Alaska Key Sites

Figure 4. Key habitat sites for sea ducks in Alaska.

Key Site 4: Annette-Betton-Cleveland Islands, Alaska

Location: 55°27'24"N, 131°54'16"W

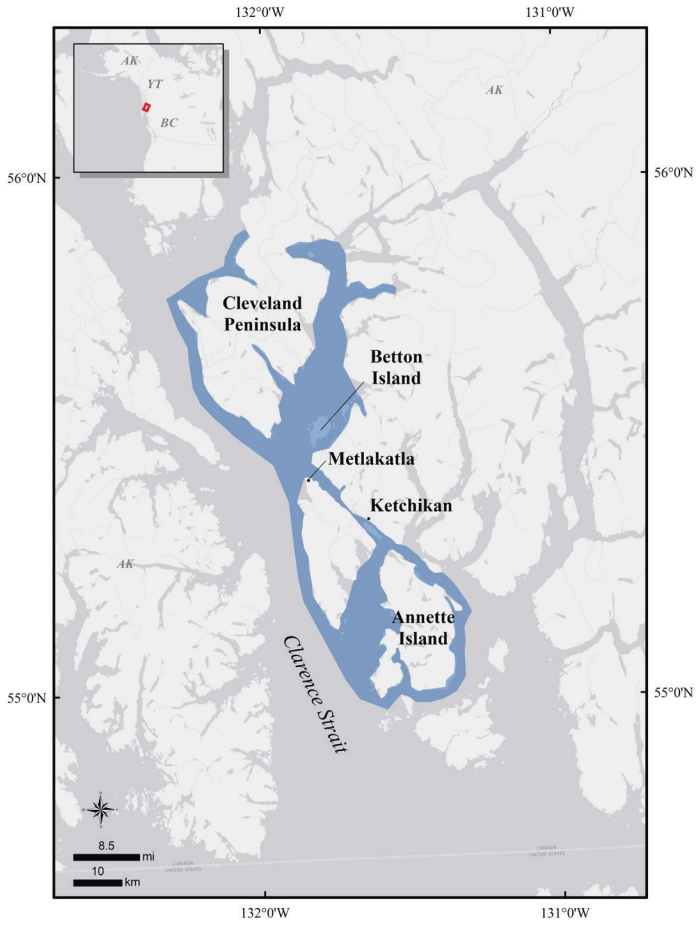
Size: 1288 km^2

Description: This key habitat site is located just north of the border between British Columbia and Alaska, at the southern extent of the Alexander Archipelago, north of Dixon Entrance, and is within the Inside Passage, about 100 km from open Pacific Ocean. It includes most of the shoreline of Annette Island, west Behm Canal (particularly Betton Island and Helm Bay), and Vixen Inlet on the north side of Cleveland Peninsula. It is bordered on the north by Ernest Sound, to the west by Clarence Strait, and to the south and east by Felice Strait and Revillagigedo Channel. The communities of Ketchikan (population ~14,000) and Metlakatla (population ~1,400) border this key habitat site.

This area is one of the wettest regions in Southeast Alaska, with average annual precipitation of 386 cm and generally mild temperatures ranging from a mean of 1°C in January to 14°C in July (Carstenson et al. 2007). The region is characterized by convoluted shorelines, with numerous islands, bays, inlets, and channels (Heinl and Piston 2009). The surrounding land is hilly and mountainous, with a relatively high proportion of intact old-growth coastal temperate rainforest (especially on the Cleveland Peninsula) and widespread wetlands (Smith 2016).

Precision and Correction of Abundance Estimates Presented: Estimates given from aerial survey data have had no correction factors applied.

Biological Value: This area provides important spring migration stopover habitat for Surf Scoters (*Melanitta perspicillata*) on the Pacific coast (Lok et al. 2011, 2012; Heinl and Piston 2009). During late April to early May, Pacific herring (*Clupea pallasi*) spawn in this region, providing an abundant, rich food source at which Surf Scoters and other sea duck species are known to congregate (Heinl and Piston 2009). Flocks of over 10,000 Surf Scoters have been observed, along with smaller numbers of Harlequin Ducks (*Histrionicus histrionicus*) and Barrow's Goldeneye (*Bucephala islandica*) (Heinl and Piston 2009). Aerial surveys in late April 2006 documented 77,860 Surf Scoters on a 540 km survey route in this region (Lok et al. 2012). Almost all (98%) Surf Scoters



were located within 1 km of a herring spawn site, and the density of scoters at spawn sites was 1938 scoters per linear kilometer (Lok et al. 2012). Although these aerial survey data were from a single year, locations from satellite-tagged Surf Scoters marked on wintering areas in 2002 to 2006 also identified important stopover sites at Annette Island, west Behm Canal, and Vixen Inlet (Lok et al. 2011, 2012). Of 37 individual satellite-tagged Surf Scoters that made spring migratory stopovers in southeast Alaska, eight used Annette Island, four used west Behm Canal, and three used Vixen Inlet; Annette Island was used as a stopover site in all four years of the study, and west Behm Canal and Vixen Inlet were each used in two of the four years (Lok et al. 2011). These areas were more likely to be used for short stopovers (two to seven days) rather than for longer staging (greater than seven days) during spring migration (Lok et al. 2011). Annette Island, west Behm Canal, and Vixen Inlet are well-documented herring spawn sites (Lok et al. 2011). In late April and early May, there may be nearly constant migration of Surf Scoters northwards

through Tongass Narrows, with flocks of 50 to several hundred flying through (Heinl and Piston 2009).

Several sea duck species are found in this area throughout the winter as well; Surf Scoters are the most abundant, but White-winged Scoters (*Melanitta deglandi*), Bufflehead (*Bucephala albeola*), Common (*B. clangula*) and Barrow's goldeneyes, Long-tailed Ducks (*Clangula hyem*alis), and Common Mergansers (*Mergus merganser*) are also common (Heinl and Piston 2009). Abundance of Surf Scoters begins to increase in late March and peaks in late April to early May (Heinl and Piston 2009). White-winged Scoters are common during winter, but numbers decline through April and May, and, unlike Surf Scoters, they do not congregate in large numbers at herring spawn sites in this area (Heinl and Piston 2009). Barrow's Goldeneye have been observed in flocks of up to 100 during winter and 500 at herring spawn sites (Heinl and Piston 2009). Long-tailed Ducks and Common Mergansers are abundant during winter with around 1000 of each species observed in the Ketchikan vicinity (Heinl and Piston 2009). Creeks provide important habitat for Common Mergansers and protected nearshore waters are important for Barrow's Goldeneye and Common Merganser (Heinl and Piston 2009).

Sensitivities: The value of this key habitat site as a spring migratory stopover is likely due in large part to the predictable occurrence of herring spawn events. Pacific herring abundance has declined throughout many parts of its range, and the location and size of spawn sites may change over time, impacting the value of this rich but ephemeral food source. Additionally, the very large and dense aggregations of Surf Scoters at herring spawn sites in this area could be vulnerable to disturbance and to stochastic events such as oil spills.

Potential Conflicts: This key site lies within the Alaska portion of the Inside Passage waterway and consequently experiences frequent marine traffic, including ferries, freighters, cruise ships, tugs, fishing boats, and recreational craft, which could disturb sea ducks and contribute to the potential for oil spills or chronic contamination. The communities of Ketchikan and Metlakatla are located within this site.

Status: This site falls within the Revilla/Cleveland biogeographic province, in which 23% of the land is congressionally protected in Land Use Designation II areas (Misty Fiords Wilderness, Naha River, and Anan Creek); 35% is protected under the Tongass Land Management Plan and 42% is available for development (Carstensen et al. 2007). Annette Island is under jurisdiction of the Annette Island Indian Reservation, the only remaining Indian reservation in Alaska (Carstenson et al. 2007, Metlakatla Indian Community 2017). Metlakatla Indian Community has exclusive commercial and subsistence fishing rights to the waterways of the Annette Islands Reserve, extending to 3000 feet from mean low tide (Metlakatla Indian Community 2017). The State of Alaska has jurisdiction over tidelands (between mean high water and mean low water) and submerged lands (from mean low water to the three-nautical-mile line) with the authority to manage, develop, and lease resources. However, the federal government regulates commerce, navigation, power generation, national defense, and international affairs throughout state waters.

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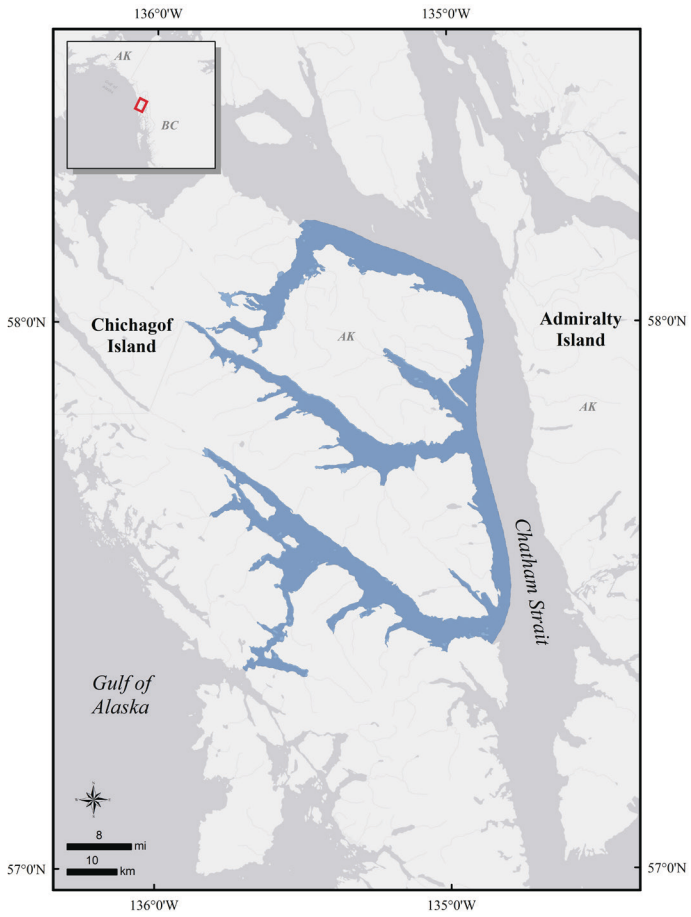
Key Site 5: Eastern Chichagof Island, Alaska

Location: 57°46'10"N, 135°15'12"W

Size: 1247 km^2

Description: Chichagof Island is one of the largest islands of the Alexander Archipelago in Southeast Alaska. This archipelago is comprised of more than 1000 islands and is characterized by deep channels and fjords. Surrounding terrestrial areas are mostly mountainous, reaching elevations of almost 1200 m on Chichagof Island (Carstensen et al. 2007). Steep-sided valleys and extensive estuaries punctuate the landscape, and temperate rainforests are the dominant vegetation type. Temperatures are moderated by the Pacific Ocean, producing cool summers, mild winters, and high levels of precipitation. Coastal waters are generally ice-free but areas with significant freshwater input (e.g., heads of bays and inlets) occasionally freeze.

This key habitat site is bounded on the north by southeastern Icy Strait, on the east by Chatham Strait (separating Chichagof and Admiralty islands), and on the south by Baranof Island. The convoluted coastline includes Port Frederick, Freshwater Bay, Tenakee Inlet, Sitkoh Bay, and Hoonah Sound, as well as numerous smaller bays, channels, inlets, islands, and reefs. The communities of Hoonah and Tenakee Springs are located within this key site.



Precision and Correction of Abundance Estimates Presented: Abundance estimates presented for this key habitat site have been adjusted to account for incomplete detection by applying species-specific visibility correction factors (VCF) estimated for surveys specific to this area (Hodges et al. 2008).

Biological Value: The near-shore waters of East Chichagof Island provide wintering habitat for a variety of sea duck species, most notably approximately 12,000 Barrow's Goldeneyes (*Bucephala islandica*) (Hodges et al. 2008), representing almost 5% of the western North America population. This area also supports thousands of Harlequin Ducks (*Histrionicus histrionicus*), Surf Scoters (*Melanitta perspicillata*), Bufflehead (*B. albeola*), and Red-breasted (*Mergus serrator*) and Common mergansers (*Mergus merganser*), as well as hundreds of White-winged Scoters (*Melanitta deglandi*) and Common Goldeneyes (*B. clangula*) (Hodges et al. 2008, D. Groves, USFWS unpublished data; Appendix 1). Within this site, particularly high densities of wintering sea ducks were observed in upper Port Frederick, near Tenakee Springs, Sitkoh Bay, Catherine Island, Otstoia Island, and Vixen Islands (Gunn et al. 2008). During winter, several sea duck species tend to choose sheltered locations close to large freshwater streams (Gunn 2009).

Some species, such as Harlequin Ducks and Common Mergansers, may also breed and molt in this area, while scoters likely molt here as well. Densities of sea ducks in this region are lower during the summer, but may still reach 10 to 50 ducks per square kilometer in some areas (Gunn et al. 2008).

Sensitivities: Sea ducks wintering at the northern periphery of their range may experience lower over-winter survival; Uher-Koch et al. (2016) found that female and immature Surf Scoters had lower survival rates in Southeast Alaska than in the southern part of their range and suggested poor body

condition and/or increased predation rates as contributing factors.

Potential Conflicts: Chatham, Peril, and Icy straits are major elements of the Alaska portion of the Inside Passage waterway and consequently have frequent marine traffic, including ferries, freighters, cruise ships, tugs, fishing boats, and recreational craft, which could disturb wintering sea ducks. There is also the potential for oil spills or chronic contamination.

Status: Most of the terrestrial area surrounding this key habitat site falls within the East Chichagof Island biogeographic province. In this region, 53% of the land area is available for development, 25% is congressionally protected Roadless Wildlands (Land Use Designation II), 6% is congressionally designated wilderness, and 16% is administratively protected by the U.S. Forest Service (Carstensen et al. 2007). The State of Alaska has jurisdiction over tidelands (between mean high water and mean low water) and submerged lands (from mean low water to the three-nautical-mile line), with the authority to manage, develop, and lease resources. However, the federal government regulates commerce, navigation, power generation, national defense, and international affairs throughout state waters.

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Key Site 6: Lynn Canal–Frederick Sound, Alaska

Location: 57°52'59"N, 133°53'45"W

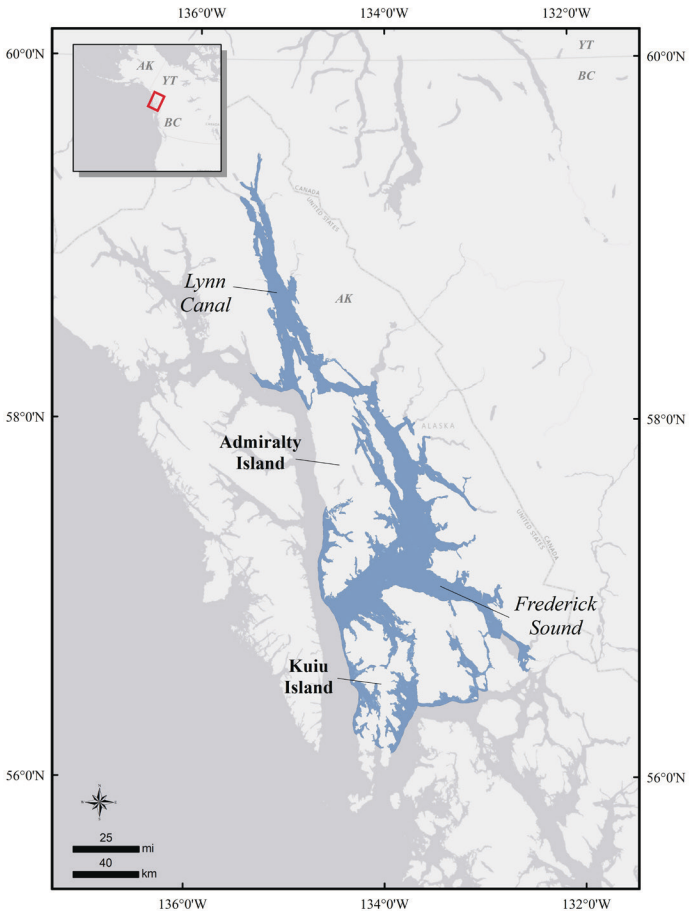
Size: 8933 km²

Description: This site extends nearly 400 km from north to south, encompassing much of the coastline of Southeast Alaska. It includes most of the Alexander Archipelago (Admiralty, Kuiu, Kupreanof, Mitkof, and many smaller islands) and the mainland coast from the head of Lynn Canal to the Stikine River Delta. This region is characterized by fjords, high mountains, numerous glaciers, productive estuaries, and complex rocky shorelines. Chichagof and Baranof islands provide protection from the open waters of the Gulf of Alaska, but the proximity of the Pacific Ocean contributes to a moderate maritime climate, with sea and air temperatures relatively cool in summer and warm in winter. The complex topography results in variable precipitation levels, with annual rainfall ranging from <100 cm to >500 cm, depending on location (Carstensen et al. 2007). The low-elevation coastal temperate rainforest is dominated by Sitka Spruce and Western Hemlock. Coastal waters generally remain ice-free, but areas with significant freshwater input (e.g., heads of bays and inlets) occasionally freeze, and some mainland fjords contain large quantities of ice calved from tidewater glaciers.

Lynn Canal, with depths of >600 m, is one of the deepest and longest fjords in the world. In addition to its steep rocky coasts, the area includes estuaries and a variety of soft-bottom shorelines. The mainland coast of Stephens Passage is mountainous, with narrow inlets and glacial rivers in Port Snettisham and Tracy and Endicott arms. Southern Frederick Sound separates Kupreanof and Mitkof islands from the mainland coast and borders the northern portion of the Stikine River Delta. Duncan Canal is a narrow waterway that almost bisects Kupreanof Island, and Keku Strait is a convoluted channel separating Kupreanof and Kuiu islands.

