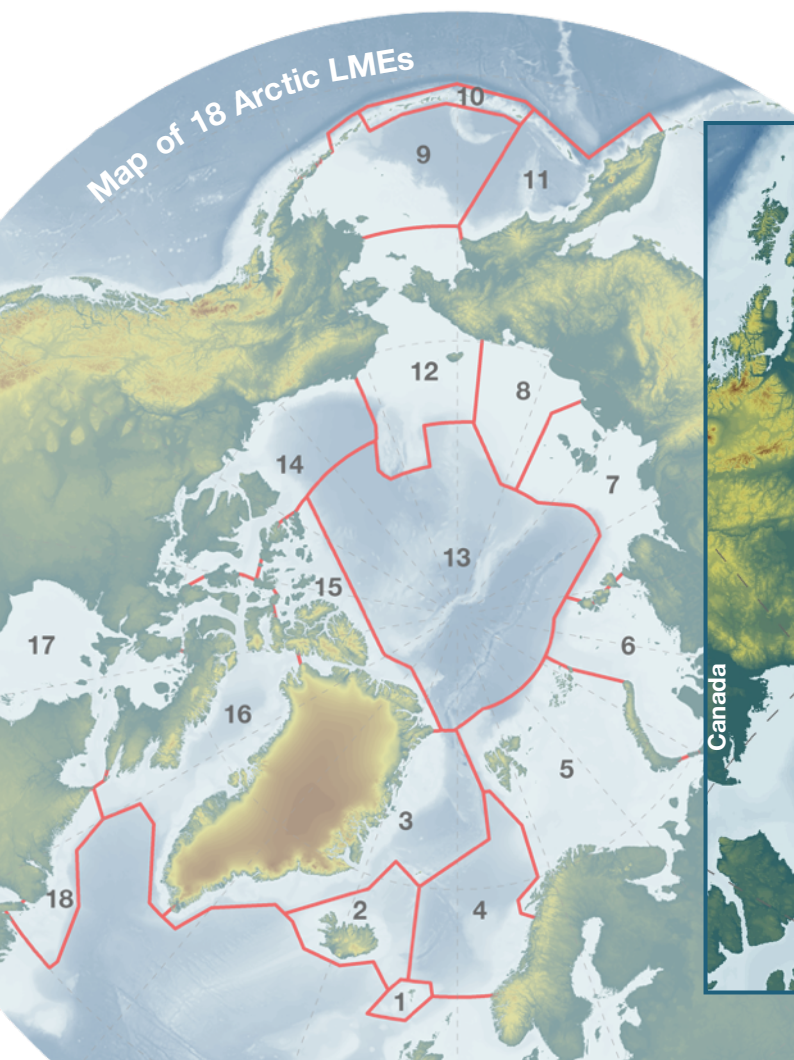
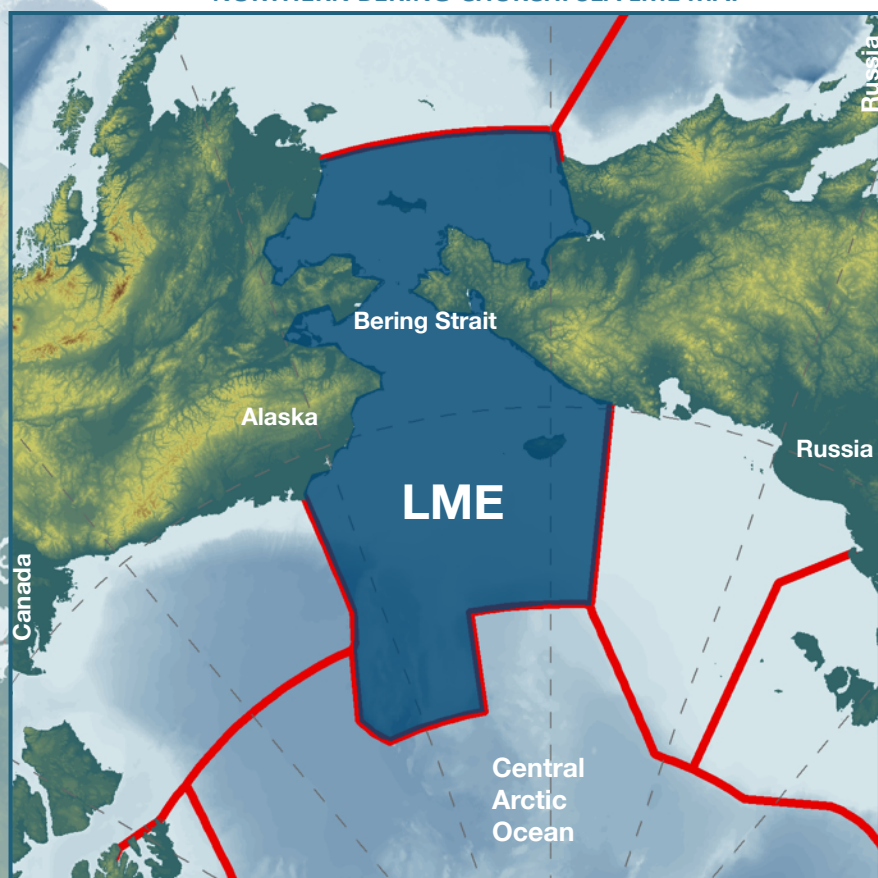


