salmon also use the Ikpikpuk as a rearing area.

Yellow-billed and Red-throated loons, all four species of eiders, Long-tailed Ducks, and other waterfowl forage in this area in summer, approximately June to September, as well as breed in high concentrations just inland of these bays (Maps 19–25). King Eiders use Smith and Harrison bays as a summer staging area (Map 23). The deltas of the Ikpikpuk and Colville rivers are highly important areas for shorebirds (Map 31).

This is a major maternal denning concentration area for polar bears, and is



designated critical habitat for feeding and denning (Map 32). Just inland, Arctic fox populations are dense; they use these bays in winter by scavenging atop the sea ice (Map 33). Pacific walrus occasionally travel to the Beaufort Sea and haul out here in small numbers (Map 34). All four species of ice seals occur here, but only ringed and spotted occur in large concentrations. Smith Bay is the largest spotted seal haulout on the Beaufort Sea coast; a second smaller haulout is located along the Colville River delta at Harrison Bay (Map 36). These bays are ringed seal concentration areas from February to September (Map 37), and bearded seal concentration areas from July to September (Map 38). Bowhead whales migrate east across the bays in the fall in high to very high concentrations, feeding on zooplankton (Map 39). Smith Bay is part of the fall hunting area for Native Alaskan whalers from Barrow. Beluga and gray whales also inhabit these bays in summer and fall (Maps 40–41).

### Current Resource Use

Some seal hunting takes place in this area, and bowhead whales have occasionally been harvested this far east of Barrow. Fishing occurs from Nuiqsut, though primarily for anadromous fish in the Colville River rather than in the ocean itself.

### Conservation Status

- Teshekpuk Lake is a globally significant Important Bird Area and

Colville River Delta is a continentally significant Important Bird Area, both designated by the National Audubon Society and BirdLife International (Map 31).

- Designated no disturbance zone critical denning and feeding habitat for polar bears by the U.S. Fish and Wildlife Service (Map 32).
- Bowhead whale subsistence hunting quiet area designated by Alaska's North Slope Borough (Map 39).
- Currently closed to commercial fishing by the U.S. North Pacific Fishery Management Council.

### Current and Future Threats

- Oil and gas seismic exploration, exploratory drilling, production well development, and/or oil spills (Map 42).
- Disturbance or pollution from shipping traffic (Map 43).
- Future increased vessel traffic due to shipping, tourism, or fishing as the ice-free season continues to lengthen.
- High air temperature increases (up to 3.8° C) projected by the end of the century (Map 44).
- Expected, but not well understood, changes in marine productivity due to changes in timing and extent of sea ice.

## WESTERN BEAUFORT SHELF & LEAD SYSTEM

### Description of Area

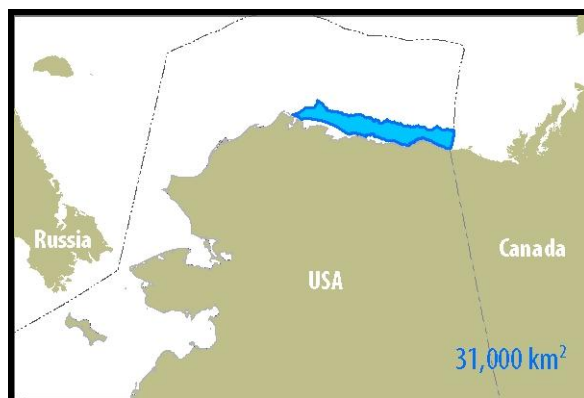
This area covers the continental shelf in the Beaufort Sea from the edge of Smith and Harrison bays and the Beaufort barrier islands to approximately 80 kilometers offshore where the seafloor quickly drops from 200 meters to more than 3000 meters deep (Map 2). Much smaller than the Chukchi Sea shelf, this narrow band is an area of recurring leads in the sea ice. These factors make this an important wildlife concentration area year-round.

The Alaska Coastal Current flows east at the edge of the shelf, but recirculates and heads west again in waters more near shore (Map 4). Approximately nine months per year, from November to July, water near the coast is covered with landfast ice (Map 5). Unable to flow freely into the sea, fresh water from the Meade, Ikpikpuk, Colville, and Canning rivers backs up and floods over the landfast ice. A system of open leads occurs regularly along the edge where the stable landfast ice and the drifting pack ice meet. The seafloor here is mostly gravel and mud, with small areas of sand (Map 6). Water temperatures are 0-2° C during the short ice-free season from mid-July through October (Map 7).

Historically the summer sea ice did not recede far from the Beaufort coast, remaining over the continental shelf in late summer, then meeting back up with the coast in early fall. Sea surface temperatures have not changed as drastically in this area as in the Chukchi Sea, but the extent of summer sea ice has moved offshore about 400 kilometers or more compared to the historical average (Map 8).

### Outstanding Biological Features

Primary production in this area is low to moderate (Maps 9–10). There is little large-



scale data available on zooplankton in this area (Map 11), although bowhead whales and other wildlife appear to be selecting for this area due to high forage value. Benthic productivity is virtually unsampled here (Map 12). Opilio crab may inhabit the Beaufort shelf, but research on their distribution is incomplete (Map 13).