Communities within the region include the state capital of Juneau (population >30,000), Haines, Skagway, Kake, Petersburg, and Angoon.

Precision and Correction of Abundance Estimates Presented: Abundance estimates from Hodges et al. (2008) have been adjusted to account



for incomplete detection by applying species-specific visibility correction factors estimated for surveys specific to this area. Scoters (*Melanitta* spp.), goldeneyes (*Bucephala* spp.) and mergansers (*Mergus* spp.) were not identified to species during aerial surveys; species composition ratios were based on boat surveys in the same areas.

Biological Value: The Lynn Canal–Frederick Sound region is important wintering habitat for several species of sea ducks, while during spring and summermore localized concentrations of sea ducks occur. Of particular importance during spring staging, the Lynn Canal area extends from Chilkat, Chilkoot, and Taiya inlets down the eastern side of Lynn Canal, including Berners Bay, Gastineau Channel, northern Stephens Passage, and Seymour Canal. Within this large region, areas vary in importance depending on season and species (Appendix 1, Appendix 2, Appendix 3).

Winter: Lynn Canal to Frederick Sound. Based on surveys during February–March, this region supports almost 170,000 sea ducks at a density of >20

ducks per km^2 (Hodges et al. 2008). Estimated counts are 44,000 Barrow's Goldeneyes (*Bucephala islandica*) (~18% of the western population), 30,000 Harlequin Ducks (*Histrionicus histrionicus*) (~12% of the western population), 26,000 Surf Scoters (*M. perspicillata*), 23,000 Buffleheads (*Bucephala albeola*), 20,000 White-winged Scoters (*M. deglandi*) (~5% of the continental population), 11,000 Long-tailed Ducks (*Clangula hyemalis*), 6800 Red-breasted Mergansers (*M. serrator*), and 4800 Common Mergansers (*M. merganser*) (Hodges et al. 2008, D. Groves, USFWS unpublished data). Mergansers, Bufflehead, goldeneyes, and scoters tend to be found in less exposed areas (Gunn 2008). Mergansers, Bufflehead, and goldeneyes are usually closer to large streams whereas scoters, Bufflehead, and Harlequin Duck are found in areas with more small islets (Gunn 2008).

Spring staging: Lynn Canal. During the spring staging period, Lynn Canal is used by about 25% of the continental population of Surf Scoters (Appendix 1 and Appendix 3). Aerial surveys in May 2006 counted >170,000 Surf Scoters (no visibility correction factors applied) along about 850 km of shoreline near Juneau and Haines, at densities of about 300 per km^2 (Lok et al. 2012). Many of the Surf Scoters using Southeast Alaska in spring congregate at herring spawn sites, which provide an important seasonal food resource (Lok et al. 2011, 2012). Herring runs were formerly widespread throughout Lynn Canal but now mainly occur in Berners Bay (Lok et al. 2011). Berners Bay is one of the most productive watersheds in Lynn Canal, partially due to spawning aggregations of herring and eulachon (Carstensen et al. 2007). The Lynn Canal area, and Taiya Inlet in particular, serve as a final coastal staging area for Surf Scoters before they migrate to inland breeding areas in the boreal forest (Appendix 3; De La Cruz et al. 2009, Lok et al. 2012). Abundance of Surf Scoters likely peaks in early to mid-May, with most individuals departing to inland breeding areas by the end of May (De La Cruz et al. 2009, Lok et al. 2012). This area is likely used by other sea duck species as well, but spring survey data are not available.

Summer/molt: Lynn Canal to Frederick Sound. During the summer/molting period, Surf and White-winged scoters and Harlequin Ducks are particularly abundant in Southeast Alaska, with Common and Red-breasted mergansers present as well. Scoters and Harlequin Ducks generally migrate from inland breeding areas to the coast before undergoing annual feather molt and may remain in this area throughout the winter or move to more southern coastal wintering areas. While the flightless period of wing molt lasts around one month for individuals, intraspecific timing is quite variable, and molting Surf and White-winged scoters can be found in Southeast Alaska from late June to late October (Dickson et al. 2012). Early in the summer, subadults of both sexes and adult males outnumber adult females; the frequency of adult females increases in the late summer/fall (Dickson et al. 2012). Numbers of White-winged Scoters also increase during the molt period (R. Dickson unpublished data).

Surveys during late July and early August indicated there were >70,000 Surf Scoters, >9000 White-winged Scoters, almost 9000 Harlequin Ducks, 2000 Red-breasted Mergansers, and 1500 Common Mergansers in the Lynn Canal/Stephens Passage/Admiralty Island area (Appendix 2; Hodges et al. 2008, D. Groves, USFWS unpublished data). Particularly high densities of sea ducks have been recorded along the north shore of Admiralty Island, the east side of the Glass Peninsula, Seymour Canal, Holkham Bay, and Tracy and Endicott arms (Gunn et al. 2008). In Keku Strait/Duncan Canal there were >14,000 Surf Scoters, almost 2000 White-winged Scoters, 4000 Harlequin Ducks, and several hundred Red-breasted and Common mergansers during summer (Hodges et al. 2008, D. Groves, USFWS unpublished data). The head of Duncan Canal and northern Keku Strait had the highest densities, with Harlequin Ducks especially abundant in northern Keku Strait (Gunn et al. 2008, Hodges et al. 2008). The mainland coast of Frederick Sound, from Port Houghton to the Stikine River Delta, provides summer/molting habitat for >14,000 Surf Scoters, 1800 White-winged Scoters, >3000 Harlequin Ducks, and several hundred Red-breasted and Common mergansers (Hodges et al. 2008, D. Groves, USFWS unpublished data). Hotspots within this area include Point Vandeput at the mouth of Thomas Bay, the northern side of the Stikine Delta, and around Petersburg, with mergansers more abundant near the Stikine Delta and Harlequin Ducks more concentrated in the northern half of this area (Gunn et al. 2008, Hodges et al. 2008).

Sensitivities: Sea ducks wintering at the northern periphery of their range may experience lower

over-winter survival; Uher-Koch et al. (2016) found that female and immature Surf Scoters had lower survival rates in Southeast Alaska than in the southern part of their range and suggested poor body condition and/or increased predation rates as contributing factors. During spring staging, sea ducks may be concentrated in very large flocks (tens of thousands), thus significant numbers could be negatively affected by localized threats. During the summer molting period, sea ducks are incapable of flight and particularly sensitive to disturbance but cannot easily relocate in response to negative pressures.

Potential conflicts: Frederick Sound, Stephens Passage, and Lynn Canal are major elements of the Alaska portion of the Inside Passage waterway and consequently have frequent marine traffic, including ferries, freighters, cruise ships, tugs, fishing boats, and recreational craft, which could disturb sea ducks. The communities of Juneau, Haines, Skagway, Kake, Petersburg, and Angoon are located in this area. Cruise ship itineraries often include travel to Juneau, Skagway, and Tracy and Endicott arms. Mining activity in the area has diminished and less freight is now being shipped through Lynn Canal. There are concerns about the re-opening of a gold mine on the north side of Berners Bay and possibly other areas. The Greens Creek Mine near Hawk Inlet on Admiralty Island is the largest silver mine in the U.S.; recent approval of expanded tailings storage has raised concerns regarding discharge of contaminants such as cadmium, copper, mercury, and lead (Audubon Alaska 2016). Throughout the Lynn Canal–Frederick Sound area there is the potential for oil spills or chronic contamination.

Status: Extent of protected areas varies widely throughout this region. In the Lynn Canal area, only 2% of land is legislatively protected and 10% is administratively protected in the Chilkat River Complex biogeographic province, whereas 90% of Admiralty Island is legislatively protected within the Admiralty Island National Monument and Kootznoowoo Wilderness with only 4% in development status (Audubon Alaska 2016). Protected areas within or partially overlapping this region include the Alaska Chilkat Bald Eagle Preserve, Klondike Gold Rush National Park (at head of Taiya Inlet), Tracy Arm–Fords Terror Wilderness, Chuck River Wilderness, Stikine–LeConte Wilderness, Petersburg Creek–Duncan Salt Chuck Wilderness, Tebenkof Bay Wilderness, and Kuiu Island Wilderness (Audubon Alaska 2016).

Several Important Bird Areas including Berners Bay, Mendenhall Wetlands, Stephens Passage, Frederick Sound to Duncan Canal, Stikine River Delta, Sumner Strait, Outside Islands Marine, and Tebenkof Bay are within or overlap Lynn Canal–Frederick Sound (Audubon Alaska 2016). Designation as an Important Bird Area does not imply any protected status but does emphasize the importance of this area to waterfowl and other marine birds.

The State of Alaska has jurisdiction over tidelands (between mean high water and mean low water) and submerged lands (from mean low water to the three-nautical-mile line), with the authority to manage, develop, and lease resources. However, the federal government regulates commerce, navigation, power generation, national defense, and international affairs throughout state waters.

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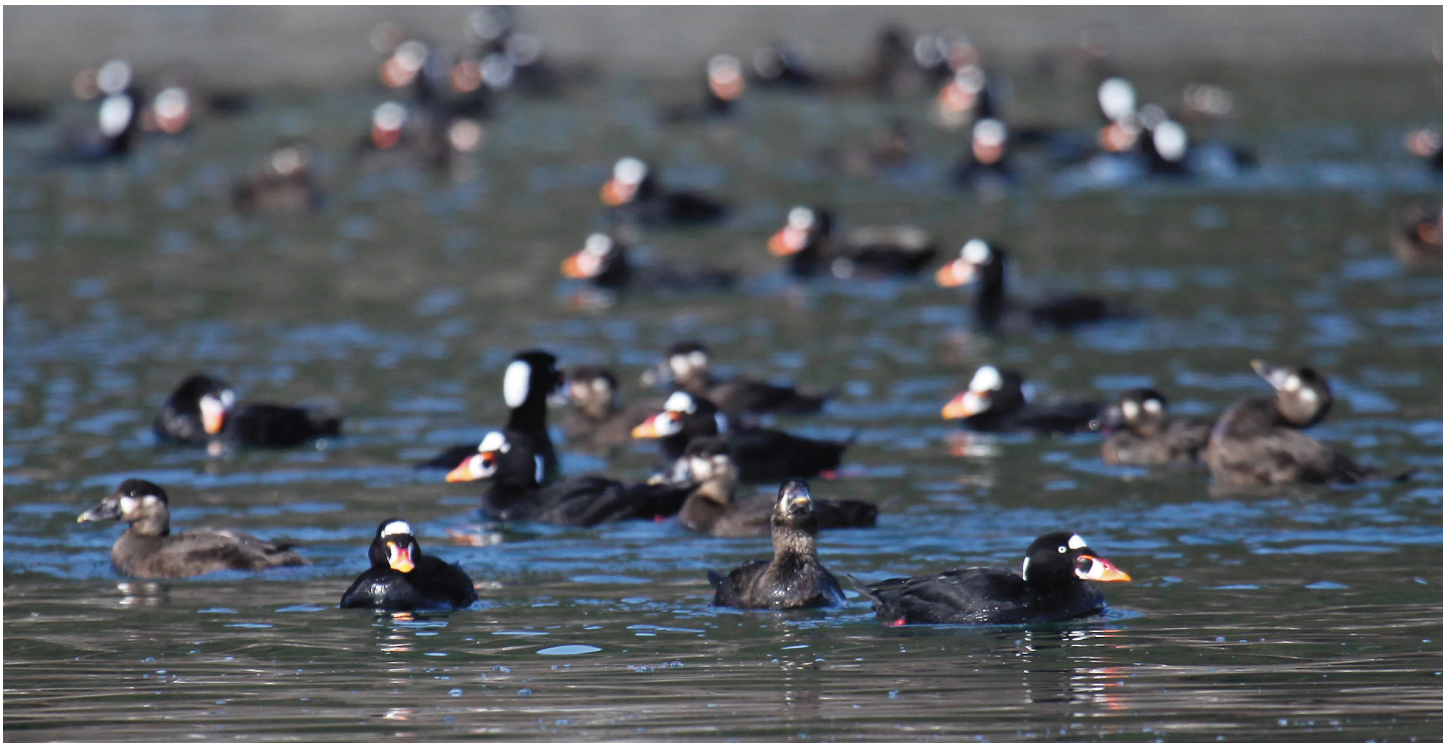


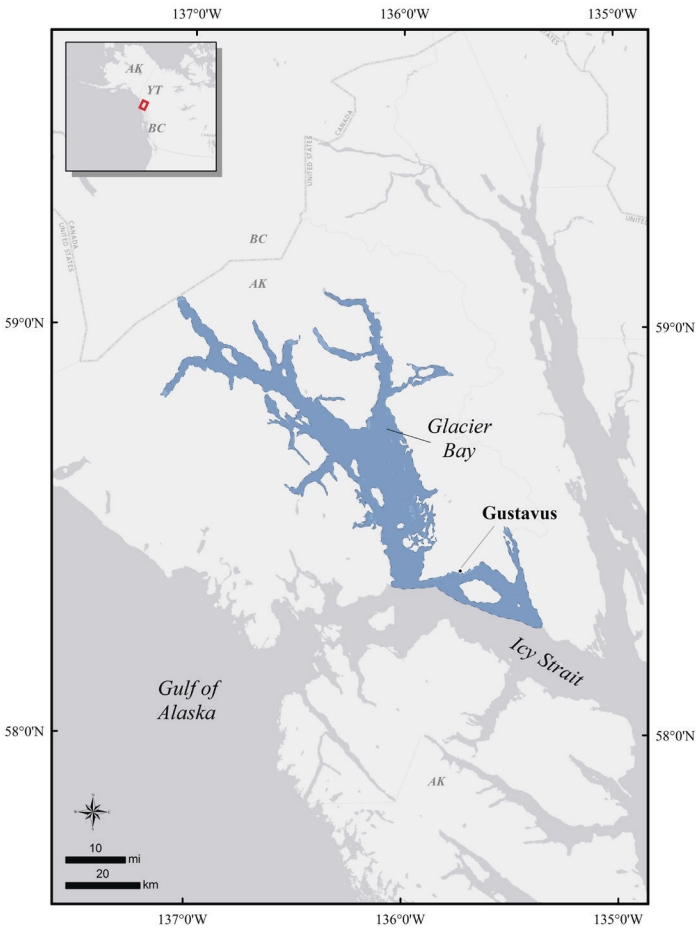
Surf Scoters. Photo: Tim Bowman.

Key Site 7: Glacier Bay, Alaska

Location: 58°40'28"N, 136°6'30"W

Size: 1588 km^2

Description: Glacier Bay is a complex fjord system, connected to the Gulf of Alaska by the waters of Icy Strait and Cross Sound. Most of the key habitat site falls within Glacier Bay National Park and Preserve and includes Glacier Bay (to the heads of the East and West arms) and the northeastern part of Icy Strait, around Gustavus, Pleasant Island, and Porpoise Islands, extending up into Excursion Inlet east of Gustavus. About 27% of Glacier Bay National Park is covered by glaciers, including seven active tidewater glaciers, but the area is undergoing recent and very rapid deglaciation (National Park Service 2016). The region has a wet and moderate maritime climate with about 175 to 200 cm of rain annually (Audubon Alaska 2016a). Freshwater input from glacier and snowfield melt as well as precipitation runoff combined with strong tidal mixing contributes to high levels of productivity in Glacier Bay (Etherington et al. 2007).



Precision and Correction of Abundance Estimates Presented: Abundance estimates based on data from Hodges et al. (2008) have been adjusted to account for incomplete detection by applying species-specific visibility correction factors (VCFs) estimated for aerial surveys specific to this area (Appendix 1).

Biological Value: The waters of Glacier Bay regularly support at least 10 species of sea ducks, some in great abundance (Nadeau et al. 2017). Sea ducks accounted for about half of all marine birds surveyed during summer and winter (Robards et al. 2003). During winter (mid-February to mid-March), there were estimated to be >14,000 Barrow's Goldeneyes (*Bucephala islandica*) (>5% of the western population), >3,000 Surf Scoters (*Melanitta perspicillata*), >2,000 White-winged Scoters (*M. deglandi*), >1,500 Bufflehead (*B. albeola*), and lesser numbers of Harlequin Ducks (*Histrionicus histrionicus*), Long-tailed Ducks (*Clangula hyemalis*), Common Goldeneyes (*B. clangula*), and Red-breasted (*Mergus serrator*) and Common mergansers (*M. merganser*) (Hodges et al. 2008, D. Groves, USFWS unpublished data; Appendix 1). In the summer molting period (late July to early August), nearly 49,000 Surf Scoters (~7% of the continental population), >6,000 White-winged Scoters, >6,000 Harlequin Ducks, >3,000 Red-breasted Mergansers, and >2,000 Common Mergansers used this site (Hodges et al. 2008, D. Groves, USFWS unpublished data). Although Drew et al. (2008) did not apply VCFs to their boat-based survey data, they reported much higher densities of sea ducks in Glacier Bay than did Hodges et al. (2008). Differences in survey and analysis methodologies make comparisons difficult, but sea ducks may be even more abundant in this area than indicated by Hodges et al. (2008). Additionally, some surveys have found that during summer White-winged Scoters were up to three times more abundant than Surf Scoters, so there may be high variability across seasons and years (Nadeau et al. 2017). Barrow's Goldeneyes were found throughout Glacier Bay but consistently used the same areas over a five-year period. Harlequin Ducks were mostly in the upper Bay during summer and shifted south in winter. Common Mergansers were particularly numerous in the Beardslee Islands, Berg Bay, and Adams Inlet,

and Surf and White-winged scoters were more frequent in the northern Bay, especially Muir Inlet and West Arm (Robards et al. 2003, Drew et al. 2008). Numbers of Long-tailed Ducks may fluctuate significantly between years (Drew et al. 2008, National Park Service 2016).

