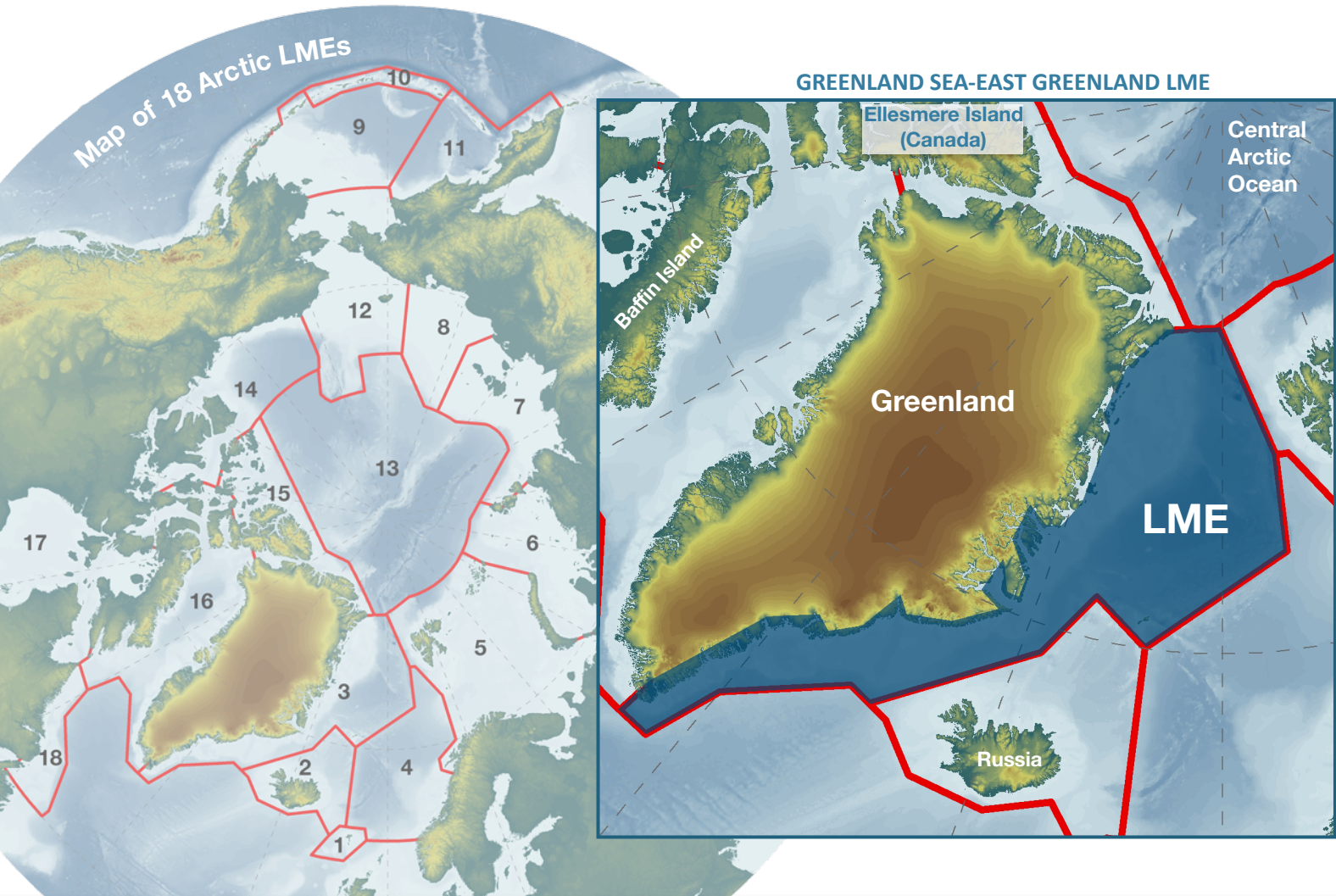


GREENLAND SEA- EAST GREENLAND LME



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: GREENLAND SEA-EAST GREENLAND LME SEA LME

This LME consists of three distinct portions, the Greenland Sea, the western Denmark Strait, and the Southeast Greenland Shelf. The cold East Greenland Current that exits from the Arctic Ocean through the Fram Strait, is a prominent oceanographic feature, as is the gyre circulation in the Greenland Sea. This is an Arctic LME where most of the area is covered with sea ice in winter. Polar cod is an important fish species, and the LME constitute important breeding and feeding habitat for populations of harp and hooded seals. It is also the home of the East Greenland subpopulation of polar bears.