NORTHERN BERING-CHUKCHI SEA LME



NORTHERN BERING-CHUKCHI SEA LME MAP



ARCTIC LMEs

Large Marine Ecosystems (LMEs) are defined as regions of ocean space of 200,000 km² or greater, that encompass coastal areas from river basins and estuaries to the outer margins of a continental shelf or the seaward extent of a predominant coastal current. LMEs are defined by ecological criteria, including bathymetry, hydrography, productivity, and trophically linked populations. PAME developed a map delineating 17 Arctic Large Marine Ecosystems (Arctic LME's) in the marine waters of the Arctic and adjacent seas in 2006. In a consultative process including agencies of Arctic Council member states and other Arctic Council working groups, the [Arctic LME map was revised in 2012](#) to include 18 Arctic LMEs. This is the current map of Arctic LMEs used in the

work of the Arctic Council in developing and promoting the Ecosystem Approach to management of the Arctic marine environment.

Joint EA Expert group

PAME established an Ecosystem Approach to Management expert group in 2011 with the participation of other Arctic Council working groups (AMAP, CAFF and SDWG). This joint Ecosystem Approach Expert Group (EA-EG) has developed a [framework for EA implementation](#) where the first step is identification of the ecosystem to be managed. Identifying the Arctic LMEs represents this first step.

This factsheet is one of 18 in a series of the Arctic LMEs.

OVERVIEW: NORTHERN BERING CHUKCHI SEA LME

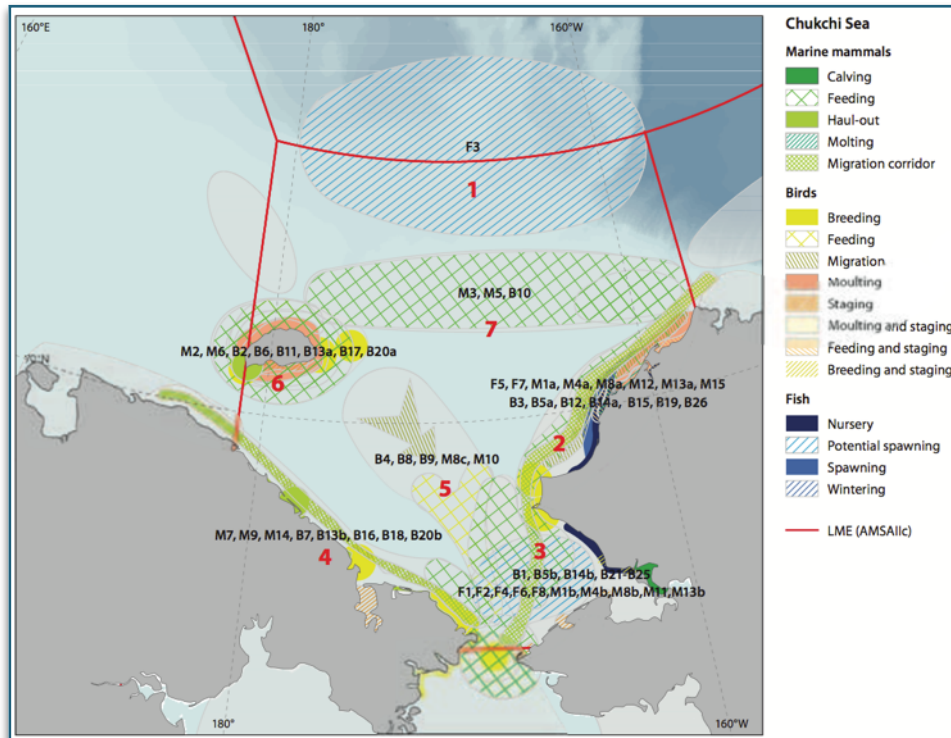
The Chukchi Sea is a shallow Arctic shelf sea located north of the Bering Strait between Chukotka and Alaska in the south and the East Siberian Sea and the Beaufort Sea in the north.