High and sustained primary productivity (phytoplankton, seaweed, and kelp) supports sustained zooplankton abundance from spring through fall (Robards et al. 2003, Etherington et al. 2007), as well as large numbers of forage fish, benthic invertebrates, waterbirds, and marine mammals (Drew et al. 2008).

Sensitivities: Large aggregations of molting sea ducks may be particularly sensitive to disturbance. Mortality rates may be higher during winter, especially for female and immature sea ducks wintering near the northern extent of their range (Uher-Koch et al. 2016).

Potential Conflicts: Glacier Bay National Park receives about 350,000 visitors each year, mostly on cruise ships and tour boats (Etherington et al. 2007, National Park Service 2016). The majority of these visitors arrive during June through August (Nadeau et al. 2017), when the bay is also used by tens of thousands of molting sea ducks, which are sensitive to disturbance by vessels large and small, including kayaks. In addition to disturbance, vessel traffic also increases the risk of exposure to petroleum pollution and other contaminants (Nadeau et al. 2017). The community of Gustavus is located within this site.

Sea otter abundance has increased dramatically in Glacier Bay since the mid-1990s, and their foraging activity may reduce the availability of important sea duck prey species (e.g., clams, mussels) as well as impacting the structure and function of nearshore ecosystems (Nadeau et al. 2017).

Status: The majority of this Key Habitat site is encompassed by Glacier Bay National Park, which was established as a national monument in 1925 and expanded and given national park status in 1980. It has also been designated as part of a World Biosphere Reserve and World Heritage Site. About 80% of the park is designated Wilderness and access to some areas is restricted or prohibited to protect wildlife (National Park Service 2016). From June 1 to August 31, permits are required for vessels entering the park, and there are daily quotas on the number of vessels allowed (National Park Service 2016). There were important commercial fish and crab harvests in Glacier Bay, but these are now restricted or prohibited. However, these activities continue to be permitted within the Key Habitat site east of the park. There is a lot of overlap between this Key Habitat site and the Glacier Bay and Icy Strait Important Bird Area, although that IBA also covers large areas of Icy Strait, Cross Sound, and the Gulf of Alaska coastline (Audubon Alaska 2016b). Within Glacier Bay, marine waters are protected within the national park, but in the area to the east of the park the State of Alaska has jurisdiction over tidelands (between mean high water and mean low water) and submerged lands (from mean low water to the three nautical mile line), with the authority to manage, develop, and lease resources. However, the federal government regulates commerce, navigation, power generation, national defense, and international affairs throughout state waters.

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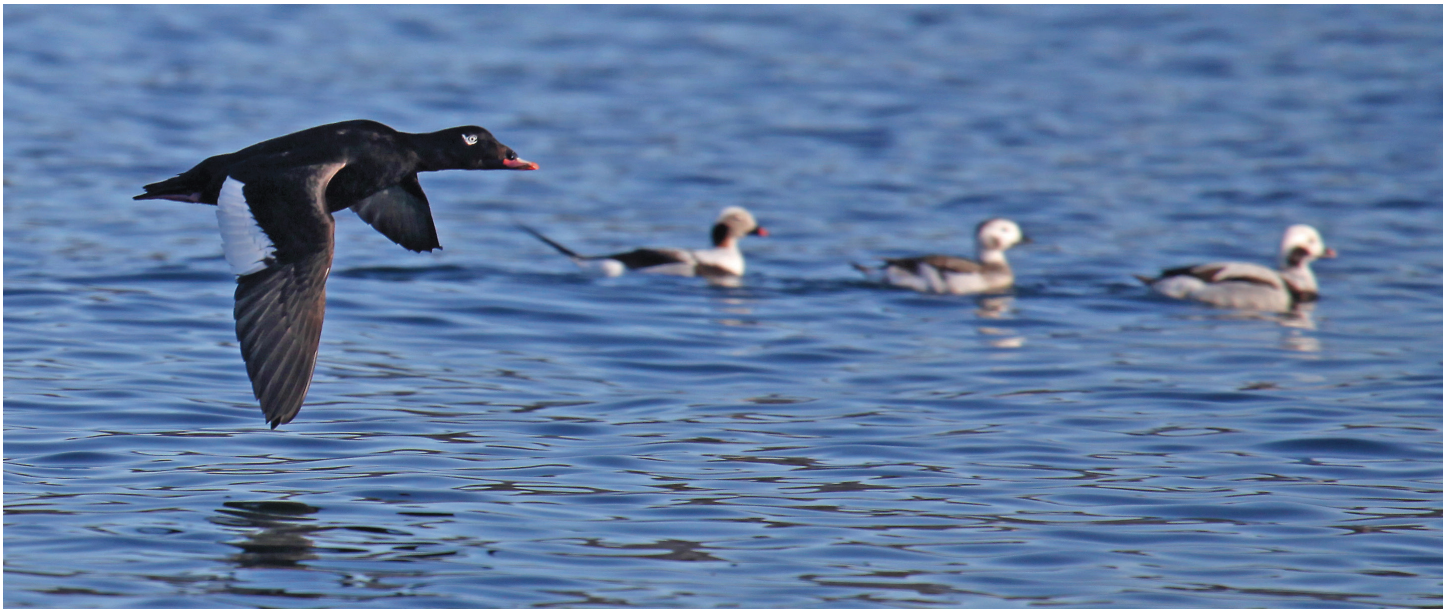
Robards, M., G. Drew, J. Piatt, J. M. Anson, A. Abookire, J. Bodkin, P. Hooge, and S. Speckman. 2003. Ecology of selected marine communities in Glacier Bay: Zooplankton, forage fish, seabirds, and marine mammals. Unpublished report, U.S. Geological Survey, Alaska Science, Center, Anchorage, Alaska, and Glacier Bay National Park and Preserve, Gustavus, Alaska. xiii + 156 pp.

Uher-Koch, B. D., D. Esler, S. A. Iverson, D. H. Ward, W. S. Boyd, M. Kirk, T. I. Lewis, C. S. VanStratt, K. M. Brodhead, J. W. Hupp, and J. A. Schmutz. 2016. Interacting effects of latitude, mass, age, and sex on winter survival of Surf Scoters (*Melanitta perspicillata*): Implications for differential migration. Canadian Journal of Zoology 94:233–241.



White-winged Scoter and Long-tailed Ducks. Photo: Tim Bowman.

Key Site 8: Lost Coast, Alaska

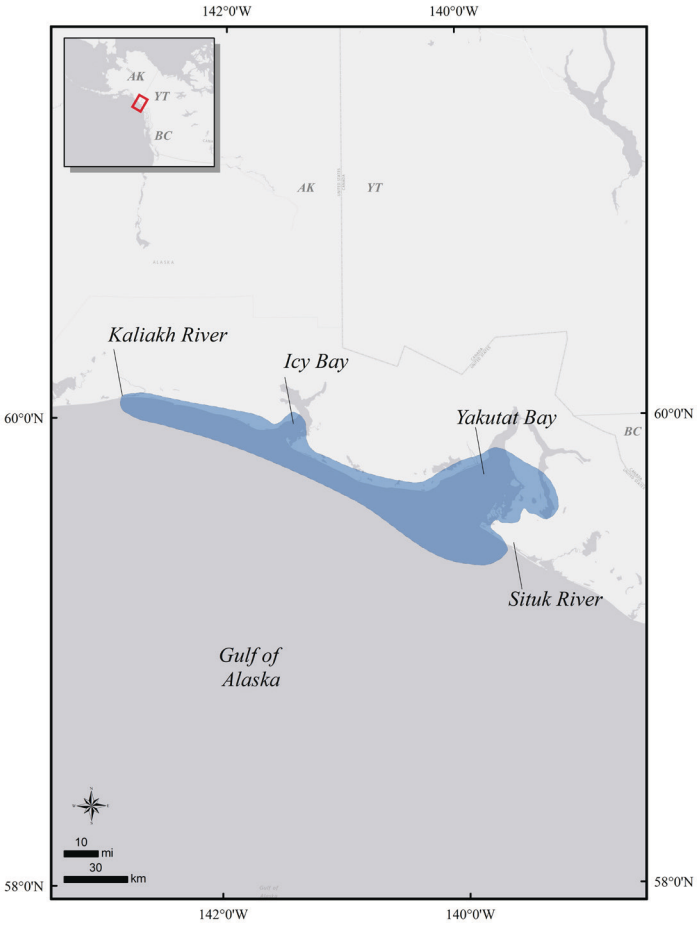
Location: 59°46'19"N, 141°2'34"W

Size: 4879 km^2

Description: This site extends for about 200 km along the coast of the Gulf of Alaska, from the Kaliakh River to the Situk River, and includes the outer portions of Icy Bay and Yakutat Bay and the south end of Russell Fiord. Most of this shoreline is highly exposed, with large beaches, sand dunes, grasslands, and lagoons, while Icy Bay and Yakutat Bay offer the only protected waters in the region. This remote and isolated region is separated from the rest of the continent by high coastal mountains and some of the largest nonpolar glaciers and snowfields in the world. The structure of the coastline is highly influenced by activity of dynamic coastal glaciers that dominate the landscape: Icy Bay was formed by rapid glacial retreat in the past century, and large, ever-changing shoal areas are created by glacial run-off and deposits (Hood et al. 2006). The Hubbard Glacier occasionally creates an ice dam across the mouth of Russell Fiord (most recently in 1986 and 2002); if this dam becomes permanent, the fiord would be transformed into a lake, likely negatively affecting its value as sea duck habitat. From Kaliakh River to Cape Yakataga, the land is relatively flat and forested, with rugged mountains rising to the south and east. Forests are dominated by Sitka Spruce and Western Hemlock, interspersed with willow, alder, and cottonwood stands and muskeg meadows.

The proximity of the Pacific Ocean creates a cool, wet maritime climate, with a mean annual temperature of ~4°C (Hood et al. 2006). Annual rainfall exceeds 300 cm (Patten 1981). Frequent and intense winter storms can cause dunes and river channels to shift dramatically (Patten 1981). Most of the human population of this region is concentrated in the community of Yakutat, with a population of ~800 (Hood et al. 2006).

Precision and Correction of Abundance Estimates Presented: Abundance estimates from Hodges 2011 have been adjusted to account for incomplete detection by applying species-specific visibility correction factors based on boat-to-air ratios calculated from similar surveys in southeast Alaska



(Hodges et al. 2008) and the estimates were expanded based on transect area relative to total survey area.

Biological Value: The bays and exposed shorelines of Alaska's Lost Coast support about 150,000 to 200,000 wintering sea ducks. White-winged Scoters (*Melanitta deglandi*) were the most numerous, with an estimated 55,000 to 70,000 present (13.75 to 17.5% of the continental population), as well as 30,000 to 39,000 Long-tailed Ducks (*Clangula hyemalis*) (3 to 4% of the continental population), 17,000 to 22,000 Pacific Black Scoters (*M. americana*) (8.5 to 11% of the Pacific population), and 13,000 to 17,000 mergansers (Red-breasted and Common; *Mergus serrator* and *M. merganser*) (Hodges 2011). There were also 24,000 to 28,000 unidentified scoters and 7000 to 9200 Surf Scoters (*M. perspicillata*) as well as several thousand Harlequin Ducks (*Histrionicus histrionicus*), Barrow's Goldeneye (*Bucephala islandica*) and Bufflehead (*B. albeola*), and a few hundred Common Goldeneye (*B. clangula*) (Hodges 2011). White-winged Scoters were observed up to the extent of the

survey transects at 5.6 km offshore, and it is possible that significant numbers would be found farther offshore as well (Hodges 2011). Other species, such as Black Scoters and mergansers, were mostly observed within 300 m of the shoreline, with few present on offshore transects (Hodges 2011). In Yakutat Bay, large groups of scoters were observed at the north and south ends of Khaantak Island and from Point Latouche to Knight Island (Patten 1981).

This region may also support significant numbers of sea ducks during other seasons, but few surveys have been conducted here. The Yakutat coastal zone is considered the most important area in Southeast Alaska for migrating birds, and tens of thousands of waterfowl use the lagoons, estuaries, and fiords during spring, molting, and fall migration (Patten 1981). Thousands of scoters and other sea ducks use Yakutat Bay during herring spawn in April. Sea ducks, including Harlequin Ducks, Long-tailed Ducks, and White-winged Scoter, were present in the Yakutat Bay region during June, with a density of 12.3 per km^2 observed for Harlequin Ducks (Stephensen and Andres 2001). About 3000 scoters (all three species) were observed near Sitkagi Bluffs in June 1980, 5000 scoters in Russell Fiord in July (Arneson 1976 in Patten 1981), and large groups of scoters and other diving ducks in the south end of Russell Fiord in late September (Patten 1981).

Sensitivities: Sea ducks wintering at the northern periphery of their range may experience lower over-winter survival; Uher-Koch et al. (2016) found that female and immature Surf Scoters had lower survival rates in Southeast Alaska than in the southern part of their range and suggested poor body condition and/or increased predation rates as contributing factors.

Potential Conflicts: This remote and isolated area has a very small human population, and the potential for conflict with sea duck habitat requirements is relatively low compared to other key sites. There are several offshore exploratory petroleum wells west and southwest of Icy Bay, and there is additional risk of petroleum spills from marine vessels, small aircraft, fuel storage facilities, ATVs, and historic drilling sites/storage areas (Hood et al. 2006). Some areas in Yakutat Bay were considered sensitive to oil and gas exploration and development due to large concentrations of birds (Patten 1981). The Gulf of Alaska is a major shipping route, and accidental petroleum release and wastewater discharge from vessels are of concern (Hood et al. 2006). Studies from Glacier Bay and Gulf of Alaska indicate a possible risk of increased mercury and persistent organic pollutants in the marine environment (Hood et al. 2006). Commercial and recreational fisheries are economically important, as well as subsistence hunting, trapping, and fishing. Subsistence hunting of Harlequin Ducks, Long-tailed Ducks, goldeneye, and other waterfowl occurs in Icy Bay, Yakutat Bay, and the Malaspina Forelands (Hood et al. 2006). Although mining in the coastal region is extremely limited (Hood et al. 2006), small-scale placer mining has occurred on sandy beaches and there is potential for offshore placer mining (Alaska DNR 1995). Recreation and tourism are limited, but kayaking, camping, hiking, flightseeing, and cruise ships are becoming more common in Icy and Yakutat bays (Hood et al. 2006).

Status: Much of the surrounding terrestrial area is protected within the Tongass National Forest, the Russell Fiord Wilderness, and Wrangell-St. Elias National Park and Preserve. The Kluane/Wrangell-St. Elias/Glacier Bay/Tatshenshini-Alsek region, which partially overlaps this site, has been designated a UNESCO World Heritage Site. The State of Alaska has jurisdiction over tidelands (between mean high water and mean low water) and submerged lands (from mean low water to the three-nautical-mile line), with the authority to manage, develop, and lease resources. However, the federal government regulates commerce, navigation, power generation, national defense, and international affairs throughout state waters.

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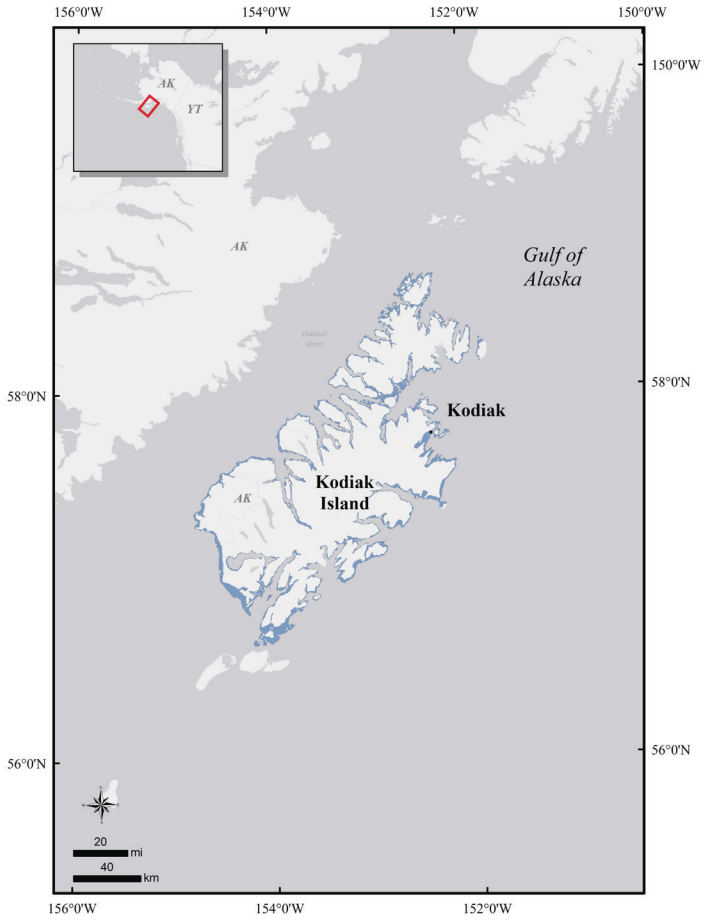
Long-tailed Ducks and scoters. Photo: Tim Bowman.