Capelin, an important forage fish for birds and marine mammals, are known to be present from June to September across the shelf (Map 14). This is the eastern extent of saffron cod distribution in U.S. Arctic waters, although this information has not been recently updated (Map 16). Both pink and chum salmon inhabit these waters in summer (Maps 17–18).

Birds heading to Alaska's North Slope migrate and forage along the open leads in early summer before moving inland to their nesting grounds, as well as after the breeding season. This includes loons, eiders, and other waterbirds (Maps 19–25). King Eiders, especially, are known to concentrate in these waters during summer.

The Beaufort Sea shelf is hugely important for polar bears, which den on the sea ice and feed on seals. This area is part of the core use area for these marine bears (Map 32). Arctic foxes tagged on the North Slope were observed foraging atop the winter pack ice (Map 33); these scavengers often pick up scraps left over from polar bear kills. Ringed and bearded

seals are present year-round, and are particularly concentrated over the shelf from July to September (Maps 37–38). This is a bowhead whale migration and concentration area in the fall, and is heavily used by Eskimo whalers during this time (Map 39). Beluga whales migrate through in both spring and fall, and are particularly concentrated in September (Map 40). Gray whales from Mexico migrate to these waters to feed in summer and fall as well (Map 41).

### Current Resource Use

Most of this area has been available for oil and gas leasing. The only current oil production in this area is at the Northstar facility.

Subsistence uses include hunting for bowhead whales by residents of Nuiqsut and Kaktovik from Cross Island and Barter Island, seals, occasional walrus, and polar bear. Fishing is practiced by residents of Kaktovik and Nuiqsut, and at other locations along the coast.

### Conservation Status

- Near Kaktovik, a portion of the federal Beaufort Sea Outer Continental Shelf Program Area is closed to leasing for protection of whaling waters (Map 42).
- Designated critical habitat for feeding polar bears by the U.S. Fish and Wildlife Service (Map 32).
- Bowhead whale subsistence hunting quiet area designated by Alaska's North Slope Borough (Map 39).
- Currently closed to commercial fishing by the U.S. North Pacific Fishery Management Council.

### Current and Future Threats

- Oil and gas seismic exploration, exploratory drilling, production well, production facility, and pipeline development, associated aircraft and vessel support, and oil spills (Map 42).
- Disturbance or pollution from shipping traffic (Map 43).
- Future increased vessel traffic due to shipping, tourism, or fishing as the ice-free season continues to lengthen.
- High air temperature increases (up to 3.0° C) projected by the end of the century (Map 44).
- Expected, but not well understood, changes in marine productivity due to changes in timing and extent of sea ice.



## BEAUFORT LAGOONS & BARRIER ISLANDS

### Description of Area

A series of long, thin barrier islands and spits lines the Beaufort Sea coast from the Colville River to Demarcation Bay (Map 1). The islands are close to shore (1 to 15 kilometers away), helping protect the coastline from storms and erosion. Between the islands and the coast, shallow lagoons and bays (less than 10 meters deep) act as a large estuary due to many large rivers which drain into the sea in this area (Map 2).

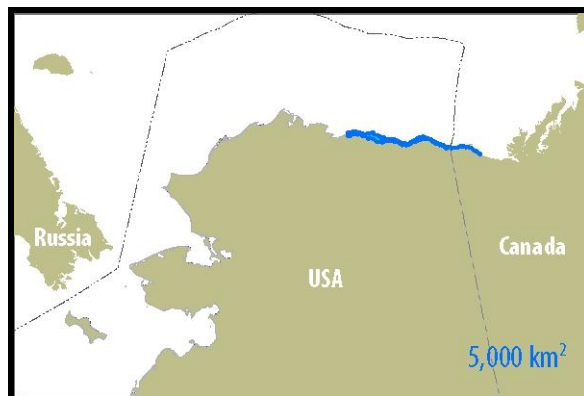
The Alaska coastal current flows east at the edge of the continental shelf, but recirculates and heads west again in waters more near shore (Map 4). About nine months per year, from November to July, this area is covered with landfast ice (Map 5). Unable to flow freely into the sea, fresh water from the Meade, Ikpikpuk, Colville, and Canning rivers flows over the top of the ice.

The seafloor here is mud and sand, with rare boulder patches present in Stefansson Sound and Camden Bay (Map 6). Water temperatures are 0-2° C during the short ice-free season from mid-July through October (Map 7).

### Outstanding Biological Features

Stefansson Sound and Camden Bay are home to boulder patch communities, which are very rare. They are the only known places capable of supporting kelp forests, and in turn a unique assemblage of associated organisms. This is the most biologically diverse community discovered in Alaska's Beaufort Sea (Map 6).

Phytoplankton concentration is moderate compared to the Chukchi Sea, but is a hotspot for the Beaufort Sea (Maps 9-10). Benthic productivity in the Beaufort Lagoons and



Barrier Islands area is very high for this region (Map 12).

