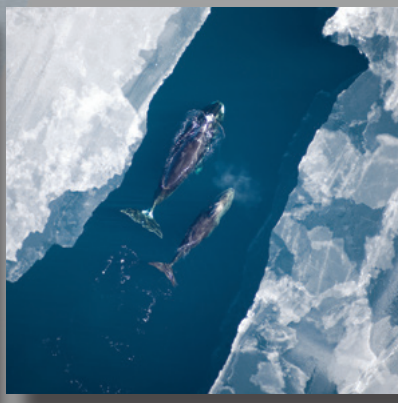
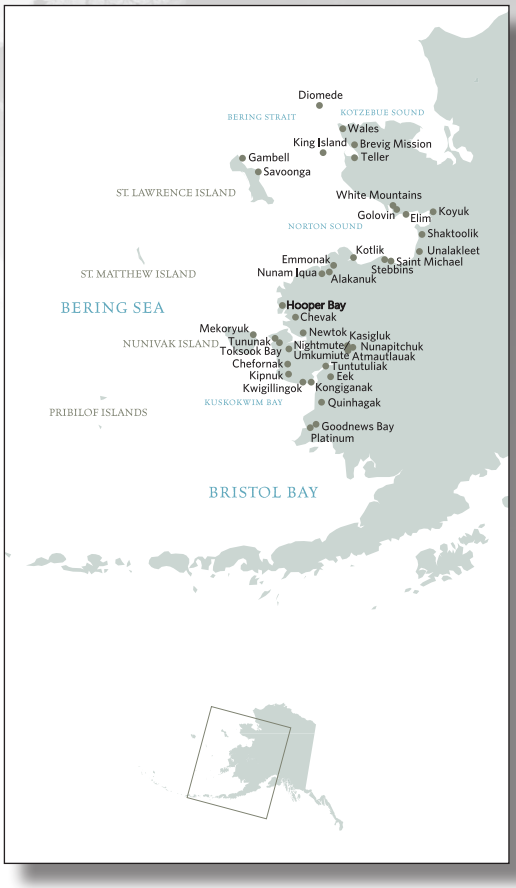
Northern Bering Sea and Bering Strait

Ecosystem and Climate Change



Bering Sea Elders Group

George Riggs, NASA



Bering Sea Elders Group

Bering Sea Elders Group is an association of elders appointed by 39 participating tribes from the Kuskokwim Bay to the Bering Strait. Our mission is to speak and work together as one voice to protect and respect our traditional ways of life, the ocean web of life that supports the resources we rely on, and our children's future. The Elders Group serves as a messenger to our children, tribal councils, and government decision-makers.