Key Site 9: Kodiak Archipelago, Alaska

Location: 57°43'3"N, 153°21'16"W

Size: 1883 km^2

Description: The Kodiak Archipelago is in the northwest Gulf of Alaska, in the North Pacific Ocean. The key site consists of nearshore areas around the perimeter of the archipelago's islands but is mostly confined to sea duck coastal habitats of depths less than 20 m. The area's rich marine ecosystem is influenced by a variety of oceanographic features, including the Alaska Coastal Current, the Alaska Stream, and large amounts of freshwater runoff into its bays and inlets. The Whale Pass and Afognak Strait area has tidal flows as high as 7.5 knots that produce large upwellings over an extensive shallow bottom, providing foraging areas for some wintering sea ducks. Large tidal ranges (up to 9 m) in most bays produce local productive upwelling areas and feeding habitats accessible to birds at low tides. Most of the inner bays, lagoons, and estuaries are relatively ice-free during winter. Steep mountains and convoluted shorelines provide waterfowl with shelter from high winds and rough seas even in the worst winter storms (Zwiefelhofer and Forsell 1989).



Precision and Correction of Abundance Estimates Presented: Estimates of sea duck abundance are based on winter boat strip transects using methods described by Gould and Forsell (1989) and shoreline aerial surveys of most of the area conducted in 1980 (Forsell and Gould 1981). The accuracy of sea duck counts is high because most sea ducks inhabit nearshore protected waters where detection of birds is high. Because Forsell and Gould (1981) did not estimate abundance for northern Afognak Island (about 20% of the water area), population estimates from 1980 were increased by 20% to represent the entire archipelago. Trends were derived from 28 years of boat surveys that sampled about 17% of Uyak and Uganik Bays, and Sitkalidak Strait, and abundance compared between 1980–1983 and 2004–2008.

Biological Value: Forsell and Gould (1981) estimated that more than 200,000 sea ducks of 14 species wintered in the archipelago. Appendix 1 lists the most abundant sea ducks as estimated in 1980, with 2008 populations estimated by adjusting the 1980 numbers by the percent change on long-term monitoring surveys of selected bays. More than 5% of the continental populations of Black Scoter (*Melanitta americana*), White-winged Scoter (*M. fusca*), Harlequin Duck (*Histrionicus histrionicus*), and Barrow's Goldeneye (*Bucephala islandica*) winter in the Kodak Archipelago. Long-tailed Ducks (*Clangula hyemalis*) were, and remain, the most abundant sea duck, although their numbers appear to have declined by about 50%. Other abundant species included Black Scoter and White-winged Scoter, whose numbers also appear to be declining but remain the third and fourth most abundant sea ducks. Steller's Eider (*Polysticta stelleri*) and King Eider (*Somateria spectabilis*) do not occur in high enough numbers in areas where boat surveys were conducted to determine a trend, but anecdotal evidence indicates that there are far fewer eiders now. Barrow's Goldeneye appear to have increased substantially and now are the second most-abundant sea duck. Bufflehead (*Bucephala albeola*), Surf Scoter (*M. perspicillata*), Harlequin Duck, Red-breasted

Merganser (*Mergus serrator*), and Common Merganser (*M. merganser*) are also increasing. In addition to wintering and migratory stopover habitats, the marine waters of the Kodiak Archipelago provide breeding and molting habitat for over 20,000 Harlequin Ducks, Barrow's Goldeneyes, and Red-breasted and Common Mergansers (Corcoran 2016). Kodiak Island is the southernmost wintering area for Steller's Eider in the U.S., where it is listed as a threatened species. Radio-telemetry of wintering birds indicated that most eiders subsequently flew to breeding areas in Russia (Rosenberg et al. 2014).

Sensitivities: Declining numbers of wintering Black Scoter and White-winged Scoter, along with Long-tailed Duck and Steller's Eider, may be due to climate change. Kodiak is located toward the middle or southern end of the winter ranges of Black Scoter and White-winged Scoter and the southern edge of Steller's Eider range. The waters to the north seldom freeze as they did 35 years ago. Increasing numbers of Bufflehead, Harlequin Duck, Barrow's Goldeneye, and Red-breasted and Common Merganser may be a result of changes in distribution due to climate change, the recovery of pollock and herring stocks, increased survival of breeding birds, and/or better management of illegal take and overharvest. Because of the unique 1980–2008 dataset and its northern location, Kodiak Archipelago should be considered as a monitoring site for measuring response of sea ducks and seabirds to climate change. No large-scale winter surveys of sea ducks have been conducted since 2008.

Potential Conflicts: Kodiak Island is within a major marine transportation corridor and has frequent ferries, freighters, and barges in the outer waters. Kodiak is home to more than 700 commercial fishing vessels, including large trawl, longline, and crab vessels, plus at least 16 land-based seafood processing plants (Kodiak Chamber of Commerce 2009). Within the bays, hundreds of fishing boats and recreational craft can disturb wintering sea ducks. In addition to disturbance and oil spills, some types of fishing present further threats to sea ducks from entanglement in both actively fished and derelict gillnets, crab pots, or trawl nets.

The Kodiak Archipelago has 32 sea duck hunting guides registered with the state and the highest sport sea duck harvest in Alaska (USFWS 1999). Mortality from hunting and poaching may have caused localized depletion of sea ducks, although the actual contribution of harvest to declines in sea duck populations has not been quantified.

Some waters and shoreline of the Kodiak Archipelago were oiled by the 1989 *Exxon Valdez* Oil Spill, and the potential exists for additional oil spills from sinking boats and chronic oil contamination. Offshore areas have been considered for oil and gas leasing in the past, but there was little industry interest in developing resources there.

Status: The terrestrial area falls within multiple agency and corporate jurisdictions, including four Federal (USCG, USFWS, BLM, and FAA), four state (ADFG, DNR, DOT, and the University of Alaska), 12 Alaska Native corporations, and seven municipalities. The state of Alaska has jurisdiction over submerged lands between mean high water and 5.6 km from shore, with the authority to manage, develop, and lease resources, except the tidal waters surrounding Afognak Island that are part of the Alaska Maritime National Wildlife Refuge.

The Kodiak Archipelago has five coastal and two marine IBAs (Audubon Alaska 2016). The importance of Kodiak as a wintering area for sea ducks may change as birds shift their winter ranges northward in response climate change.

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Rosenberg, D. H., M. J. Petrula, J. L. Schamber, D. Zwiefelhofer, T. E. Hollmen, and D. D. Hill. 2014. Seasonal movements and distribution of Steller's eiders (*Polysticta stelleri*) wintering at Kodiak Island, Alaska. Arctic 67:347–359.

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Barrow's Goldeneyes. Photo: Tim Bowman.

Key Site 10: Izembek Lagoon, Alaska

Location: 55°19'11"N, 162°50'36"W

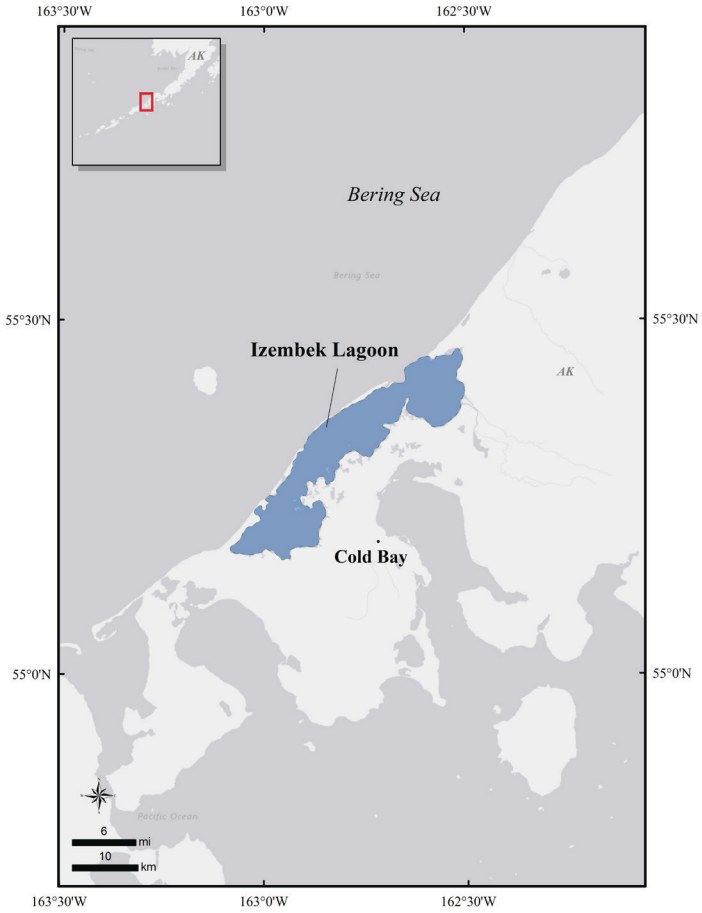
Size: 322 km^2

Description: Izembek Lagoon is a marine body of water located on the north side of the Alaska Peninsula near its western tip, about 10 km north of the city of Cold Bay, Alaska. Long, narrow, sparsely vegetated barrier islands form a shallow lagoon on the south side of the Bering Sea (Appendix 1). The lagoon contains extensive eelgrass beds that are exposed at low tide, along with sand and mudflats, with a few deeper channels connecting the lagoon to the Bering Sea. Izembek Lagoon contains the largest eelgrass beds in the world; about 60 to 70% of the lagoon is vegetated with eelgrass. The upland area surrounding the lagoon includes wet sedge meadows and upland tundra with numerous ponds and lakes.

Precision and Correction of Abundance Estimates Presented: Abundance estimates are based on either single counts or an average of within-year repeated counts from aerial surveys of waterfowl *coducted from fall through* early spring (i.e., September to April; Wilson 2016, 2017a, 2017b, 2019, Dooley et al. 2016). This was intended to illustrate maximum value of the area to sea ducks during the fall-to-spring nonbreeding period. During those surveys, all birds observed are tallied but there is no estimate of detection rate or adjustment for counting error. Thus, counts are considered indices and are not adjusted for incomplete detection.

Biological Value: This site is an important molting and staging area for several species of waterfowl, including Steller's Eiders (*Polysticta stelleri*) that breed in Russia and northern Alaska. Steller's Eiders are present in this area from mid-August through April; wing molt occurs from August into October. Izembek is one of the few important molting sites for Steller's Eiders in Alaska, with about 2500 to 7000 birds seen during August/September surveys from 2012 to 2016 (Williams et al. 2016). Based on data from fall goose surveys (Wilson et al. 2017a), numbers of molting Steller's Eiders seem to be decreasing from estimates over the past two decades.

During January to March winter surveys, 6000 to 43,000 Steller's Eiders have been observed in the lagoon on a single day (Wilson et al. 2017b),



although the total number of Steller's Eiders that pass through the area during fall and spring migration is undoubtedly much larger, perhaps 70,000 or more, and represents a significant proportion of the Pacific population.

In addition to Steller's Eiders, several thousand Black Scoters (*Melanitta americana*), Long-tailed Ducks (*Clangula hyemalis*), as well as smaller numbers of Red-breasted Mergansers (*Mergus serrator*) and Harlequin Ducks (*Histrionicus histrionicus*) inhabit this area during fall and winter. Izembek is along a major migration route for sea ducks wintering further west in the Aleutian Islands. The abundance of eelgrass throughout the lagoon makes this a particularly productive habitat for waterfowl.

Sensitivities: The barrier islands that separate the adjacent Bering Sea from the lagoon are subject to erosion, which may increase due to sea level rise, reduced ice coverage in the southern Bering Sea, and increased frequency of storm tides as a result of climate change. It is not known how this may affect the protected lagoon system, or benthic prey

communities, upon which Steller's Eiders rely during much of the nonbreeding season. Eelgrass beds may be harmed by increases in sea level, and the marine invertebrate community could be impacted by increasing ocean temperatures and acidification.

Steller's Eiders that molt in this area are sensitive to disturbance from boaters, particularly when flightless. Although there is little motorboat use until fall-winter hunting season starts September 1, and flightless eiders are present into October. Steller's Eiders are identified as "vulnerable" by the International Union for Conservation of Nature (BirdLife International 2012). Greater than 90% of the Pacific population of Steller's Eiders molts and winters in Alaska. Alaska-breeding Steller's Eiders (a subset of the Pacific population) are listed as a threatened species in Alaska under the Endangered Species Act (ESA; USFWS 1997). Currently, Steller's Eiders are closed to harvest during both the fall-winter and spring-summer hunting seasons.

Potential Conflicts: Izembek Lagoon is remote and there is little human use of the area, with the exception of fishing in the waters outside the lagoon in the Bering Sea. Birds that molt in this area would be particularly vulnerable to oil spills because they cannot fly and leave the area.

The area of the Outer Continental Shelf currently designated by BOEM as the North Aleutian Basin Planning Area, including Bristol Bay, was withdrawn from federal offshore oil and gas leasing and development in 2014 for an indefinite period of time due to the area's importance to Alaska Native subsistence users, fish and wildlife species, and commercial and recreational fisheries. The withdrawn area includes Izembek Lagoon. A road through Izembek National Wildlife Refuge connecting the communities of King Cove and Cold Bay has been proposed, but plans are currently on hold. The existence of the road could increase hunting access and increase disturbance of Steller's eiders during molt and wintering periods.

Status: Izembek Lagoon comprises most of the Izembek Lagoon and Bechevin Bay Important Bird Area (IBA) and is considered an IBA of global importance (Audubon 2017) because of its importance to waterfowl and shorebirds. It is also designated as a wetland of international importance under the Ramsar Convention (Ramsar 2018). Izembek Lagoon is designated critical habitat for Steller's eiders under the ESA. The lagoon and intertidal habitats are managed by the State of Alaska as Izembek State Game Refuge, while the surrounding uplands are managed by the U.S. Fish and Wildlife Service as part of Izembek National Wildlife Refuge. Parts of the refuge are designated wilderness. There are a few small sections within this area that are considered "selected" under the Alaska Native Claims Settlement Act, but not yet conveyed, which means they are currently managed as refuge lands.

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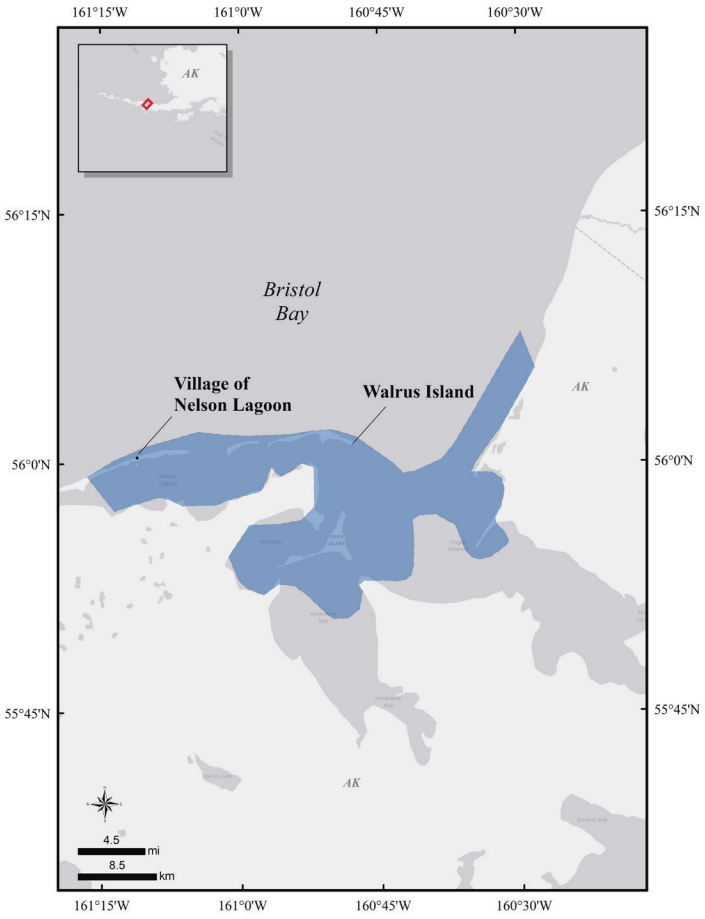
Key Site 11: Nelson Lagoon, Alaska

Location: 56°0'19"N, 160°47'55"W

Size: 525 km^2

Description: Nelson Lagoon lies 14 to 23 km east of the village of Nelson Lagoon (2016 summer pop. ~120) on the Alaska Peninsula. Nelson Lagoon is a shallow bay protected by a series of long, narrow, and partially vegetated barrier islands and often remains ice-free during winter. The area is at the southern potential extent of the sea ice in winter. The high biological productivity of the area is generated by the exchange of nutrients and physical dynamics between the Bering Sea and freshwater and terrestrial habitats. Tide ranges average 2.4 to 3 m.

Precision and Correction of Abundance Estimates Presented: Abundance estimates for Steller's Eiders (*Polysticta stelleri*) at Nelson Lagoon are based on aerial photographic surveys. For other species, abundance numbers have been adjusted to account for incomplete detection, either by applying species-specific visibility correction factors estimated from other similar areas and surveys, or based on expert and local knowledge.



Biological Value: Nelson Lagoon supports high concentrations of wintering, staging, and molting sea ducks, most notably Steller's Eider and Black Scoter (*Melanitta americana*) (Bowman et al. 2021) with lesser numbers (<1500 per species) of Pacific Common Eider (*Somateria mollissima v-nigra*), King Eider (*S. spectabilis*), and Surf Scoter (*M. perspicillata*). It has historically been used by Steller's Eiders for spring and fall staging, as well as fall molt. Nelson Lagoon is currently the primary molting area for Steller's Eiders in Alaska; 20,000 to 47,000 Steller's Eiders have been observed there in late August and early September 2012–2016 (Williams et al. 2016), possibly representing more than half of the Pacific population (Wetlands International 2006). Steller's Eiders are known to molt in this area from mid-August through early October (Williams et al. 2016). Within this key site, the most important molting sites are immediately south (inside) and adjacent to Walrus Island, which is part of the Kudobin Islands chain. Many Steller's Eiders and Black Scoters remain in this area throughout the fall and winter, and up to 50,000 birds of both species stage there during spring migration, as do an estimated 10,000 King Eiders (Larned 2012). This area is also important for other waterfowl, particularly Emperor Geese (*Anser canagicus*) and shorebirds. Large eelgrass beds and abundant benthic resources, including shellfish (e.g., *Macoma* and *Mytilus* spp.), occur in Nelson Lagoon and adjacent areas.