The Chukchi Sea LME has a surface area of about 1.36 million km². Much of the seabed is a shallow plain with roughly 50% of the area less than 50 m deep. The distance from the Bering Strait, located at about 66° N, to the shelf edge at around 73° N is about 800 km. The Chukchi Sea is about 500 km wide in the central part and about 800 km wide at the northern shelf edge.

The flow of Bering Sea water through the Bering Strait carries zooplankton that represents a major food source in the Chukchi Sea ecosystem. The zooplankton consists partly of oceanic forms advected from the Bering Sea basin and slope waters, and partly of more neritic forms advected from the Bering shelf. The oceanic forms come with the Anadyr water on the western side and large oceanic herbivorous copepods typically dominate the biomass.

The LME is ice-covered in winter but clears of ice in summer except for the northern part of the Chukchi Sea in cold years.

The southern part of the LME (the northern Bering Sea) contains important winter habitats for migratory marine mammals including bowhead, beluga, and walrus. The northern Bering Sea is important also for ice-breeding seals (ribbon, spotted, ringed and bearded seals).



Map: Northern Bering Chukchi Sea LME.

Source: AMSAIIIC

In spring, large numbers of bowheads (about 10.000) and belugas (more than 40.000) migrate north through the Bering Strait and up along the lead system through the eastern Chukchi Sea off Alaska towards summering areas in eastern Beaufort Sea. Large numbers of Pacific walrus (possibly about 200 thousands) also migrate north through the Bering Strait to benthic feeding areas in the Chukchi Sea.

The northern Bering Sea and the Bering Strait region are very important areas for seabirds and hold large breeding colonies, particularly of small plankton-feeding species such as least and crested auklets, and common and thick-billed murre.



MARINE MAMMALS

Eighteen species of marine mammals have been recorded in the Chukchi Sea, of which nine are regular residents or seasonal visitors to this ecosystem. These include the four ice-associated seals, ringed seal, bearded seal, spotted seal, and ribbon seal, the Pacific walrus, the two ice-associated whales, bowhead whale and beluga or white whale, the benthic-feeding grey whale, and the polar bear. Individuals of killer whale, harbor porpoise, fin whale, humpback whale, and minke whale regularly visit the southern Chukchi Sea in summer, while blue whale is a fairly rare visitor.

The five pinnipeds (four seals and walrus) are all ice-associated and important constituents of the Chukchi Sea LME. Bearded seal and Pacific walrus are primarily benthic feeders, while ringed, spotted and ribbon seals feed mainly on fish and crustaceans in the water column. The three latter seal species are relatively small (1.3 to 1.7 m in length, weighing 50 to 100 kg), while the bearded seal (2 to 2.5 m, 200 to 300 kg) and walrus (2 to 3.5 m, 500 to 2000 kg) are considerably larger. Ringed and bearded seals are equipped with claws on their fore-flippers which they use to excavate and maintain breathing holes in sea ice. This allows them to live through the winter in ice-covered Arctic seas, while the other pinnipeds depend on migrating south with the advancing ice in autumn. Bearded and ringed seals also migrate to some extent with the ice.