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Introduction

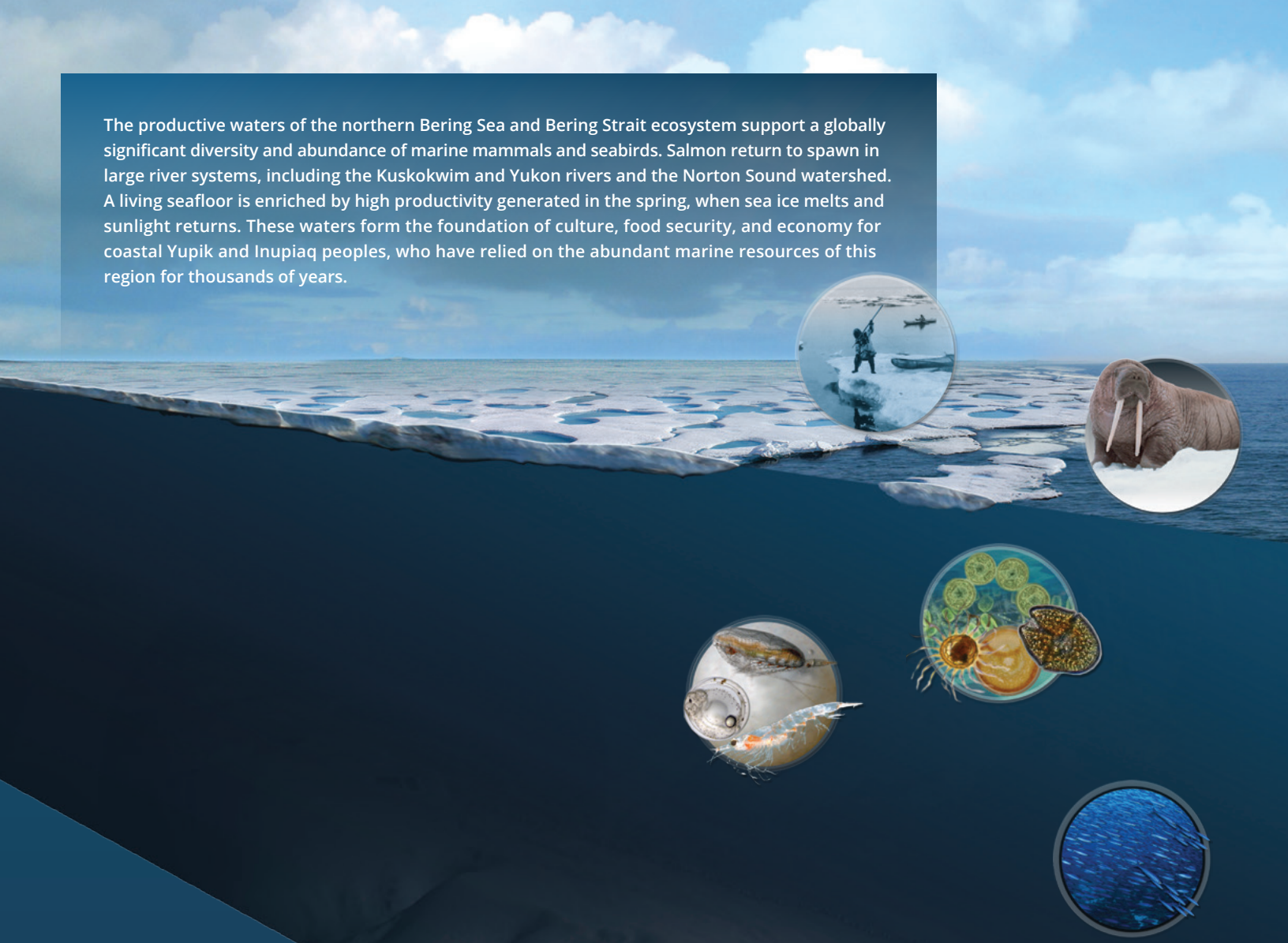
The cold, rich waters of the northern Bering Sea and Bering Strait form the foundation of culture, food security, and economy for coastal Yupik and Inupiaq peoples, who have relied on the abundant marine resources of this region for thousands of years. Cultural practices associated with hunting and fishing bind people to the sea, and tie families and communities together through the passing of knowledge from one generation to the next. Alongside ongoing traditional uses are small-scale commercial fisheries for salmon, crab, herring, and halibut, which are a vital component of regional employment and the cash economy. The seafloor and waters of this region are extraordinarily productive, and support a globally-significant diversity and abundance of marine mammals, seabirds, and other ocean life. One of the largest marine migrations on Earth moves through the northern Bering Sea and Bering Strait each spring to take advantage of the Arctic's burst of summer productivity,[1] including thousands of bowhead and beluga whales, hundreds of thousands of walruses, an estimated one million ice seals, and millions of seabirds.

One of the largest marine migrations on Earth moves through the northern Bering Sea and Bering Strait each spring to take advantage of the Arctic's burst of summer productivity.

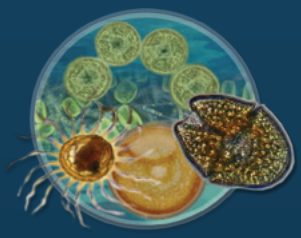
But this unique ecosystem is vulnerable to ecological transformation and uncertainty due to climate change. For thousands of years, seasonal ice cover has structured ecological mechanisms underpinning marine life. Climate warming is leading to change in seasonal ice, altering the abundance, timing, and distribution of important species. The loss of sea ice is in turn causing a dramatic increase in ship traffic through these highly sensitive and important areas. Strengthening the role of tribal governance and utilizing precautionary management principles are tools that can address key concerns shared by tribes in the region.