Sensitivities: Steller's Eiders are identified as "vulnerable" by the International Union for Conservation of Nature (BirdLife International 2012). Greater than 90% of the Pacific population of Steller's Eider are believed to molt and winter in Alaska. The Alaska-breeding population was listed as threatened under the Endangered Species Act in 1997 due to population decline and range contraction (USFWS 1997), and some of these birds are known to molt in Nelson Lagoon (Martin et al. 2015).

The coastal barrier islands that create the sheltered lagoons are highly dynamic. Climate change and subsequent effects, including increased storm frequency, sea level rise, and erosion, have the potential to alter these natural features, but it is not clear

whether effects would be adverse (i.e., threatening the barrier islands and lagoon) or beneficial (i.e., creating more lagoon habitat) to sea ducks and other wildlife that use this area. Increasing water temperature and ocean acidification may affect the marine invertebrate community, an important source of prey for Steller's eider.

Potential conflicts: Major threats include the risk of oil contamination from spills in the Bering Sea and potential habitat degradation or ecosystem-level changes associated with climate change. Offshore oil and gas resources exist in the vicinity, but there is currently no active oil drilling. The area of the Outer Continental Shelf currently designated by BOEM as the North Aleutian Basin Planning Area, including Bristol Bay, was withdrawn from federal offshore oil and gas leasing and development in 2014 for an indefinite period of time due to the area's importance to Alaska Native subsistence users, fish and wildlife species, and commercial and recreational fisheries. The withdrawn area includes Nelson Lagoon. There are known coal reserves near Nelson Lagoon but no active mining.

Commercial fishing for salmon and subsistence activities are major components of the village of Nelson Lagoon's economy. A fish processing plant was recently completed in Nelson Lagoon but is not yet functional. Because Nelson Lagoon is nearly drained of water at low tide, navigation is difficult and there is little boat traffic or human use of the lagoon, where most sea ducks congregate, or adjacent uplands.

Status: Nelson Lagoon is part of the Port Moller Important Bird Area (Audubon Alaska 2016). Lands in this area also fall within the boundaries of the Port Moller Critical Habitat Area (Alaska Department of Fish and Game 2011) and the Alaska Peninsula National Wildlife Refuge. State Critical Habitat Areas are managed to maintain and protect naturally occurring resident and migrant fish and wildlife populations and their habitats, and a Special Areas Permit is required from Alaska Department of Fish and Game for any activity that may affect fish and wildlife habitat. Nelson Lagoon was designated as Critical Habitat for Steller's Eiders under the Endangered Species Act in 2001 (USFWS 2001).

The northern Alaska Peninsula region is a mix of state and federal lands with extensive Native regional (Aleut Corporation) and village corporation lands and numerous Native allotments. Jurisdiction of intertidal and subtidal areas is under the State of Alaska.

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Key Site 12: Seal Islands, Alaska

Location: 56°40'28"N, 159°22'28"W

Size: 47 km^2

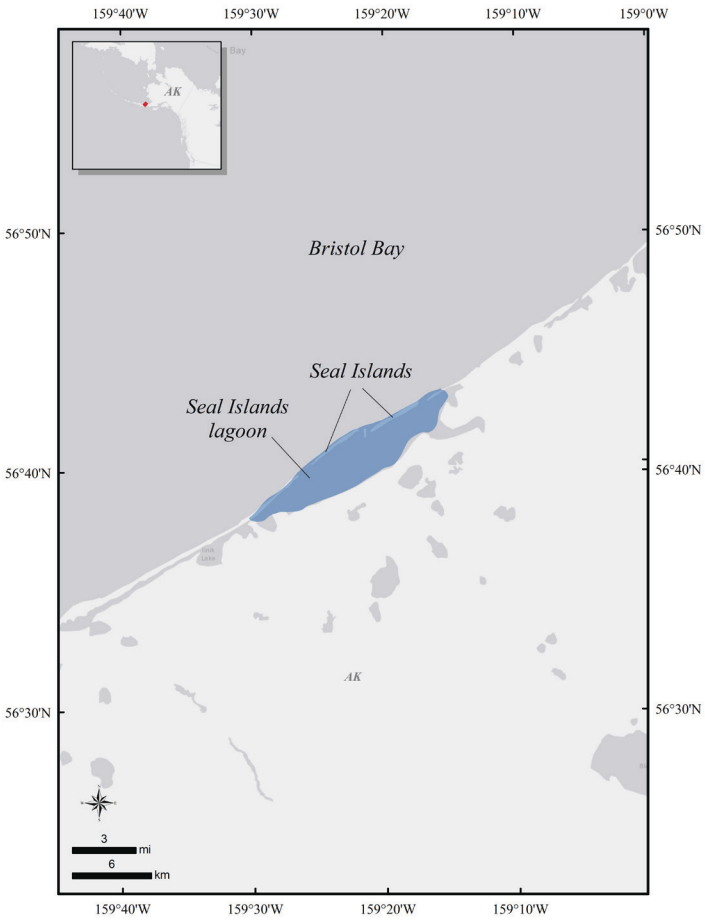
Description: Seal Islands is composed of a series of sparsely vegetated barrier islands that form a shallow lagoon on the north side of the Alaska Peninsula, about 50 km (Appendix 1) west of the village of Port Heiden. Several partially vegetated islands occur within the lagoon. At low tide, most of the Seal Islands lagoon is exposed sand/mud, with a few deeper channels. The upland area surrounding the lagoon is mostly wet sedge meadows with numerous ponds and lakes.

Precision and Correction of Abundance Estimates Presented: Abundance estimates are based on numbers of sea ducks observed during a fall survey of molting Steller's Eiders (*Polysticta stelleri*). During that survey, all birds are photographed and manually counted using imaging software. Thus, counts are considered a fairly accurate census and are not adjusted for incomplete detection.

Biological Value: This site is an important molting and staging area for Steller's Eiders that breed in Russia and northern Alaska. They are present in this area from mid-August through October. Between 4000 and 20,000 molting Steller's Eiders have been observed in the lagoon in August and September 2012–2016 (Williams et al. 2016; Appendix 2). Seal Islands is among the few known molting sites on the Alaska Peninsula, and numbers of Steller's Eiders using the area seem to be increasing in recent years (Williams et al. 2016).

In addition to Steller's Eiders, several hundred Pacific Common Eiders (*Somateria mollissima v-nigra*) and smaller numbers of Red-breasted Merganser (*Mergus serrator*) also inhabit this area during late summer and fall.

Sensitivities: The barrier islands that form a protective shield from the adjacent Bering Sea are subject to erosion, which may increase due to sea level rise, reduced ice coverage in the southern Bering Sea, and increased frequency of storm tides as a result of climate change.



Alaska-breeding Steller's Eiders are listed as a threatened species under the Endangered Species Act (USFWS 1997), and this area is designated as critical habitat for the species (USFWS 2001).

Potential conflicts: Seal Islands is remote and there is little human use of the area, with the exception of fishing in the waters outside the lagoon on the Bering Sea side. Birds that molt in this area would be particularly vulnerable to oil spills because they cannot fly and leave the area. The area of the Outer Continental Shelf currently designated by BOEM as the North Aleutian Basin Planning Area, including Bristol Bay, was withdrawn from federal offshore oil and gas leasing and development in 2014 for an indefinite period of time due to the area's importance to Alaska Native subsistence users, fish and wildlife species, and commercial and recreational fisheries. The withdrawn area includes the Seal Islands.

Status: Seal Islands is a designated Important Bird Area of Global importance (National Audubon

Society 2017) because of its importance to waterfowl and shorebirds. This key site falls within the boundary of the Alaska Maritime National Wildlife Refuge but is under the jurisdiction of the State of Alaska, as are the adjacent uplands and subtidal lands. There are no private inholdings within this area.

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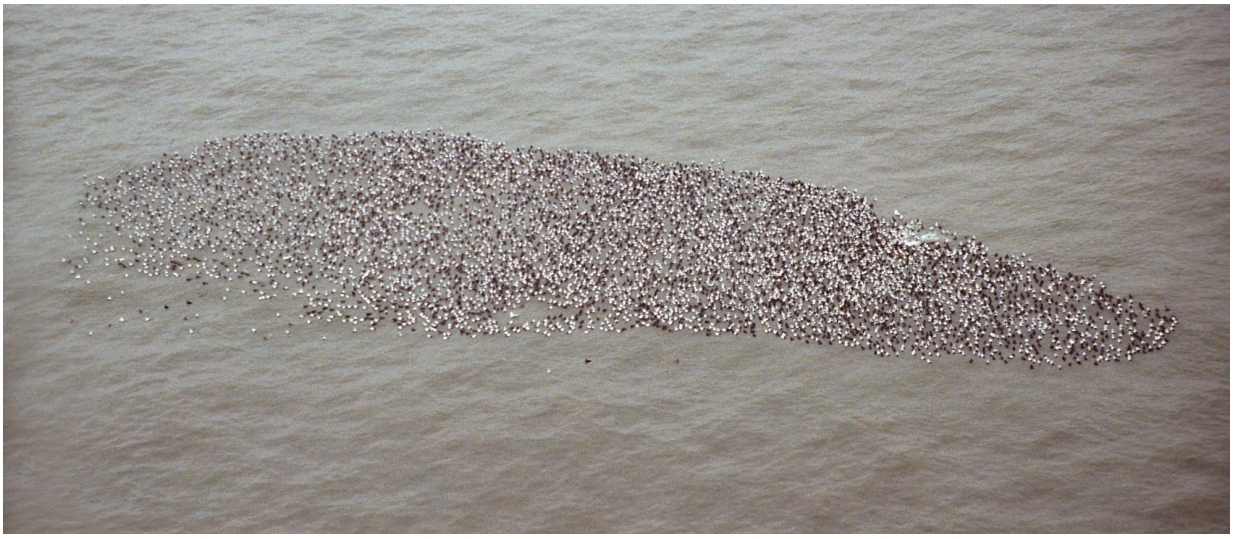


Steller's Eiders. Photo: Tim Bowman.

Key Site 13: Nushagak and Kvichak Bays, Alaska

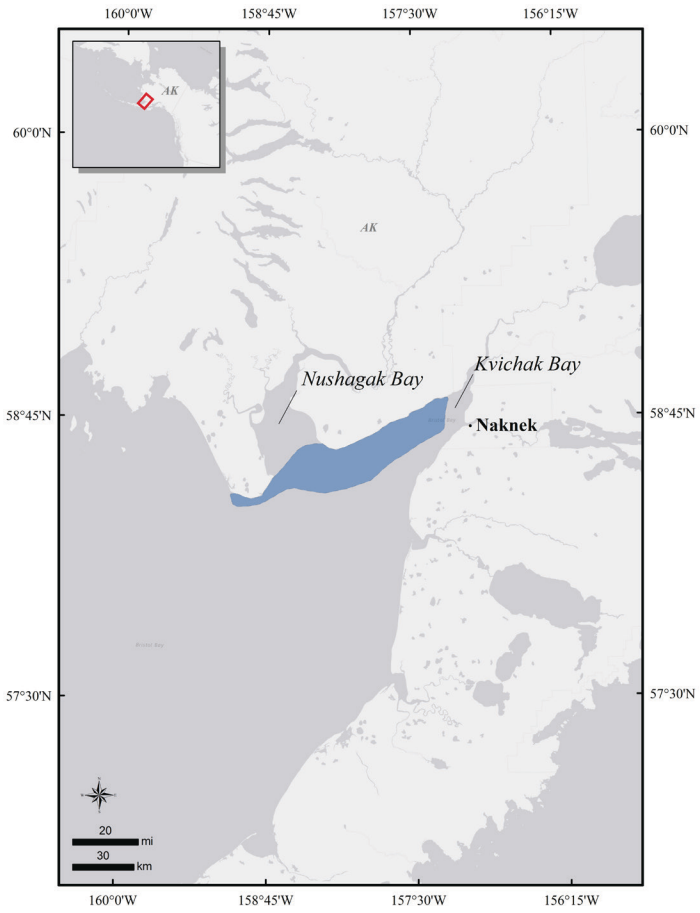
Location: 58°34'56"N, 158°5'4"W

Size: 1732 km^2

Description: Nushagak and Kvichak bays represent the northern and northeast arms, respectively, of Bristol Bay adjacent to the north side of the base of the Alaska Peninsula in southwestern Alaska. These major estuary areas encompass waters from the tip of Cape Constantine at the southwest corner of Nushagak Bay eastward to nearshore and offshore areas of Half Moon Bay in Kvichak Bay. Kvichak Bay receives two major rivers: the Kvichak River, which runs southwest from Lake Iliamna, and the Naknek River, which empties Naknek Lake, as well as several smaller drainages. Both of these rivers, and the Nushagak River, are major salmon-producing rivers. The bay is shallow, with unvegetated intertidal mud flats and sand flats exposed at low tide. Tides range 4.6 to 8 m. Benthic invertebrates, particularly bivalves (e.g., *Macoma* and *Mytilus* spp.), are numerous (Coyle et al. 2007). During winter and early spring, this area is sometimes covered with ice, concentrating sea ducks in small patches of open water or forcing them to move to other ice-free areas.

Precision and Correction of Abundance Estimates Presented: Abundance estimates presented for this key habitat site have been adjusted to reflect actual abundance (not indices), using periodic high observed counts for the area and species or based on expert and local knowledge.

Biological Value: This is a highly productive estuarine system with abundant mollusks and other invertebrates that are utilized heavily by sea ducks seasonally, particularly during migration and staging, and also during winter as ice conditions allow. Up to 125,000 King Eiders, 100,000 Black Scoters, 12,000 Long-tailed Ducks, and 50,000 Steller's Eiders stage there during spring migration (Larned 2012, J. Schamber, Alaska Department of Fish and Game unpublished data); however, these are likely minimum estimates of the number of sea ducks that the area, because spring surveys upon which most of these estimates are based provide only a snapshot of abundance, not total use over the migration period. For example, >75% of 70 Black Scoters marked with satellite transmitters during winter from



British Columbia to the Aleutian Islands used this area in May and >60% during October (Schamber et al. 2010), spending one to three weeks there. Extrapolating this to the entire western Black Scoter population, this equates to a total use by 90,000 to 120,000 individual Black Scoters during spring. Sea ducks likely use this food-rich area to acquire reserves during migration. The area is also a significant molting area for Black Scoters and some King Eiders during late summer and fall (August through September; Schamber et al. 2010). During winter, tens of thousands of King Eiders may be present, depending in large part on ice coverage (Larned 2012). King Eiders breeding in northern Alaska, the western Canadian Arctic, and Russia use this area (Oppel et al. 2008, Dickson 2012a, 2012b), suggesting the international importance of northeastern Bristol Bay. Black Scoters use relatively shallow areas whereas King Eiders and Long-tailed Ducks use deeper waters. The Nushagak and Kvichak Bay area is part of an Important Bird Area (Audubon Alaska 2014) because of its importance to waterfowl and shorebirds.

Sensitivities: This area is used by large numbers of King Eiders and Black Scoters, particularly during the spring and fall seasons when physiologic condition may have strong fitness-related consequences (Anteau and Afton 2009). Northeastern Bristol Bay is an important area for a large segment of the Pacific populations of King Eiders and Black Scoters (Bowman et al. 2021) during the annual cycle. Thus, future impacts from resource development or environmental change could have significant effects on population levels of both species. Shifts in benthic community structure or reductions in benthic biomass could have adverse consequences for birds that rely heavily on those resources; such changes have been linked to warmer sea temperatures in the Bering Sea (Grebmeier et al. 2006, Coyle et al. 2007). Steller's Eiders, which are listed as a threatened species under the Endangered Species Act (USFWS 1997), also use this area during migration.

Potential Conflicts: Major threats include the risk of oil contamination from spills in the Bering Sea and Bristol Bay and potential habitat degradation or ecosystem-level changes associated with climate change. The area of the Outer Continental Shelf currently designated by BOEM as the North Aleutian Basin Planning Area, including Bristol Bay, was withdrawn from federal offshore oil and gas leasing and development in 2014 for an indefinite period of time due to the area's importance to Alaska Native subsistence users, fish and wildlife species, and commercial and recreational fisheries. The withdrawn area includes Nushagak and Kvichak Bays.

Significant mining activities have been proposed within the bay's watershed that could impact Bristol Bay chemistry and biology. The largest proposed mine is the open pit Pebble Mine, which is currently stalled in planning and permitting processes and has met with significant opposition due to environmental concerns.

Tourism within the estuary is minimal; at low tide, navigation is difficult and there is little recreational boat traffic or human use. Commercial salmon fishing is a huge industry, with boat traffic mostly confined to deep water channels. Most shore-based fish processing plants are located in the village of Naknek and city of King Salmon.

Status: King Eiders breeding in northern Alaska, the western Canadian Arctic, and Russia use this area (Oppel et al. 2008, Dickson 2012a, 2012b), suggesting the international importance of northeastern Bristol Bay. Kvichak Bay was recently designated as one of only 49 sites within the Western Hemispheric Shorebird Reserve Network, which was established to protect critical shorebird habitat across the Americas. Nushagak and Kvichak Bays are designated as a coastal Important Bird Area (Audubon Alaska 2016).