This is an important area for many species of fish, some of which were not mapped in the Arctic Marine Synthesis, such as Arctic cisco and dolly varden. Capelin, an important forage fish for birds and marine mammals, are known to be present from June to September across the shelf (Map 14). This is the eastern extent of saffron cod distribution in U.S. Arctic waters, although this information has not been recently updated (Map 16). Both pink and chum salmon inhabit these waters in summer (Maps 17-18), and are present in the Colville, Itkillik, Sagavanirktok, and Canning rivers which flow into the sea here.

Birds heading to Alaska's North Slope migrate and forage in these waters in early summer before moving inland to their nesting grounds, as well as after the breeding season. This is a marine concentration area for Long-tailed Ducks (Map 25), and the site of a globally significant Important Bird Area for this species (Map 31). Red-throated Loons, Spectacled Eiders, King Eiders, and Long-tailed Ducks nest in high concentrations just inland of this section of the Beaufort Sea coast (Maps 20-21, 23, 25).

The barrier islands are a refuge for nesting and foraging birds and resting mammals. Common Eiders nest in colonies of up to 500 birds throughout this area (Map 24), as well as several other species such as Arctic Terns,

Glaucous Gulls, and Snowy Owls. In winter the sea ice stacks up along the islands and coast, where polar bears dig dens. This is the highest-known polar bear denning concentration area in the U.S. Arctic Ocean, especially along the coast of the Arctic National Wildlife Refuge. The barrier islands and coastline are designated no disturbance zone critical habitat, and the marine waters are designated critical feeding habitat (Map 32).

Pacific walrus occasionally visit the Beaufort Sea; there are three known haulouts along this area of coastline, which are used in low numbers (Map 34). This is a spotted seal foraging area from June to December, with one known haulout just east of the Colville River (Map 36). Ringed and bearded seals are present year-round, and are particularly concentrated in the shallow lagoons from about February to September. (Maps 37–38).

Some bowhead whales migrate near shore, and feed in the passes between barrier islands and off the Jago and Okpilak Rivers. Waters from Nuiqsut to Cross Island and around Kaktovik are important areas for Eskimo whalers during this time (Map 39). Beluga whales migrate through in both spring and fall (Map 40). Gray whales from Mexico migrate to these waters to feed in summer and fall as well (Map 41).

### Current Resource Use

The Alaska state-owned waters between the Colville River and Stefansson Sound are the center of intense energy exploration with most production occurring immediately offshore of the existing onshore development. A large number of exploration wells have been drilled here, and several sites are in production. The area has been altered by the building of artificial gravel drilling islands and the Endicott and West Dock causeways and trenched, buried undersea pipelines.

From the Canning River east to the Canadian border the barrier islands and lagoons are located within the Arctic National Wildlife Refuge, a conservation area protected for wilderness, wildlife, recreation, and subsistence.

Subsistence hunting and fishing for marine mammals, fish, birds, and caribou takes place on barrier islands and in the lagoons by residents of Nuiqsut and Kaktovik.

### Conservation Status

- Designated no disturbance zone critical denning and feeding habitat for polar bears by the U.S. Fish and Wildlife Service (Map 32).
- Eastern Beaufort Sea Lagoons & Barrier Islands is a globally significant Important Bird Area designated by the National Audubon Society and BirdLife International (Map 31).
- The eastern section of the area is within the Arctic National Wildlife Refuge which is managed by the U.S. Fish and Wildlife Service for wilderness, wildlife and their habitats, recreation, subsistence, upholding international treaties, subsistence, and water quality. The lagoon/barrier island system east of the Aichilik River and Demarcation Bay is also designated within the National Wilderness Preservation System. Although oil and gas drilling is a continual threat for its contested Coastal Plain, oil and gas leasing, exploration and production are prohibited by law (Map 42).
- Near Kaktovik, a portion of the State's Beaufort Sea Areawide Lease Sale Area has been deferred from leasing for protection of whaling

waters but this is subject to change at any time (Map 42).

- Bowhead whale subsistence hunting quiet area designated by Alaska's North Slope Borough (Map 39).
- Currently closed to commercial fishing by the U.S. North Pacific Fishery Management Council.

## Current and Future Threats

- A continued threat of potential oil exploration and development in the Coastal Plain (1002 Area) of the Arctic National Wildlife Refuge. (Map 42).
- Oil and gas seismic exploration, exploratory drilling, production well, production facilities, pipelines and development, and oil spills, including spills from activities in adjacent State of Alaska and federal Beaufort Sea Outer Continental Shelf Lease Program Area (Map 42).
- Disturbance or pollution from shipping traffic (Map 43).
- Future increased vessel traffic due to shipping, tourism, or fishing as the ice-free season continues to lengthen.
- High air temperature increases (up to 3.0° C) projected by the end of the century (Map 44).
- Expected, but not well understood, changes in marine productivity due to changes in timing and extent of sea ice.



## **APPENDIX A**

### **REFERENCES SECTION FROM THE ARCTIC MARINE SYNTHESIS**

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