Ringed seals are year-round residents in the Chukchi Sea. Ringed seals feed mainly on ice-associated or pelagic crustaceans and small fish. Polar cod is a principal prey for ringed seal and is the main prey in the Chukchi Sea in winter and spring. The number of ringed seals in the Chukchi Sea is not well known and is probably seasonally variable as seals migrate through the Bering Strait to and from the Bering Sea. The regional population in the Bering, Chukchi, and Beaufort Seas has been suggested to be 1 to 1.5 million or in the range 1 to 3.6 million individuals.

Ribbon seal is a North Pacific ice-associated species with a Bering Sea population that occurs in the marginal ice zone during winter where they give birth to their 'whitecoat' pups on ice floes in the front zone south of the consolidated pack. After the pups are weaned, ribbon seals move with the receding ice north in the Bering Sea. It is suggested that many or most seals migrate into the Chukchi Sea with the receding ice in summer. Ribbon seals feed largely on

cephalopods and various small fish including polar cod. The size of the Bering Sea ribbon seal population was estimated to be 120,000 to 140,000 animals in the late 1980s.

Spotted seal is another North Pacific ice-associated seal distributed with a breeding population in the Bering Sea. It also gives birth in late winter (late March to late April) to 'whitecoat' pups born on ice floes. It has a largely coastal distribution in the ice-free season. They are commonly seen in bays, lagoons and estuaries and frequently haul out on land. Spotted seals feed mainly on various fish, including polar cod, saffron cod, and capelin, but also take other prey such as shrimps and krill. The size of the spotted seal population in the Bering Sea was estimated to be 200,000 to 250,000 animals in the 1970s and 100,000 to 135,000 animals in the 1980s and there are indications of further decline that could reflect changing climate with less ice.

Bearded seal has a wide circumpolar distribution and is a year-round resident in the Chukchi Sea. The preferred habitat is drifting pack ice over shelf areas where they can dive to the bottom to feed. Bearded seals feed mostly in shallow water less than 100 m deep, although they are capable of diving to 300 m or more. They feed variously on demersal fish and benthic invertebrates.

Pacific walrus is considered a subspecies separate from Atlantic walrus. The Pacific walruses in the Bering and Chukchi Seas are considered to constitute one migratory population, moving south with the advancing ice in autumn and north as the ice recedes in spring. In winter, Pacific walruses inhabit the pack ice of the Bering Sea where they breed. They are segregated by gender for much of the year as they migrate between the Bering and Chukchi Seas. During the summer months, the majority of the females, calves, and subadults move into the Chukchi Sea, while most of the adult males remain in the ice-free Bering Sea.

Walrus is a specialized benthic feeder that takes various bivalve clams and also other benthic invertebrates. Feeding areas are typically sediments with soft fine sands that are habitats of burrowing clams, which are the principal and preferred prey of walrus. Walruses may in some cases feed along rocky substrates and have been reported to kill and eat small seals such as ringed and ribbon.



Three whale species are common and important constituents of the Chukchi Sea ecosystem. These are the two ice-associated species, bowhead whale and beluga, and the grey whale. All three are migratory: bowhead whales and belugas between wintering areas in the Bering Sea and feeding areas in the Chukchi and Beaufort Seas, while grey whales migrate north from wintering in the subtropical waters of Baja California. The three species differ very much in their feeding ecology, bowhead being a plankton feeder, beluga taking a variety of fish and invertebrates, while grey whale is a benthic feeder taking largely bottom-dwelling amphipods.

Bowhead whale in the Chukchi Sea belongs to a large migratory population that inhabits the Bering, Chukchi and Beaufort Seas. It is called the Bering-Chukchi-Beaufort (Seas) stock (BCB stock) or the Western Arctic stock, and is by far the largest of five recognized stocks of bowheads.