Nushagak and Kvichak Bays are part of two boroughs, Bristol Bay and Lake and Peninsula, to the south and east, and the Dillingham Census Area to the north and west. Surrounding lands are under the jurisdiction of various entities, including the Bristol Bay Borough, Bristol Bay Native Association, Bristol Bay Native Corporation, Bureau of Land Management, Alaska Department of Natural Resources, Alaska Department of Fish and Game, and several Native villages. Intertidal and subtidal lands are administratively regulated by the State of Alaska. There is currently little commercial development surrounding Nushagak and Kvichak Bays, although the waters support one of the largest wild salmon fisheries in the world with commercial fishing and processing and subsistence fishing. Much of the estuary is managed as a fisheries conservation zone.

The Nushagak and Kvichak Bay area is part of an Important Bird Area (Audubon Alaska 2014) because of its importance to waterfowl and shorebirds.

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Key Site 14: Kuskokwim Shoals, Alaska

Location: 59°37'60"N, 163°46'46"W

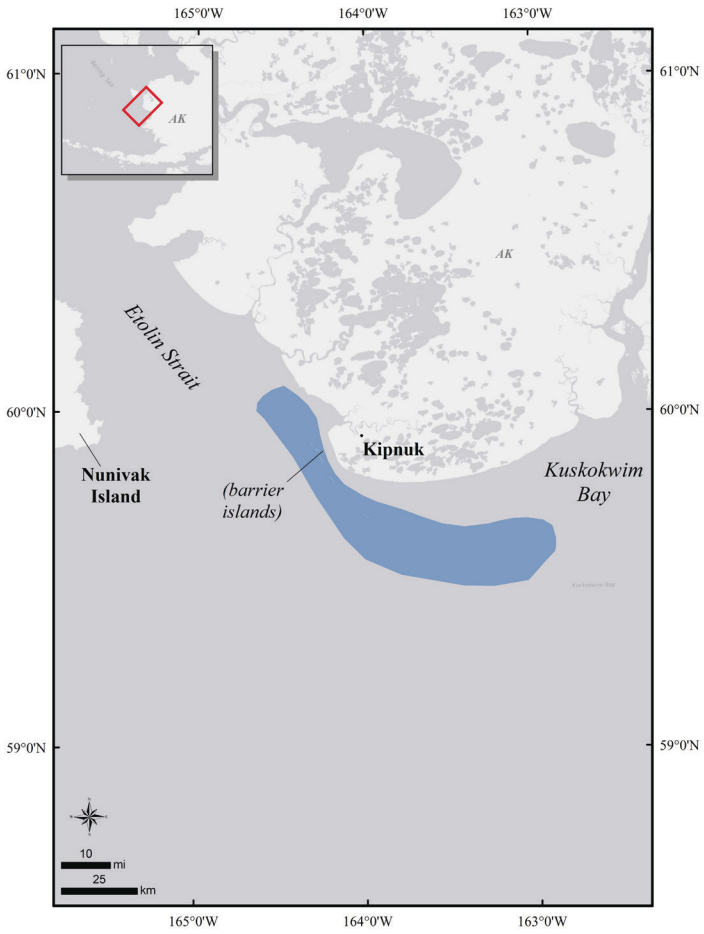
Size: 1918 km^2

Description: The Kuskokwim Shoals key sea duck habitat site extends southeast from Etolin Strait into Kuskokwim Bay, offshore from the village of Kipnuk and Cape Avinof. This coastal marine habitat is shallow (<10 m), with extensive tidal flats supporting substantial eelgrass beds. Barrier islands, including Kikegtek, Pingurbek, and Kwigluk islands, lie within this key site. Freshwater input is mainly from the Kuskokwim River. The neighboring coastline consists of intertidal wetland ecosystems with prolific graminoid vegetation.

Precision and Correction of Abundance Estimates Presented: Fall and spring abundance estimates have not been adjusted to account for incomplete detection or other biases and can be treated as minimum estimates (Larned and Tiplady 1996, Larned 2012).

Biological Value: The shoals of northwestern Kuskokwim Bay provide critical staging habitat for migrating Steller's Eiders (*Polysticta stelleri*) and a variety of other sea duck species. Aerial survey data suggest highest use by most sea duck species takes place in marine waters near the prominent barrier islands in the northwest portion of this site (Larned and Tiplady 1996, Larned 2012). Up to 11,000 Steller's Eiders have been observed there during the fall molt and migration period (B. McCaffery, USFWS, pers comm.).

Nearly the entire Pacific population of Steller's Eiders (>80,000 birds) passes through this area in the spring after wintering in areas of southwestern and southcentral Alaska (Larned 2012, Rosenberg et al. 2014, Martin et al. 2015); they use this key habitat site for three to five weeks before dispersing to breeding grounds in Russia and northern Alaska (Rosenberg et al. 2014, Martin et al. 2015). This key habitat site also represents an important staging location for thousands of Pacific Common Eiders (*Somateria mollissima v-nigra*) and tens of thousands of King Eiders (*Somateria spectabilis*) during spring and fall migration periods (Larned and Tiplady 1996, Larned 2012). This coastal shoal habitat also supports thousands of fall-staging Black



Scoters (*Melanitta americana*) and Long-tailed Ducks (*Clangula hyemalis*) (Larned and Tiplady 1996, Larned 2012, J. Schamber, Alaska Department Fish and Game unpublished data).

While this is not a primary migration corridor, smaller numbers of Spectacled Eiders (*Somateria fischeri*), Surf Scoters (*Melanitta perspicillata*), and White-winged Scoters (*Melanitta deglandi*) occupy this offshore habitat during migration and molt periods (Larned and Tiplady 1996, Rosenberg et al. 2006a, 2006b). Aerial survey data suggest species-specific use and distribution across this key habitat site, with eiders and Long-tailed Ducks frequenting the mainland side of the barrier islands and scoters occupying shoal habitat, as well as deep-water habitat further east in Kuskokwim Bay (Larned and Tiplady 1996).

Sensitivities: Near-shore marine ecosystems may be at risk for contamination associated with transportation of petroleum and mining products by ocean-going vessels (National Audubon Society

2017). Molting sea ducks (e.g., Steller's Eiders, scoters) in this area may be especially vulnerable to disturbance and collisions from local vessel traffic and associated cultural use activities. Sea duck species using the Kuskokwim Shoals area may be vulnerable to changing sea ice distribution and major regime shifts in the North Pacific and Bering Sea (Grebmeier et al. 2006, Flint 2013, Lovvorn et al. 2014). Because much of the Yukon-Kuskokwim River Delta is relatively low-lying, rising sea level and/or frequency of storm surges may advance erosion of the coastline and offshore barrier islands in this area (Jorgenson and Ely 2001).

Potential Conflicts: This key site lies within a high traffic area for ocean-going vessels representing a variety of different industries (Nuka Research and Planning Group 2016). It is likely that vessel traffic will increase due to several factors, including (1) loss of sea ice opening up the northwest passage to ship traffic, (2) possible development of deepwater ports in western Alaska (U.S. Army Corps of Engineers 2015), and (3) shipping associated with the Donlin Gold mine (Donlin Gold 2019). Additional boat traffic may be seasonally present as local residents hunt, fish, and commute between villages bordering Kuskokwim Bay. Because sea ducks exhibit interspecific variation in response to disturbance from ocean-going vessel traffic (Schwemmer et al. 2011), further elucidating seasonal use patterns may help reduce disturbance effects on more vulnerable species that use the Kuskokwim Shoals key site.

Status: The Kuskokwim Shoals key habitat site lies within state and federally regulated waters. The barrier islands in the northwest portion of this site fall under state jurisdiction of submerged lands (from mean low water to the three-nautical-mile line; NOAA 2017). Under this jurisdiction, the Alaska Department of Natural Resources has the authority to manage, develop, and lease resources within this boundary (Alaska Department of Natural Resources 2000). However, the majority of the Kuskokwim Shoals key site falls within both the Territorial Sea (0 to 12 nautical mile line) and Contiguous Zone (12 to 24 nautical mile line) of U.S. government jurisdiction (NOAA 2017). Therefore, the federal government exercises authority over most domestic and foreign affairs occurring within these boundaries. Kuskokwim Shoals have been designated critical habitat for Steller's Eiders under the Endangered Species Act (USFWS 2001). This area also falls within the Kuskokwim Bay Important Bird Area (IBA), identified as a high-priority conservation area of global significance (National Audubon Society 2017), largely because of its use by migrating Steller's Eiders and other sea duck species. Adjacent to this offshore site, the shoreline represents the border of the Yukon Delta National Wildlife Refuge (YDNWR), which includes the Kuskokwim River Delta, another globally significant IBA (National Audubon Society 2017). The YDNWR provides nesting habitat for Spectacled Eiders as well as significant numbers of the Pacific populations of Common Eiders, Black Scoters, and Long-tailed Ducks (Fischer et al. 2017).

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Key Site 15: Yukon-Kuskokwim Delta, Alaska

Location: 61°8'3"N, 165°3'48"W

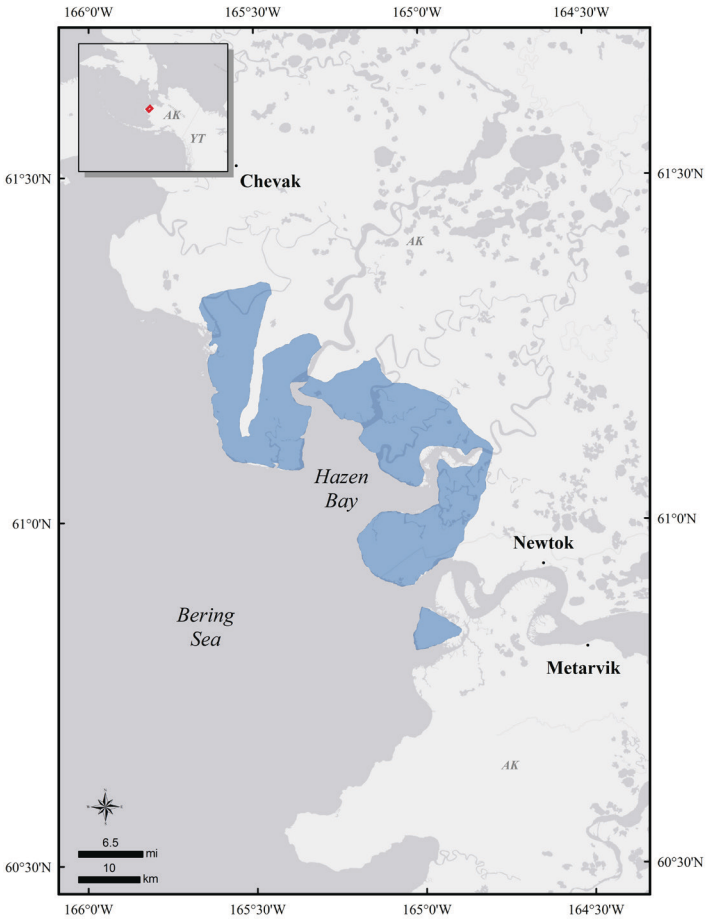
Size: 861 km^2

Description: The Yukon-Kuskokwim Delta Key Habitat Site lies within the Yukon Delta National Wildlife Refuge and includes the near-coastal areas in the vicinity of Hazen Bay, where high densities of waterfowl nest. Both the Yukon and Kuskokwim rivers traverse the refuge, and over time these rivers have created one of the largest river deltas in the world. The coastal area of the Yukon-Kuskokwim Delta is generally a flat plain containing innumerable lakes and ponds, as well as tidal rivers and sloughs with extensive mud and sandflats (Appendix 1). Tide heights are up to about 2 m, and storm-driven high tides during spring and fall sometimes inundate large areas with salt water (Terenzi et al. 2014). Upland areas include sedge-graminoid meadows, palsas, and limited upland tundra (Tande and Jennings 1986). The communities of Chevak, Newtok, and Metarvik are located near this key site, and subsistence harvest activities of community members (e.g., fish camps, waterfowl hunting) do occur within the area.

Precision and Correction of Abundance Estimates Presented: Abundance estimates are based on ground-based nest surveys and aerial surveys of waterfowl during early spring (Fischer et al. 2017, Swaim 2017). Estimates have been adjusted for incomplete detection of nests and/or birds (Fischer et al. 2018).

Biological Value: This site is an important breeding area for several species of waterfowl, including Spectacled Eider (*Somateria fischeri*) and Pacific Common Eider (*S. mollisima v-nigra*). Spectacled Eiders and Common Eiders are present in this area from mid-May through August. The Yukon-Kuskokwim Delta is one of two primary breeding areas for Spectacled Eiders in Alaska, with about 15,000 birds present during the breeding season (Fischer et al. 2017); their numbers remain well below historic levels but seem to have increased since the mid-1980s (Dunham et al. 2021).

Pacific Common Eiders breed in coastal areas, with about 8000 birds present during the breeding season (Fischer et al. 2017). Several thousand Long-tailed Ducks (*Clangula hyemalis*) also occur and likely nest within the coastal area (Swaim 2017).



Sensitivities: Spectacled Eiders are listed as a threatened species, and this area is designated critical habitat for the species under the Endangered Species Act (USFWS 1993, 2001). Hunting of Spectacled Eiders has been prohibited since 1991, but some harvest does occur.

This low-lying habitat is particularly sensitive to increases in sea level rise due to climate change. Increased severity of storm surges has already been documented (Terenzi et al. 2014); the resulting changes in salinity of coastal ponds could impact many species that rear young in these ponds and require fresh water.

Ingestion of lead shot deposited in wetlands has been documented to cause mortality and sublethal effects in Spectacled Eiders (Grand et al. 1998, USFWS 2020). Lead shot has been banned for waterfowl hunting since 1991, and the State of Alaska prohibited use of lead shot for hunting of upland game birds and small game on the Yukon-Kuskokwim Delta. Still, illegal use of lead shot for hunting waterfowl and upland game birds (e.g.,

ptarmigan) near wetlands has contributed to continued deposition and exposure of birds to lead shot. Education efforts are underway to help ensure use of steel shot for hunting in this area.

Potential Conflicts: Offshore oil and gas development is currently (as of 2022) not a significant threat, although leasing plans are subject to change based on politics. Because most of this area falls within the boundaries of the Yukon Delta National Wildlife Refuge, activities that would adversely affect waterfowl and their habitats are largely regulated. Subsistence take occurs in the area, mainly in the form of egg collection, but is focused largely on geese and gulls and is considered an insignificant threat to Spectacled or Common Eiders. Predation of waterfowl eggs and young by foxes, gulls, and jaegers can be significant (Bowman et al. 2004).

Status: The coastal area of the Yukon-Kuskokwim Delta is within the Central Yukon-Kuskokwim Important Bird Area (National Audubon Society 2018) because of its importance to waterfowl and shorebirds. The entire refuge is also designated as a Marine Protected Area (NOAA 2018). Intertidal habitats are managed by the State of Alaska, while the surrounding wetlands and uplands are managed by the U.S. Fish and Wildlife Service as part of the Yukon Delta National Wildlife Refuge. Several small terrestrial sections within this area have been conveyed or remain "selected" under the Alaska Native Claims Settlement Act, but there has been little or no development of these lands. The primary Alaska Native Regional Corporation in the area is the Calista Corporation.

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Key Site 16: Norton Sound, Alaska

Location: 63°57'22"N, 161°47'20"W

Size: 937 km^2

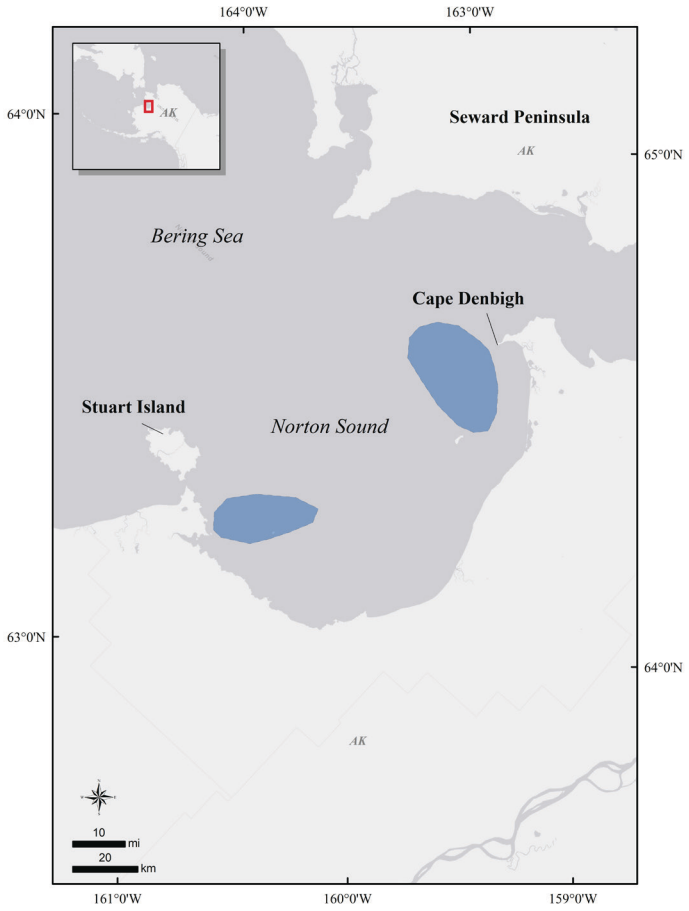
Description: Norton Sound is one of the largest coastal water bodies along the Bering Sea coast of northwest Alaska. Lying between the Seward Peninsula to the north, the Nulato Hills to the east, and the Yukon River delta to the south, this key habitat site includes an array of coastal habitat features. Several islands, including Stuart, Egg, and Besboro Islands, lie within this key site. Many large rivers empty into Norton Sound, including the Unalakleet and Shaktoolik rivers. The adjacent coastline is comprised of variable terrain with steep cliffs, low-lying hills, and extensive river deltas. Nearshore water depths remain relatively shallow (<5 to 20 m) as far as 40 km from the shoreline.

