

Arctic Network

National Park Service
U.S. Department of the Interior

Alaska Region
Inventory & Monitoring Program



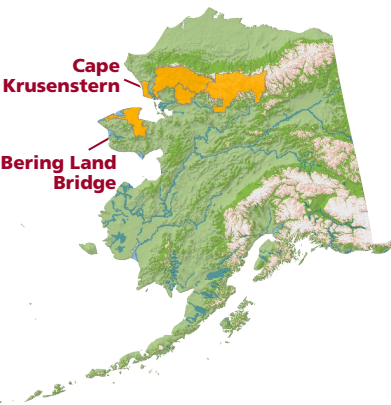
Bering Land Bridge N Pres. • Cape Krusenstern NM
Gates of the Arctic NP & Pres. • Kobuk Valley NP • Noatak N Pres.

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Coastal Lagoon Resource Brief



The Importance of Coastal Lagoons in the Arctic Network



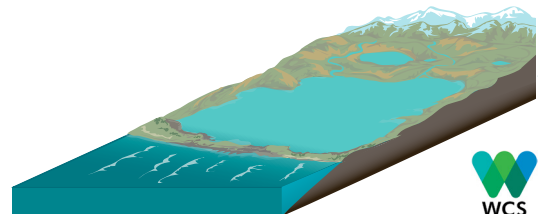
Map: Coastal lagoons are being monitored in 2 Arctic Network parks: Bering Land Bridge N Pres. and Cape Krusenstern NM.

Arctic lagoons make up about a third of the Arctic coastline. These dynamic coastal lagoons are a critically important ecosystem in the region because they support avian, fish, and invertebrate populations, and are used by both terrestrial and marine mammals. They also support seasonal traditional subsistence activities for Alaska Natives and serve as navigational pathways throughout the year by local village residents. Coastal lagoons are shallow, semi-enclosed, brackish waterbodies that have conditions between fresh and marine waters. There are eight major lagoons described within the boundary of Cape Krusenstern National

Monument – Aukulak, Imik, Ipiavik, Kotlik, Krusenstern, Port, Taseychek, and Sisualik. Five major lagoons are within the boundary of Bering Land Bridge National Preserve – Lopp, Kupik, Shishmaref, Ikpek and Arctic and sediment transport is beginning to form a sixth in the shallow, protected waters behind Cape Espenberg. Lagoons in both parks are vulnerable to climate change through increased coastal erosion and decreased ice cover. Lagoon breaching by marine waters is a part of the naturally functioning system, but these dynamics are changing due to beach erosion and changes in lagoon ice cover. This, in turn, alters fish community patterns and the availability of fish resources to subsistence fishers. Coastal lagoons also face threats from increased human activities in the region, such as oil and gas development, development of deep-water ports, and international shipping. Despite their ecological and cultural importance, there has been very little research on coastal lagoons in the western Arctic. The Arctic Network Inventory and Monitoring Program is developing long-term monitoring protocols for these lagoons with Wildlife Conservation Society and the Native Village of Kotzebue, along with input from local indigenous knowledge holders.



Images: (top) NPS monitoring efforts, (near right) juvenile ninespine stickleback, (far right) conceptual diagram of a lagoon when connection to the marine environment is closed (courtesy of the Wildlife Conservation Society).



What We Want To Know About This Vital Sign	• Lagoon water chemistry and connectivity with the marine environment • Fish community composition and patterns of use • Fish growth rates for resident and migratory species	• Aquatic food web and trophic dynamics • Contaminants levels in fish • Extent of overwintering fish habitat • The importance of fish species for subsistence fishers in specific lagoons and at specific times
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How We Monitor This Vital Sign	• These lagoons are highly dynamic systems where water quality changes drastically as connections to the marine environment open and close. We monitor water quality parameters (temperature, dissolved oxygen, salinity, specific conductivity, turbidity, pH, chlorophyll, and blue green algae) through the season (3-5 times total per lagoon per season when logistically feasible). • Lagoons in both parks range in size, connectivity and saltwater influence, allowing us to sample fish distributions, abundance, and community composition through the season and across selected environmental gradients. We sample fish using beach seines, fyke nets, and gill nets. Initial efforts show that key prey species include mysid shrimp, midge (fly) larvae, and ninespine stickleback. • Documenting fish growth rates allows us to monitor long-term changes in fish condition, and ultimately changes to the lagoon conditions that affect fish growth. Examining fish diets establishes key trophic linkages among species in order to develop a broader understanding of Arctic lagoon food webs. We measure fish length and collect otolith (structures in the inner ear of fish) samples to examine fish growth rates for resident and migratory species. • Levels of contaminants in the Arctic may increase. Although analysis of fish in these	Dolly Varden, an important subsistence species for Kivalina. Courtesy of J.L. Bryant. lagoons suggests they are healthy and low in contaminants, we collaborate with the state of Alaska to analyze contaminants (metals and persistent organic pollutants) in key fish species in order to establish a baseline for Arctic lagoons. • We use Synthetic Aperture Radar (SAR) remote sensing techniques to locate available liquid water that may serve as overwintering habitat for whitefishes in watersheds of coastal Arctic lagoons. • Subsistence fishers have a traditional understanding of the ecosystem that can provide crucial ecological and cultural insights. We work with local communities to combine our scientific findings with traditional knowledge to gain a more complete picture of whitefish subsistence use and whitefish ecology.
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How Monitoring This Vital Sign Can Help Park Managers	• Provide baseline conditions of the lagoons to better detect long-term changes • Characterize seasonal and inter-annual variability of physical and biotic components of lagoons • Determine relative productivity of lagoons	- to better prepare for and quantify impacts of industrial marine accidents • Provide information about the ecological role of lagoons to improve resource protection
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