But this unique ecosystem is vulnerable to ecological transformation and uncertainty due to climate change.

The productive waters of the northern Bering Sea and Bering Strait ecosystem support a globally significant diversity and abundance of marine mammals and seabirds. Salmon return to spawn in large river systems, including the Kuskokwim and Yukon rivers and the Norton Sound watershed. A living seafloor is enriched by high productivity generated in the spring, when sea ice melts and sunlight returns. These waters form the foundation of culture, food security, and economy for coastal Yupik and Inupiaq peoples, who have relied on the abundant marine resources of this region for thousands of years.



The Ecosystem



Fueled by powerful North Pacific currents, nutrient-rich waters support seasonal "blooms" of phytoplankton and large populations of zooplankton.

The northern Bering Sea and Bering Strait region is a dynamic ecosystem strongly influenced by the annual cycle of the formation and retreat of winter sea ice.[2] Fueled by powerful North Pacific currents from the south that force deep, nutrient-rich waters up onto the broad, shallow continental shelf, the waters of this region support seasonal "blooms" of phytoplankton and large populations of zooplankton.[3] Sea ice acts as an organizing force for the mechanics of this productive ecosystem—changes in the timing and extent of sea ice in the region affect growth and distribution of animal and plant life, both in the water column and on the seafloor.[4]

During the winter and spring, large marine mammal and seabird aggregations use the ice as a platform for resting, breeding, or feeding. The four ice seal species—ringed (*Phoca hispida*), bearded (*Erignathus barbatus*), ribbon (*P. fasciata*) and spotted (*P. largha*) seals—occupy these waters, with some favoring the southern edge of the ice and others the St. Lawrence Island polynya or coastal waters.[5] Herds of Pacific walrus (*Odobenus rosmarus divergens*) use the ice as a platform in constant motion across the continental shelf, allowing them to stage trips to the shallow seafloor to forage on rich benthic infauna.[6] The northern Bering Sea provides important winter feeding and calving grounds for bowhead whales (*Balaena mysticetus*) in areas of broken ice before heading north to the Arctic Ocean for the summer.[7] The waters between St. Lawrence and St. Matthew islands are designated as critical habitat for the threatened spectacled eider (*Somateria fisheri*), where the entire global population forms stunningly dense aggregations during winter in open water leads within the ice pack.[8,9]