Aerial survey and telemetry data suggest that sea ducks use marine habitats near Stuart Island on the southern portion of the sound and shallow water habitat around Cape Denbigh in the northeast portion of this site (D. Rosenberg and J. Schamber, Alaska Department Fish and Game unpublished data, Bollinger and Platte 2012, Martin et al. 2015, Bartzen et al. 2016, Sexson et al. 2016).

Precision and Correction of Abundance Estimates Presented: Summer abundance estimates have not been adjusted to account for incomplete detection or other biases and can be treated as minimum estimates (Bollinger and Platte 2012).

Biological Value: The coastal waters of Norton Sound provide critical molting habitat for threatened Spectacled Eiders (*Somateria fischeri*; USFWS 2001). Telemetry data from individuals marked on the Yukon-Kuskokwim Delta indicated that most (45 of 46) females traveled to Norton Sound to molt after the breeding period (Sexson et al. 2014). Thus, nearly all western Alaska breeding females (>7000) molt in Norton Sound before wintering with the entire world population on polynyas in the Bering Sea (Petersen et al. 1999, 2000, Sexson et al. 2016).

Aerial surveys were conducted from 2006 to 2009 to determine the presence of Common Eiders (*S. mollissima v-nigra*) and other waterbird species along the Norton Sound and Seward Peninsula



shoreline (Bollinger and Platte 2012). Within the Norton Sound key habitat area, up to 1064 Common Eiders have been observed during the breeding period (Bollinger and Platte 2012).

Telemetry data indicate this key habitat site also supports Steller's Eiders (*Polysticta stelleri*), Black Scoters (*Melanitta americana*), Surf Scoters (*M. perspicillata*), and Long-tailed Ducks (*Clangula hyemalis*) that stage in the key site during migration events (D. Rosenberg and J. Schamber, Alaska Department Fish and Game unpublished data, Martin et al. 2015, Bartzen et al. 2016).

Sensitivities: The marine ecosystem of Norton Sound may be at risk of contamination from mining and the transportation of petroleum products (National Audubon Society 2018a). Because the molting period is energetically expensive for sea ducks, distribution of Spectacled Eiders typically follows the distribution of prey (Sexson et al. 2016). Oscillating ocean conditions within Norton Sound could impact the density of prey species within this key habitat site (Lovvorn et al. 2014, Sexson et al. 2016).

Potential Conflicts: Molting Spectacled Eiders may be sensitive to disturbance and collisions from commercial fishing and vessel traffic in Norton Sound, as this is a high-traffic area for vessels operating in Norton Sound and the Bering Sea (Nuka Research and Planning Group 2016). Interest in offshore natural gas production in the Norton Sound could continue to increase, especially as remote communities in Alaska strive for energy independence (Reitmeier 2005).

Status: Norton Sound lies within state and federally regulated waters. Nearshore islands within 5.6 km of land fall under state jurisdiction of submerged lands (NOAA 2017); the Alaska Department of Natural Resources has the authority to manage, develop, and lease resources within this boundary (Alaska Department Natural Resources 2000). However, the majority of the area designated as key habitat for sea ducks falls within both the Territorial Sea (0 to 12 nautical mile line) and Contiguous Zone (12 to 24 nautical mile line) under U.S. government jurisdiction (NOAA 2017). Norton Sound has been designated critical habitat for molting Spectacled Eiders under the Endangered Species Act (USFWS 2001). Norton Sound includes multiple Important Bird Areas, including the East Norton Sound IBA, listed as a high-priority conservation area of global significance (National Audubon Society 2018a). The Stebbins–St. Michael Important Bird Area, with state-level significance, occurs here and also falls within the Yukon Delta National Wildlife Refuge (National Audubon Society 2018b). Additional areas with habitat protection include segments of shoreline and islands that are designated as part of the Alaska Maritime National Wildlife Refuge.

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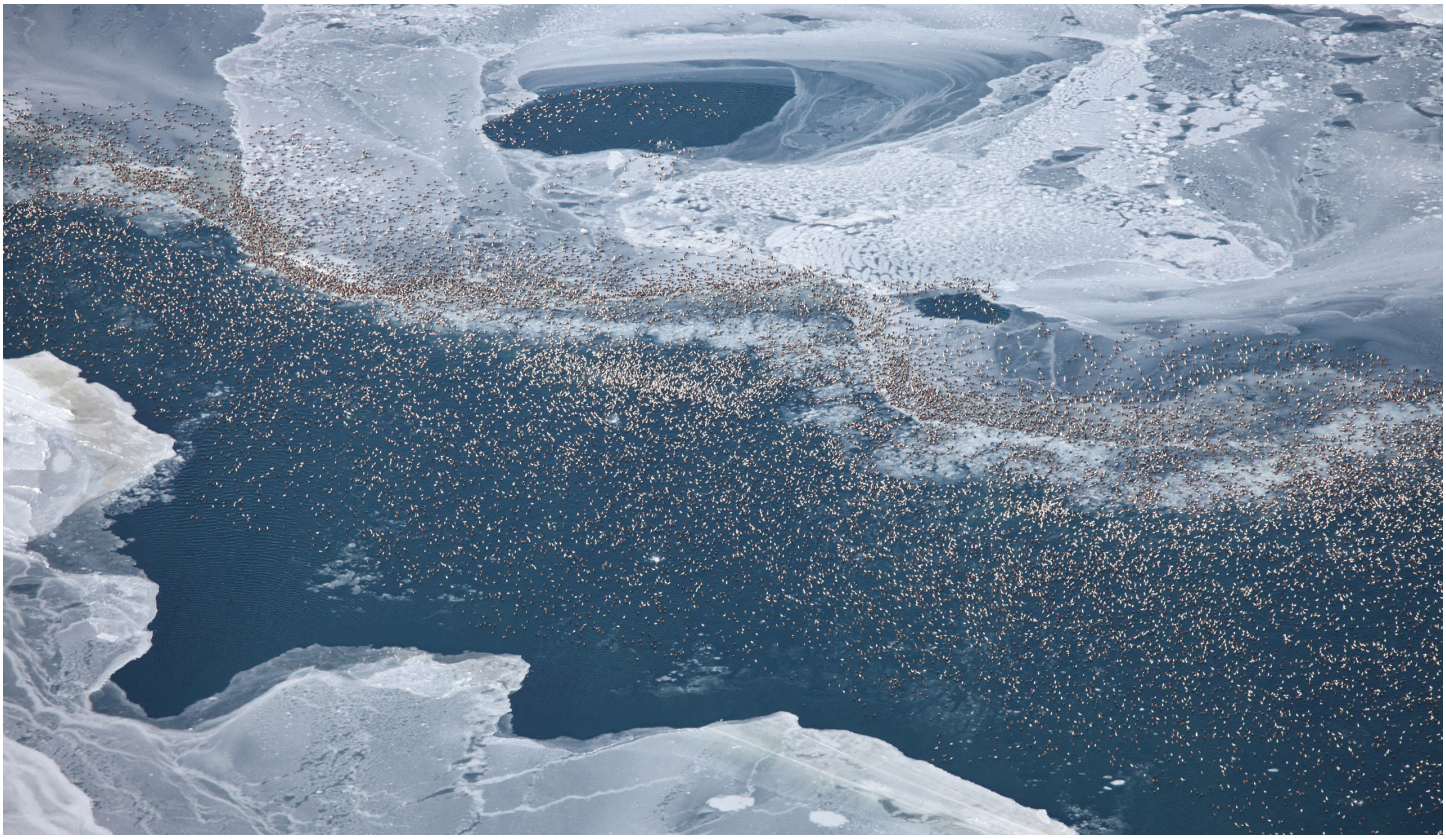


Spectacled Eiders in pack ice. Photo: Tim Bowman.

Key Site 17: Northern Bering Sea, Alaska

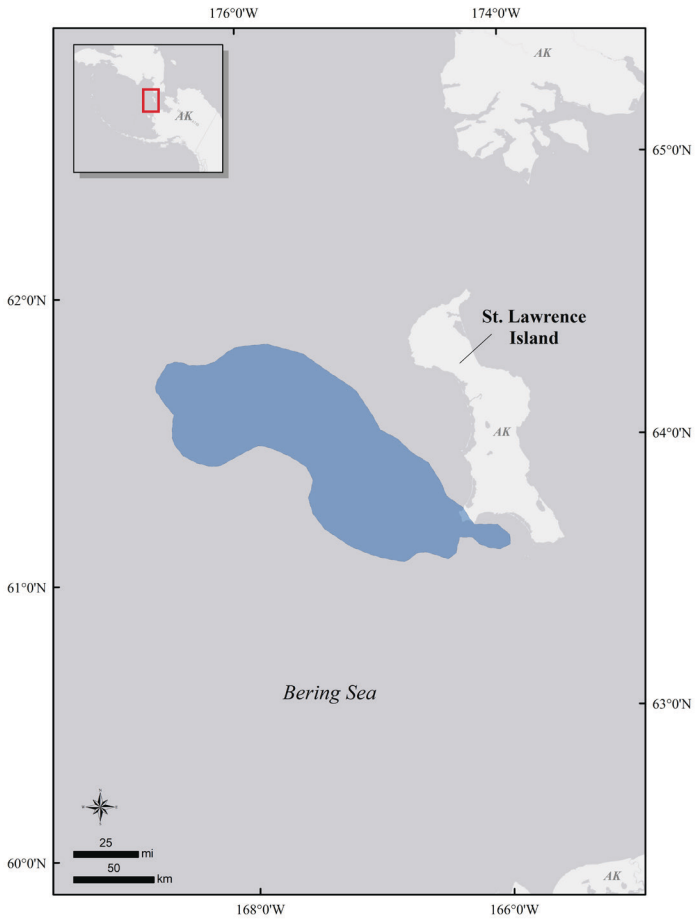
Location: 62°39'5"N, 171°16'53"W

Size: 12,644 km^2

Description: This key habitat site lies about 200 km off the southern and western coast of St. Lawrence Island, Alaska. The Anadyr Current from the western side of the Bering Sea controls nutrient distributions in this region. The high productivity in this area along with the shallow shelf of the Bering Sea result in large quantities of carbon available to support productive benthic communities, which in turn support marine animals. In winter, sea ice is a dominant physical feature in the northern Bering Sea.

Precision and Correction of Abundance Estimates Presented: Abundance estimates presented for this key habitat site have not been adjusted to account for incomplete detection. Within this area, bird abundance estimates were based on aerial oblique photos, in which birds were manually counted. These photos were taken over a geographic area delineated based on the distribution of radio-tagged Spectacled Eiders (*Somateria fischeri*) (Larned et al. 2012) and should be considered an approximate or minimum estimate.

Biological value: Benthic communities in the northern Bering Sea support organisms that forage on benthic food sources, including several sea duck species, most notably Spectacled Eiders (Grebmeier et al. 2006, Grebemeier 2012). This key site supports the entire world population of Spectacled Eiders (~370,000 birds; Larned et al. 2012) during winter (Petersen et al. 1999, Sexson et al. 2014). Spectacled Eiders spend a maximum of nine months in this region, arriving as early as the last week of September and departing by late May (Sexson et al. 2014). The distribution of wintering eiders is controlled to some extent by the location of open water leads and polynyas, which provide areas for foraging and resurfacing after dives (Bump and Lovvorn 2004, Lovvorn et al. 2014). In addition, the distribution and location of eiders also appears to respond to changes in sea ice concentration (Cooper et al. 2013). Sea ice provides a critical habitat as a resting platform between foraging bouts because sea ducks lose heat at a greater rate in water than when exposed to air (De Vries and Van Eerden 1995). The use of this key site as an exclusive



wintering area appears to be unique to Spectacled Eiders. Other sea ducks, such as Common Eiders (*S. mollissima v-nigra*), King Eiders (*S. spectabilis*), and Long-tailed Ducks (*Clangula hyemalis*), have been observed during winter within the key site boundaries (particularly in the northern portion of this site), but most use other areas throughout the Bering Sea and farther south near western Alaska (Petersen and Flint 2002, Petersen et al. 2003, 2012, Phillips et al. 2006, Oppel et al. 2008).

Sensitivities: In 1993, Spectacled Eiders were listed as threatened under the provisions of the U.S. Endangered Species Act due to population decline on its principal breeding areas in Alaska (Federal Register 1993). This key wintering area, along with breeding, migration, and molting areas, are designated as critical habitat for Spectacled Eiders (Federal Register 2000).

Changes in climate have been linked to large-scale decadal regime shifts in the Bering Sea ecosystem (Hare and Mantua 2000, Grebmeier et al. 2006). Within this key site, shifts in the once-dominant

bivalve *Macoma calcarea* to *Nuculana radiata* over the last 40 years (Richman and Lovvorn 2003, Lovvorn et al. 2009) coincided with population declines of Spectacled Eiders (Flint 2013). Other effects of climate change include variation in sea ice conditions and shifts in prevailing winds, which can affect Spectacled Eiders' access to feeding areas and availability of ice as resting platforms and thus increase energetic costs (De Vries and Van Eerden 1995, Lovvorn et al. 2014). Higher energy costs and restricted access to preferred feeding habitat and food items might affect not only short-term survival but also future breeding success (Petersen and Douglas 2004, Lovvorn et al. 2014). Dramatic decreases in ice in the Northern Bering Sea were observed during the winters of 2018 and 2019, and in the winter of 2019–2020 a sample of radio-tagged eiders allowed documentation of dispersion of wintering birds to marine areas far outside the traditional wintering area (i.e., coastal Russia, eastern Chukchi Sea); the consequences of these shifts are not known.

Potential conflicts: Major threats include the risk of oil contamination from vessel spills in the Bering Sea and potential habitat changes (i.e., sea ice) or ecosystem-level (i.e., food web and diet items) changes associated with climate change. Ship traffic through the Bering Strait is expected to increase as decreased sea ice opens the Arctic to shipping and resource development. Threats also include disturbance or harvesting of benthic communities in this area.

Status: This key wintering area in the northern Bering Sea south of St. Lawrence Island was designated as Critical Habitat for Spectacled Eiders in 2001 (U.S. Department of Interior 2001). Of the 7,393,700 hectares in this area, approximately 98.6% is under federal ownership while the remaining 1.4% is owned by the State of Alaska (Federal Register 2000). In December 2016, an executive order was issued designating the Northern Bering Sea Climate Resilience Area in Alaska (Federal Register 2016). The executive order maintained the current prohibition on bottom trawling in this area, required additional steps to protect important places from the impacts associated with human-related activities (i.e., shipping), and prohibited oil, gas, and mineral leasing in specific areas, including this key wintering area for Spectacled Eiders (http://usa.oceana.org/northern-bering-sea-climate-resilience-area).

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Key Site 18: Ledyard Bay, Alaska

Location: 69°43'1"N, 163°47'43"W

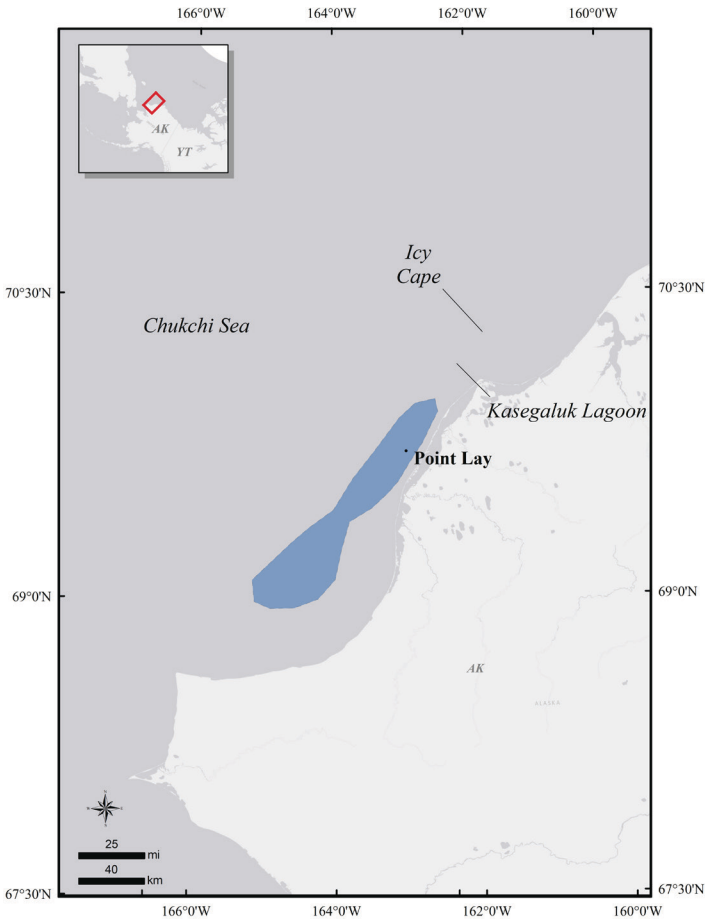
Size: 3065 km^2

Description: Ledyard Bay includes near- and offshore coastal waters between Cape Lisburne and Icy Cape on the Arctic coast of Alaska. This remote marine site on the eastern edge of the Chukchi Sea provides shallow (<30 m) water staging and molting habitat for a variety of sea duck species. Just outside the northeast portion of this site, Solivik Island and several other unnamed islands form the outer barrier of Kasegaluk Lagoon. The adjacent shoreline includes steep cliffs at Cape Lisburne, gradually descending towards wetland ecosystems, with many thermokarst lakes near Kasegaluk Lagoon. In addition to numerous small creeks emptying into Ledyard Bay, major rivers such as the Avak, Utukok, Kokolik, and Kukpowruk also provide substantial freshwater input.