The animals of this stock winter in the seasonal pack ice and polynyas in the northern Bering Sea and migrate in spring through the eastern Chukchi Sea to summer feeding areas in the eastern Beaufort Sea and the Amundsen Gulf. The Chukchi Sea serves as a migration area for bowheads in spring and a feeding area in autumn when the bowheads return on their way back to the wintering areas in the Bering Sea.

Bowhead whales are equipped with long (greater than 4 m in large individuals), fine-meshed baleen that allows them to filter-feed on Arctic copepods and other small planktonic crustaceans.

A time series of estimated population size from surveys, which started in the late 1970s, has shown a steady increase with an estimated annual rate of 3.4%. This represents about a doubling of the size of the population from around 5,000 individuals in the late 1970s. The current population size is within the lower limit of the pre-whaling estimate.

Beluga whale is an ice-associated whale that winters in pack ice and polynyas of the northern Bering Sea and migrates seasonally north into the Chukchi Sea and beyond. Beluga is a smaller toothed whale that feeds on various fish and larger invertebrates. It occurs with five recognized stocks in Alaskan waters, two of which occur in the Chukchi Sea, and four more in Russian waters, one of which inhabits the western Chukchi Sea in summer.

Belugas move into shallow coastal waters as ice clears in summer for feeding, calving and molting. Belugas feed on a wide variety of fish and invertebrates. The food varies greatly over the season and between areas, reflecting the occurrence and abundance of prey and the migratory cycle of the belugas.

Grey whale is a medium-sized baleen whale (maximum length of about 15 m) that occurs with two populations in the North Pacific. The western North Pacific stock is Critically Endangered, whereas the eastern North Pacific stock is in a healthy condition. Grey whales are benthic feeders that suspend and suck up sediments, retaining benthic organisms by filtration through their short, coarse baleen.

Two toothed whales are regular summer visitors to the Chukchi Sea. **Killer whale** grows to a size of 7 to 8 m and is widely distributed in all oceans. In the North Pacific, it occurs with resident, transient and offshore ecotypes that differ in aspects of their morphology, ecology and genetics. Two distinct killer whale stocks occur in the Bering Sea: the Alaska resident stock and the Gulf of Alaska, Aleutian Islands, and Bering Sea transient stock, with minimum population estimates of about 1,100 and 300 animals, respectively. Killer whales come through the Bering Strait into the Chukchi Sea in the ice-free period in summer; they are assumed to belong to the transient stock. Killer whales of the resident ecotype are often fish eaters, whereas those of transient types rely on other marine mammals as predominant prey, including grey whales in the eastern Chukchi Sea, bowheads, and belugas, seals and walrus.

Harbor porpoise is a small cetacean (about 1.6 m in length) that is widely distributed in coastal waters from temperate to sub-Arctic areas. Three stocks are provisionally recognized in Alaskan waters, of which the Bering Sea stock is estimated to number about 66,000 individuals (considered a conservative estimate).

Three additional species of baleen whales may occur in the southern Chukchi Sea. **Fin whale** is the second largest whale (21 to 27 m long). Commercial whaling decimated the fin whales in the North Pacific from perhaps around 45,000 individuals down to some 20,000s.

Humpback whale is a somewhat smaller species (up to 17 m) that shares some features in its feeding ecology with fin whales; it also has a cosmopolitan distribution in both the northern and southern hemispheres. Humpbacks were severely depleted by whaling, and the population was taken down to possibly 10% of the pre-exploitation level that has been estimated to be about 15,000 whales.

Minke whale is the smallest of the baleen whales (up to 9 m) and is migratory between wintering and breeding areas at low latitudes and northern summer feeding areas. Minke whales are known to penetrate loose ice, and some individuals venture north of the Bering Strait into the Chukchi Sea during the summer.

The North Pacific right whale occurs with two populations in the eastern and western North Pacific both of which are considered Critically Endangered. The eastern North Pacific population probably totals only tens of animals. The distribution of North Pacific right whale during the whaling period

included the northern Bering Sea and some whales were observed north of the Bering Strait.