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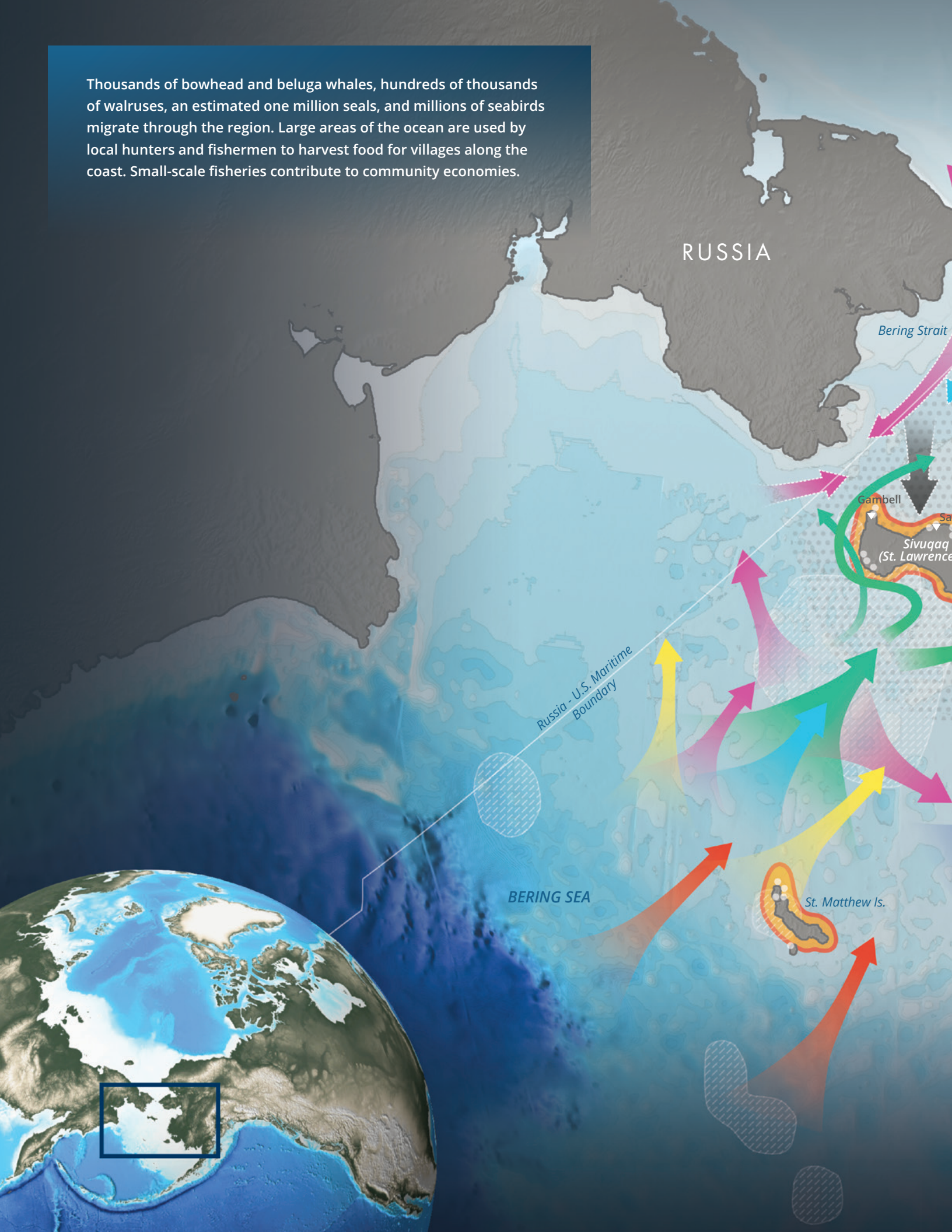
Thomas Van Pelt

SPECTACLED EIDER FLOCK IN WINTER, SURROUNDING AN OPEN WATER LEAD IN SEA ICE SOUTH OF ST. LAWRENCE ISLAND.


Thousands of bowhead and beluga whales, hundreds of thousands of walruses, an estimated one million seals, and millions of seabirds migrate through the region. Large areas of the ocean are used by local hunters and fishermen to harvest food for villages along the coast. Small-scale fisheries contribute to community economies.
RUSSIA
Bering Strait
Gambell
Sivuqaq
(St. Lawrence
Russia - U.S. Maritime Boundary
BERING SEA
St. Matthew Is.


CHUKCHI SEA
Kotzebue Sound
Shishmaref
Diomede
Wales
Brevig Mission
Teller
King Is.
Koyuk River
Koyuk
ALASKA
Elim
White Mountain
Golovin
Nome
Shaktoolik
Unalakleet River
Norton Sound
Unalakleet
St. Michaels
Stebbins
Kotlik
Yukon River
Emmonak
Nunam Iqua
Kuskokwim River
Chevak
Hooper Bay
Bethel
Newtok
Kasigluk
Nunapitchuk
Atmautluak
Tununak
Toksook Bay
Nightmute
Tuntutuliak
Eek
Mekoryuk
Chefornak
Kipnuk
Kongiganak
Nunivak Is.
Kwigillingok
Kwinhagak
Kuskokwim Bay
Goodnews Bay
Platinum
Bristol Bay
Bearded Seal
Ringed Seal
Spotted Seal
Walrus
Spectacled Eider
Gray Whale
Bowhead Whale
Beluga Whale
Salmon
Important Bird Areas
Subsistence Harvest Areas
Spring Movement
Fall Movement
Presence Along Coastline

Year-round, the northern Bering Sea is also a unique and sensitive acoustic environment.