Telemetry and aerial survey data suggest use by sea duck species takes place throughout marine waters of Ledyard Bay, with concentrations occurring near Kasegaluk Lagoon in the northeast portion of this site (Larned et al. 1995, Petersen and Flint 2002, Oppel et al. 2009, Bartzen et al. 2016, Sexson et al. 2016). Also see description for Beaufort Sea Lagoons Key Site, which includes part of Kasegaluk Lagoon.

Precision and Correction of Abundance Estimates Presented: Fall abundance estimates for this key habitat site have not been adjusted to account for incomplete detection or other biases and can be treated as minimum estimates of population size (Larned et al. 1995).

Biological Value: The coastal waters of Ledyard Bay provide critical staging habitat for all four eider species (*Somateria* and *Polysticta* spp.) (Larned et al. 1995, Petersen and Flint 2002, Oppel et al. 2009, Martin et al. 2015). In particular, this area provides important staging and molting habitat for Spectacled Eiders (*S. fischeri*) breeding on the Arctic Coastal Plain of Alaska (Sexson et al. 2014, 2016). As many as 33,192 Spectacled Eiders have been observed in Ledyard Bay during the fall molting period (Larned et al. 1995), and it is likely that all female Spectacled Eiders breeding on the Arctic Coastal Plain molt



there, along with males from the Russia and Alaska breeding populations (Petersen et al. 1999, Sexson et al. 2014). This habitat also represents important staging habitat for threatened Steller's Eiders (*P. stelleri*) during spring migration (Martin et al. 2015).

Aerial survey data provide limited insight into species-specific seasonal use of this area. However, results from telemetry studies indicate use by all four eider species, as well as Long-tailed Ducks (*Clangula hyemalis*), which stage in the northwest portion of this key site during spring and fall migration (Bartzen et al. 2016). This key site may also provide important foraging and loafing habitat for eiders, Long-tailed Ducks, White-winged Scoters (*Melanitta deglandi*), and Red-breasted Mergansers (*Mergus serrator*) breeding nearby on the Arctic Coastal Plain (Amundson et al. 2019).

Sensitivities: Threatened populations of sea ducks (i.e., Steller's Eiders, Spectacled Eiders) using this area are vulnerable to disturbance or unintentional take associated with subsistence harvest of nonthreatened

sea ducks (e.g., King and Pacific Common eiders (S. *spectabilis* and *S. mollissima v-nigrum*) migrating through this corridor (Lovvorn et al. 2018). Changing distribution and abundance of benthic prey within Ledyard Bay may ultimately influence use by, and seasonal movement of, eiders within this key site (Lovvorn et al. 2015, Sexson et al. 2016).

Potential Conflicts: Arctic marine ecosystems may be under increasing risk of contamination associated with increased vessel traffic and transportation of petroleum products, as the ice-free period continues to lengthen (Wang et al. 2009, National Audubon Society 2018a, 2018b), increasing risk of oil spills and bird collisions with vessels. Sea ducks provide an important subsistence resource, and conservation of this key habitat site requires consideration of subsistence hunting traditions by residents of the village of Point Lay (Lovvorn et al. 2018).

Status: The Ledyard Bay key habitat site lies within federally regulated waters and falls within both the Territorial Sea (0 to 12 nautical mile line) and Contiguous Zone (12 to 24 nautical mile line) of U.S. government jurisdiction (NOAA 2018). The federal government exercises authority over oil and gas exploration in these waters, and a small portion of this key site falls within the Chukchi Sea Sale Area (BOEM 2018). Ledyard Bay is designated critical habitat for Spectacled Eiders under the Endangered Species Act (USFWS 2001). This area also falls within the Ledyard Bay Important Bird Area (IBA), identified as a high-priority conservation area of global significance (National Audubon Society 2018a), largely because of its use by molting Spectacled Eiders and other staging waterfowl. Kasegaluk Lagoon, adjacent to this key site, is another globally significant IBA (National Audubon Society 2018b). The adjacent Arctic Coastal Plain provides nesting habitat for Spectacled, Steller's, and King eiders, as well as Long-tailed Ducks, White-winged Scoters, and Red-breasted Mergansers (Amundson et al. 2019, Wilson and Swaim 2018).

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Key Site 19: Beaufort Sea Coastal Lagoons, Alaska

Location: 70°30'7"N, 151°18'58"W

Size: 6145 km^2

Description: This key habitat site encompasses a narrow strip of Alaska's Arctic coastline from Icy Cape on the Chukchi Sea eastward along the Beaufort Sea to the Canadian border. The site is about 850 km long and extends up to 20 km from the mainland coast. Barrier islands and spits enclose lagoons, bays, and estuaries along the coast (Boggs et al. 2016). Despite the name of this key site, it also borders the Chukchi Sea at its western end. The Chukchi is a very productive shallow Arctic sea separated from the Beaufort by the Barrow Canyon (Smith et al. 2017). This deep trough in the continental shelf creates mixing and upwelling, contributing to the area's tremendous productivity, including high benthic biomass (mainly polychaetes, mollusks, and crustaceans; Smith et al. 2017). The Beaufort has lower overall productivity than the Chukchi, but with strong benthic-pelagic coupling there are rich resources for bottom feeders such as sea ducks (Smith et al. 2017).

In this dynamic ecosystem, barrier islands and spits are composed of sand and gravel, with deposition determined by prevailing winds and waves and longshore drift (Boggs et al. 2016). Barrier islands and spits, up to 9 km in length, are low (<2 m) and narrow (50 to 200 m) and almost completely unvegetated due to ice scour and mobility of the sediment (Boggs et al. 2016). Lagoons and estuaries are generally shallow, with tidal flats and marshes along the landward shoreline (Boggs et al. 2016). The dry, cold Arctic climate here has very short summers and long winters. Mean annual precipitation is 10 to 26 cm, mostly as snow, with freezing temperatures possible in any month (Boggs et al. 2016). Lagoons and brackish waters usually remain frozen from October to June, while there is generally some open water present between the coast and pack ice from July to October (Willms and Crowley 1990).

Communities within this region include Wainwright, Utqiaġvik (formerly Barrow), Nuiqsut, and Kaktovik. There are also several petroleum drilling and production facilities in the area (Alpine, Prudhoe Bay, NorthStar, etc.) which may have thousands of workers on-site at any time.

Precision and Correction of Abundance Estimates Presented: Correction factors have not been applied to abundance estimates presented for this key habitat site, thus abundance estimates should be considered minimal indices.

Biological Value: This site provides important habitat for molting sea ducks, particularly Long-tailed Ducks (*Clangula hyemalis*). Surveys conducted during 1999 to 2003 indicate that in late July and early August there are, on average, >80,000 sea ducks present at this site (Lysne et al. 2004). Long-tailed Ducks are by far the most abundant species, with >70,000 individuals (~7% of continental population). The site is also used by about 4500 Pacific Common Eiders (*Somateria mollissima v-nigrum*), 4000 Surf Scoters (*Melanitta perspicillata*), and 2500 King Eiders (*S. spectabilis*), with <100 Black Scoters (*M. americana*) as well as a few White-winged Scoters (*M. deglandi*) and Spectacled and Steller's eiders (*S. fischeri* and *Polysticta stelleri*) (Lysne et al. 2004). The highest numbers and densities of Long-tailed Ducks were observed in northeastern Kasegaluk Lagoon,

Elson Lagoon, McClure and Stockton islands, and lagoons of the Arctic National Wildlife Refuge (Arctic Refuge); there were also significant numbers at Jones and Return islands, Peard Bay, Admiralty Bay, and Smith Bay (Lysne et al. 2004). In 1985, there were nearly 25,000 Long-tailed Ducks observed in the Arctic Refuge lagoons; during 1999 to 2003 the mean count in this area was less than 16,000 but in 2003 nearly 28,000 were observed with particularly high densities (>40 birds/km^2) in the eastern Arctic Refuge, from around Barter Island to Beaufort Lagoon (Brackney et al. 1987, Lysne et al. 2004). Pacific Common Eiders were most abundant in Peard Bay (in 2003, about 4000 birds were observed in this area alone), as well as Kasegaluk Lagoon and McClure and Stockton islands (Lysne et al. 2004). The distribution of King Eiders and Surf Scoters varied annually; highest numbers of King Eiders were seen at Peard Bay, Elson Lagoon, and McClure and Stockton islands, while Surf Scoters were most abundant at Harrison Bay and Jones and Return islands (Lysne et al. 2004).

Within this site, Long-tailed Ducks and Pacific Common Eiders (*v-nigrum*) are particularly associated with lagoon habitats inside barrier islands (Fischer et al. 2002). While some Long-tailed Ducks nest in the surrounding uplands, the lagoons are used primarily as molting and staging areas by Long-tailed Ducks that breed elsewhere in Alaska and Arctic Canada (Lysne et al. 2004, Bartzen et al. 2017); peak abundance of Long-tailed Ducks occurs in early August, with numbers declining through mid-September (Brackney et al. 1987). More than 50% of Long-tailed Ducks marked with satellite transmitters during molt in the Northwest Territories, Canada, used this area during their westward fall migration through the Beaufort and Chukchi seas (Bartzen et al. 2017).

This site provides important breeding habitat for Pacific Common Eiders, with 500 to 1000 pairs nesting along this stretch of coastline, usually among driftwood on low-elevation barrier islands (Flint et al. 2004, Dau and Bollinger 2009). This region is also used by King and Spectacled eiders during breeding, staging, and molting, and by Steller's Eiders during breeding and staging (Smith et al. 2017). Male Spectacled Eiders captured during the breeding season in the Prudhoe Bay area spent several weeks in coastal waters of the Beaufort and Chukchi seas, which may provide important staging and foraging habitat during post-breeding migration (Petersen et al. 1999). Adult and juvenile Spectacled Eiders marked in the Colville River delta used the western Beaufort Sea important area during breeding or post-fledging dispersal, respectively (Sexson et al. 2014). Adult female and juvenile Spectacled Eiders from fledged broods used nearshore marine waters (Elson Lagoon) near Utqiaġvik, Alaska, in late August and early September (Safine 2012).

Seaward of the barrier islands, just outside this key site, high densities of Long-tailed Ducks (35 to 50 birds/km^2) have also been observed (Brackney et al. 1987), along with fewer numbers of King Eider, scoter, Common Eider, and Spectacled Eider (Fischer et al. 2002).

Sensitivities: Lagoon habitats within this site are particularly important, with tens of thousands of molting Long-tailed Ducks feeding primarily in the open-water areas of the lagoons and resting in sheltered areas near the barrier islands at night (Flint et al. 2016). This system may be vulnerable to the impacts of climate change; as sea ice diminishes and sea levels rise, storm surges and erosion become more frequent and significant. Due to these changes, combined with permafrost thaw in coastal tundra, the barrier island lagoon systems may change dramatically. The total surface area of barrier islands in the central Beaufort Sea has decreased about 4% from the 1940s to 2000s (Boggs et al. 2016). Furthermore, with warming ocean temperatures and changes in sea ice cover, altered timing of phytoplankton blooms may cause marine ecosystems to shift from benthic-driven to pelagic-driven systems, which could have negative consequences for benthic-feeding sea ducks (Smith et al. 2017).

Large aggregations of migrating or molting sea ducks may be particularly sensitive to disturbance and marine pollution events. The barrier island lagoon system is also considered to be highly susceptible to damage from oil spills and human use (Boggs et al. 2016). However, proximity to oil field activity in Beaufort Sea lagoons did not appear to affect foraging activity of molting male Long-tailed Ducks (Flint et al. 2016).

Potential Conflicts: Although most of the terrestrial area bordering this key habitat site is undeveloped and sparsely populated, there are major

petroleum production facilities present. In the 1970s, oil was discovered near Prudhoe Bay; operated by BP in partnership with ExxonMobil and ConocoPhillips Alaska, it became the largest oilfield in North America. Since then, various other oil and gas production facilities have been developed, both on- and offshore. There has recntly been renewed interest in development in the National Petroleum Reserve-Alaska (Houseknecht et al. 2017) as well as in the Arctic Refuge.

Oil and gas exploration and development can negatively affect sea ducks by causing loss or alteration of habitat, disturbance, disorientation from or collision with offshore structures, and contamination from oil spills or other pollutants (including chronic exposure to low-level pollution) (Bartzen et al. 2017). During spring migration, Long-tailed Ducks staged in the Alaska Chukchi Sea less than 80 km from offshore oil and gas leases, and during fall migration some staged nearshore (less than 50 km) and were in or near oil and gas leases and active drilling platforms (Bartzen et al. 2017).

In addition, as Arctic sea ice decreases due to climate change, this area will likely experience increased shipping traffic associated with transportation, resource development, and tourism, thereby increasing the risk of oil spills or other contamination, disturbance, and collisions.

Sea ducks provide an important subsistence resource, and conservation of this key habitat site requires consideration of subsistence hunting traditions by residents of coastal communities.

Status: The State of Alaska has jurisdiction over tidelands (between mean high water and mean low water) and nearshore submerged lands (from mean low water to the three-nautical-mile line), with the authority to manage, develop, and lease resources. However, the federal government regulates commerce, navigation, power generation, national defense, and international affairs throughout state waters. The federal government administers the Outer Continental Shelf (OCS), which includes all submerged lands seaward of the state limit. The Bureau of Ocean Energy Management (BOEM) is mandated to develop energy and mineral resources on the OCS in an environmentally and economically responsible manner. An executive order in 2016 declared federal waters in the Arctic Ocean (including the entire Chukchi and most of the Beaufort) off-limits to oil and gas development, due to significant risk of oil spills and limited clean-up ability. However, in 2018 the Department of the Interior released a draft proposal that would open up almost all of Alaska's waters for offshore oil development. Subsequently, this was halted in court and as of 2022, the 2016 restrictions hold. The Alaska Division of Oil and Gas currently leases state lands (including Prudhoe Bay oil field and nearshore marine waters) for oil, gas, and geothermal exploration.

A variety of government bodies are responsible for administering lands adjacent to this site. Village lands, owned by Native corporations, surround each of the four small communities in the area: Wainwright (Olgoonik Corporation), Utqiaġvik (formerly Barrow; Ukpeaġvik Iñupiat Corporation), Nuiqsut (Kuukpik Native Corporation), and Kaktovik (Kaktovik Inupiat Corporation) (ASRC 2013).

Bordering the western segment of this site is the 22-million-acre National Petroleum Reserve-Alaska (NPR-A): federally managed by the Bureau of Land Management (BLM), it is the largest tract of undisturbed public land in the United States. Within the NPR-A, there are five designated Special Areas (Kasegaluk Lagoon, Peard Bay, Teshekpuk Lake, Colville River, and Utukok River Uplands) with Kasegaluk Lagoon, Peard Bay, and Teshekpuk Lake specifically managed to protect waterbird habitat in nearshore and onshore areas (BLM 2013). With the exception of the eastern part of the Teshekpuk Lake Special Area, oil and gas leasing is prohibited in these areas, as are drilling pads or processing facilities in coastal waters or on lands within one mile of the coast. Currently, 52% of the land is available for oil and gas leasing, primarily in the northeastern portion of the reserve, near Teshekpuk Lake and the Colville River. Infrastructure regulations would also permit pipelines to pass through the Peard Bay Special Area, if required to support development of offshore leases in the Chukchi and Beaufort seas (BLM 2013).

The BLM is currently (March 2022) evaluating a new Integrated Activity Plan and Environmental Impact Statement for the NPR-A, which could open new areas to leasing, examine current boundaries of Special Areas, and alter lease stipulations and best management practices. The process will also consider the options of building pipelines and other infrastructure to transport oil and gas resources

from offshore leases to the Trans-Alaska Pipeline System and consider potential for a road system connecting North Slope communities (BLM 2018).

The BLM is currently (March 2022) reviewing a 2020 Integrated Activity Plan and Environmental Impact Statement for the NPR-A. If BLM's preferred alternative is confirmed, conservation measures of the 2013 IAP/EIS will remain.

Along the eastern portion of this site, the U.S. Fish and Wildlife Service manages the 19-million-acre Arctic National Wildlife Refuge (Arctic Refuge). When the refuge was created in 1980, a large portion was designated as wilderness and the 1.5-million-acre coastal plain (the "1002 area") was identified as very important wildlife habitat that also has potentially enormous oil and gas reserves. The Tax Cuts and Jobs Act of 2017 directs the secretary of the interior to establish and administer a competitive oil and gas program in the 1002 area, with a maximum of 2000 surface acres to be authorized. In August 2020, the Department of Interior released a final record of decision for the Coastal Plain Oil and Gas Leasing Program, but the program was blocked in late 2020 by several lawsuits. In June 2021, the Department of Interior suspended all activities related to the oil and gas leasing program in the Arctic Refuge, pending completion of a comprehensive analysis under the National Environmental Policy Act, which was started in January 2022.

Essentially this entire key habitat site overlaps with several Important Bird Areas (IBAs): Kasegaluk Lagoon IBA, Chukchi Sea Nearshore IBA, Barrow Canyon and Smith Bay IBA, Teshekpuk Lake-East Dease Inlet IBA, Colville River Delta IBA, Beaufort Sea Nearshore IBA, Northeast Arctic Coastal Plain IBA (Audubon Alaska 2016). Designation as an IBA recognizes important avian resources, but does not confer any legal protection of a site.

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