The polar bear is basically a terrestrial animal that moved onto the sea ice and became adapted to Arctic marine life. The total global population of polar bears is estimated to number 20,000 to 25,000 individuals, occurring with 19 relatively discrete subpopulations recognized. The polar bears in the Chukchi Sea are part of the Bering-Chukchi Seas subpopulation (or Alaska-Chukotka subpopulation) that is widely distributed on the pack ice of the northern Bering, Chukchi, and eastern portions of the East Siberian Seas.

Ringed seals, the main prey for polar bears, are found mainly in the fast-ice zone and in the leads off the fast ice in winter and spring. In summer many ringed seals move north with the pack ice, but in late summer and autumn they may aggregate in open-water areas where they are out of reach as prey for polar bears. Many polar bears therefore concentrate in areas of walrus haul-outs on Wrangel Island and along the Chukotka coast where they prey on walruses and feed on animals killed during stampede.

The size of the Bering-Chukchi subpopulation of polar bears is estimated to be about 2,000 individuals, but this estimate has wide ranges and this subpopulation is thought to be declining. In Alaska, average annual harvests are relatively low; however, a major concern has been a substantial level of illegal harvest in Chukotka after the collapse of the Soviet Union in 1991. This illegal take of polar bears in Chukotka has been estimated to have been up to 300 bears or even more per year; recent measures undertaken by regional authorities in Chukotka may have reduced the illegal hunt.





FISH

Compared to the Bering Sea where fish play a major role in the ecosystem the Chukchi Sea is relatively poor in fish. Around 80 species of fish have been recorded. Many of these are Pacific species that occur in the Bering Sea and extend their range into the southern Chukchi Sea, while others are Arctic species. The dominant families of fish in the Chukchi Sea in terms of number of species are sculpins, salmonids, eelpouts, poachers, pricklebacks, flounders, and cods.

Sculpins (17 species), eelpouts (nine species), poachers (seven species), and pricklebacks (six species), along with sailfin sculpins (two), fathead sculpins (one), lumpsuckers (one), and gunnels (one), make up well over half the total species number in the Chukchi Sea. These families contain generally small demersal fish that constitute the dominant fish components on Arctic shelves and slope communities. Many of the species in these families are listed as rare in the Chukchi Sea.

Among the more typical demersal fish groups, flounders (nine species) and cods (four species) are present with several rare species extending north from the Bering Sea.



SHOREBIRDS

Shorebirds are small to medium-sized birds belonging to two families: plovers and snipes, sandpipers and phalaropes. Shorebirds are often seen frequenting seashores, lakeshores, mudflats, and various other wetland habitats. A large number of species (about 80, or more than 1/3 of all species globally of the two families) use the vast Arctic tundra and wetlands as their breeding ground.

Of these Arctic-breeding shorebirds, about half (around 36 species) breed in the areas adjacent to the Chukchi Sea, and most of these use coastal habitats in the Chukchi Sea during migration and for staging and feeding. These include seven species of the plover family, and about 30 species of the family of snipes, sandpipers and phalaropes. About half of the latter group are sandpipers (15 species), the

other half comprise two species of snipes and dowitchers (subfamily Gallinaginae), four species of godwits and curlews (tribe Numeniini), four shanks (tribe Tringini), two turnstones (subfamily Arenariinae), and two species of phalaropes (subfamily Phalaropodinae). Some other species that do not breed adjacent to the Chukchi Sea may pass through the area during migration.

The different groups and species of shorebirds breed in a variety of habitats from the dry polar deserts of the High Arctic, through the tundra and taiga zones, to various wetlands in the temperate zone. The tundra environment is a particularly important breeding habitat for the calidrine sandpipers, while godwits and curlews breed in marshes both on tundra and in boreal forests. Turnstones and phalaropes breed mainly on tundra habitats. The majority of species breed in inland habitats away from the coasts, while a few species such as red phalarope, black turnstone, and spoon-billed sandpiper breed at coasts close to the sea. Scolopacid shorebirds usually occur in habitats with watery, wet or moist substrates where they can feed with their sensitive long bills, while plovers typically occur in drier habitats where they pick prey from the surface with their stiffer bills. The predominant diet of shorebirds is made up of larvae and adults of various aquatic and terrestrial insects.