In the spring, the sea ice begins to retreat. Herds of Pacific walrus, predominantly females and mothers with calves, continue to follow the ice edge to the northern Chukchi Sea. Bowhead whales begin their journey to the Beaufort Sea, beluga whales (*Delphinapterus leucas*) move in from offshore following schools of fish into coastal waters,[10] and gray whales (*Eschrichtius robustus*) arrive from the south. Other marine mammal species are found here year-round or seasonally. With the returning sunlight and melting ice, a massive plankton bloom occurs, fueling the base of the northern Bering Sea marine food web. A large portion of the primary production sinks to the bottom, enriching a soft-sediment living seafloor, and sustaining this area of the world's oceans with one of the highest measurements of benthic biomass.[11] This extraordinary phenomenon continues north with the retreating ice into the Chukchi Sea.

In both spring and fall, large migrations of marine mammals and birds move to and from the Arctic Ocean through the funnel of the narrow Bering Strait, passing by St. Lawrence Island and smaller islands of the northern Bering Sea. The high productivity of these waters draws especially large numbers of birds to the uninhabited St. Matthew and Hall islands, which rank among Alaska's top five most abundant seabird colonies with over 1.6 million nesting birds.[12] The Bering Strait area is estimated to seasonally host some 12 million seabirds, one of the highest densities in the world.[13] This migration phenomenon is called *katawhsaqa* or "pouring out" in the St. Lawrence Island Yupik language.[14] During this time and throughout the summer, families living in island and coastal communities focus on subsistence hunting, fishing, and gathering activities, and participate in small-scale commercial fisheries for salmon, crab, herring, and halibut.

Year-round, the northern Bering Sea is also a unique and sensitive acoustic environment. Marine mammals rely on their acoustic environment to find food, communicate, and navigate. They produce sounds critical for communication and mating purposes, and listen for predator cues within the ambient ocean soundscape.[15]

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Amelia Brower / NOAA

BOWHEAD WHALES SWIMMING THROUGH A LEAD IN THE SEA ICE.

Thomas Van Pelt

Climate Change

Climate warming is changing the northern Bering Sea and Bering Strait ecosystem. Delayed and reduced formation of nearshore winter ice is leaving villages exposed to storm surges, resulting in dramatic coastal erosion.[16] Satellite and local observations show that the timing, duration, and extent of seasonal sea ice are changing.[17] This is linked to a suite of ecological shifts, including a decline in seafloor biological communities over the past several decades.[18] During a series of very warm years from 2000-2005, the centers of distribution for a wide range of fish species moved north.[19] In some years, the retreating ice has drifted north too fast to allow Alaska Native hunters a successful spring walrus harvest.[20] Local hunters report the absence of large ice floes coming from the north in the fall[21] and note that sea ice has been thinner, making traveling on the ice more dangerous.[22]

Oceanographers describe distinct differences between the southeast Bering Sea and the northern Bering Sea. A boundary around 60° N latitude, along a line roughly connecting St. Matthew Island to Nunivak Island, separates the consistently cold waters of the northern area with the more variable conditions to the south. The south is well-known for industrial-scale fisheries that produce roughly 40% of the U.S. domestic seafood.[23, 24] Even during relatively warm years, and despite high annual variability to the south, the north is consistently distinguished by a footprint of cold bottom temperatures and less salty surface waters left behind by winter sea ice. This condition influences ecosystem structure including the rich benthic-dominated food web and the high regional productivity.[25]

But what the future holds is an open question. Scientists forecast that the seasonal sea ice extent into the southeast Bering Sea will decrease by half over this century.[26] Climate models indicate that, for the time being, winter sea ice will continue to form in the northern Bering Sea, but freeze up will occur later and the ice pack will retreat earlier in the spring with likely ecological effects.[27] Climate forecasts indicate there will be considerable inter-annual and multi-year variability in conditions and less predictability in the timing and extent of ice.[28] Over the long-term, the Bering Sea faces a very likely warming trend, but questions remain about how climate change will unfold, especially in terms of the rate of change in summer and winter, and how change will vary between the southern and northern regions.[29] Future impacts of warming on the regional ecosystem and coastal communities, in the form of gradual change or sudden tipping points, will depend on complex interactions between physical and biological dynamics.[30]

Over the long-term, the Bering Sea faces a very likely warming trend, but questions remain about how climate change will unfold, especially in terms of the rate of change in summer and winter, and how change will vary between the southern and northern regions.