The mating system of shorebirds is variable among the species, but monogamy is the most common where a male and female pair usually shares incubation and in some cases also chick-rearing. Shorebirds place their nest on the ground, usually as a simple scrape or depression, and the clutch size is typically four eggs. The incubation period is around three weeks. The chicks are able to feed themselves shortly after they are hatched, but they are thermolabile and depend on brooding to keep warm. They are usually tended by one of the parents, often the male, while the other parent leaves the breeding ground during incubation or shortly after the chicks are hatched. The remaining parent will usually depart from the breeding area just before or at fledging, leaving the chicks by themselves to finish their growth and prepare for their southward migration.

After breeding, many shorebirds move to marine coastal areas where they feed in late summer and early autumn in preparation for the migration. All shorebirds are migratory and many fly long distances to habitats in the tropics and in the southern hemisphere. They depend on being in good condition and build up fat reserves to fuel their long migrations. In coastal habitats, the shorebirds feed on a variety of small invertebrates, including molluscs, crustaceans, and polychaetes.



SEABIRDS

More than 2 million seabirds of around 23 species use the Chukchi Sea for longer or shorter periods of the year. Many of them are temperate and sub-Arctic species that are common in the Bering Sea and that extend their breeding and/or feeding range north into the Chukchi Sea in the summer. These include northern fulmar, black-legged kittiwake, pigeon guillemot, horned and tufted puffins, Kittlitz's murrelet, least, crested and parakeet auklets, pelagic cormorant, and short-tailed shearwater.

Others are species that breed in Arctic and sub-Arctic areas, including common and thick-billed murres, black guillemot, glaucous, Ross's and Sabine's gull, Pomarine, Arctic and long-tailed skuas, and Arctic tern. The Chukchi Sea is an important migration area for Arctic seabirds (and also other marine and coastal birds) that breed along coasts and on tundra in northeastern Russia, northern Alaska and northwestern Canada. This is the case for three species of skuas or jaegers (pomarine, Arctic, and long-tailed) and Ross's and Sabine's gulls.

The most numerous seabird species in the Chukchi Sea may be short-tailed shearwater that extends its feeding range into the Chukchi Sea in late summer when it has been estimated to number about 2 million individuals. The most numerous breeding seabirds are the two species of murres (thick-billed and common) that may occur with around 0.75 million individuals for the two species combined, and black-legged kittiwake with more than 0.5 million individuals. During migration in summer, about 100,000 skuas (of the three species combined) were estimated to occur in the Chukchi Sea, while fewer than 100,000 glaucous gulls were estimated to occur in early autumn.

About 70,000 black guillemots were estimated to occur in the northern part of the Chukchi Sea in summer, while 100,000 to 300,000 small auklets (predominately crested) may extend north from their breeding colonies in the Bering Strait in the post-breeding period in late summer and early autumn. Phalaropes (predominately red phalarope), which are swimming shorebirds, may outnumber the seabird species in the Chukchi Sea in the post-breeding period in late summer, when a minimum of 1 million phalaropes were estimated to occur pelagically.



WATERFOWL

A variety of ducks and geese use Chukchi Sea habitats for various purposes during the year. Prominent among these are four species of eiders that breed along the shores or further inland on both sides of the Chukchi Sea: common eider, king eider, spectacled eider, and Steller's eider. They use coastal waters of the Chukchi Sea for staging during spring migration, feeding during and after the breeding season, molting after breeding, and staging prior to autumn migration. Long-tailed duck, harlequin duck, black scoter, surf scoter, and red-breasted merganser use Chukchi Sea habitats in a similar manner.

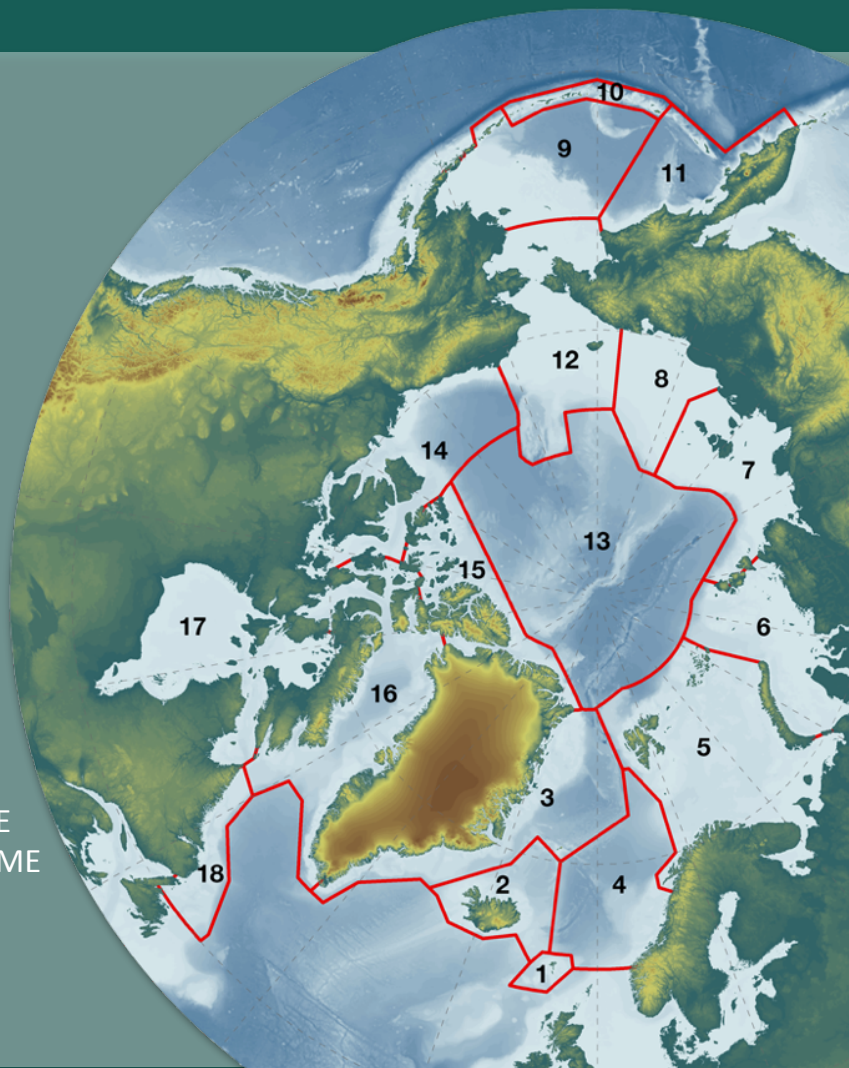
Geese use Chukchi Sea coastal habitats for staging and feeding during spring and autumn migrations. Brent goose, snow goose, and greater white-fronted goose breed along the Chukchi coasts, including on Wrangel Island for brent and snow geese. Emperor goose breeds in the Kotzebue Sound area, while cackling goose appears to use Alaskan Chukchi coasts to a limited extent during spring and autumn migration. Tundra swan breeds along Chukchi coasts and uses coastal areas for staging during migration.

All four (or five) species of divers (or loons) breed in the Chukchi Sea region. Red-throated diver and black-throated diver, including Pacific loon, are the most common and widespread, while white-billed diver and great northern diver occur in lower numbers on the Alaskan side. The Chukchi Sea provides important habitats for the divers during the autumn migration for birds from a wider breeding range in adjacent parts of the Arctic. Two species of grebes, red-necked grebe and horned grebe may occur in the southeastern Chukchi Sea.



ARCTIC LMEs

1. Faroe Plateau LME
2. Iceland Shelf and Sea LME
3. Greenland Sea-East Greenland LME
4. Norwegian Sea LME
5. Barents Sea LME
6. Kara Sea LME
7. Laptev Sea LME
8. East Siberian Sea LME
9. East Bering Sea LME
10. Aleutian Islands LME
11. West Bering Sea LME
12. Northern Bering-Chukchi Sea LME
13. Central Arctic Ocean LME
14. Beaufort Sea LME
15. Canadian High Arctic - North Greenland LME
16. Canadian Eastern Arctic - West Greenland LME
17. Hudson Bay Complex LME
18. Labrador-Newfoundland LME



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