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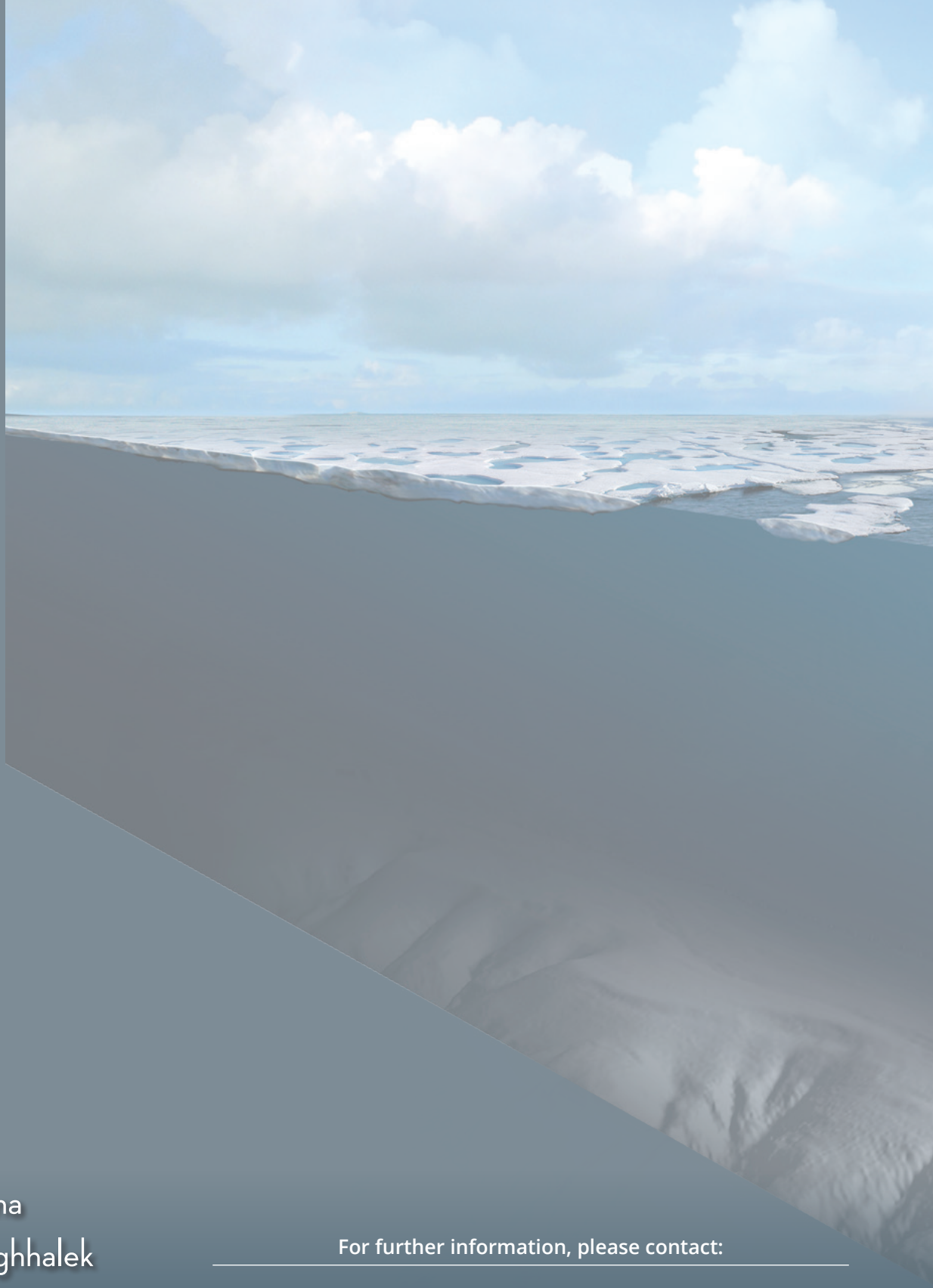

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Thank you

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