The northern boundary is at Nordostrundingen at the northeastern corner of Greenland north of the Northeast Water Polynya. The northeastern boundary to the Barents Sea LME follows the slope off western Spitsbergen and the Yarmak Plateau. The eastern boundary to the Norwegian Sea LME follows the Knipowitch Ridge and the Mohns Ridge (which are parts of the mid Atlantic ridge) to south of Jan Mayen at 70°N. The eastern boundary to the Iceland Shelf and Sea LME follows on the south side of the deep ridge that separates the Greenland and Iceland seas. This ridge steers the cold Jan Mayen Current which is part of the gyre circulation in the Greenland Sea. The eastern boundary continues south through the Denmark Strait, separating the cold and ice-infested East Greenland Current from the warmer Irminger Current and the mixed waters of the Iceland Sea.

The Fram Strait is a rather narrow passage between the Greenland Sea and the Arctic Ocean, being about 200 km across from shelf edge to shelf edge between Greenland and Svalbard. The central part of the Fram Strait has a complex topography, including a very deep area with depth of about 5,500 m and located between 79° and 80°N.

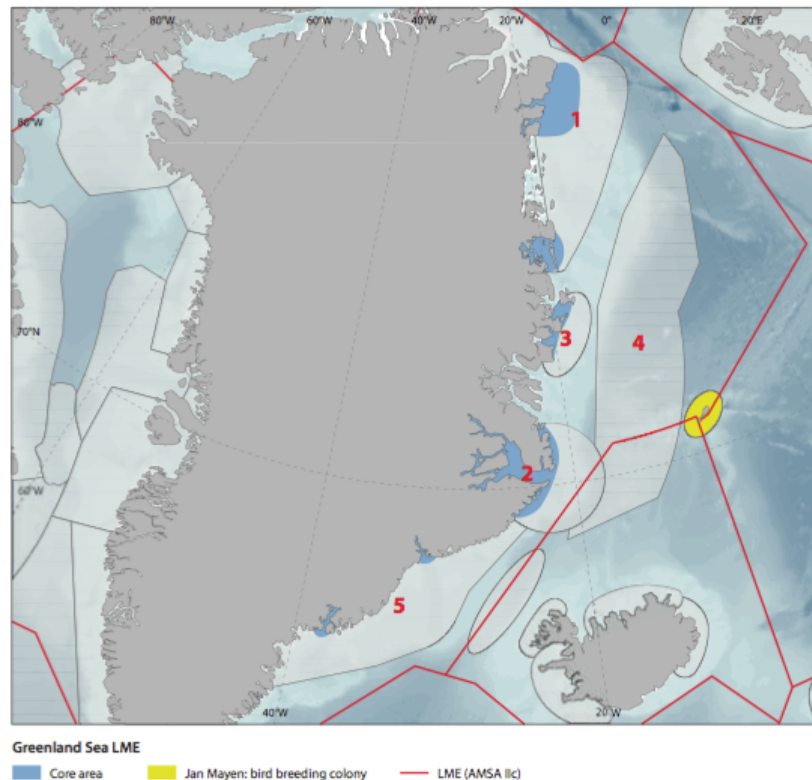


Figure A.4. Areas of heightened ecological significance in the Greenland Sea LME.

Map: Greenland-Sea LME

Source: AMSAIIIC

The Greenland Sea is very much influenced by ice. The East Greenland Current carries a large amount of pack ice from the Arctic Ocean and seasonal ice forms over much of the western and central Greenland Sea. The transport of ice from the Arctic Ocean by the East Greenland Current is considerable, amounting to an annual average of almost 3,000 km³, corresponding to an area of about 1 million km² of sea ice. There is ice transport all through the year but with a marked seasonal minimum in July-August. There is also considerable variation among years.



MARINE MAMMALS

The main mammals in the Greenland Sea are seals.

Harp seal is a North Atlantic, ice-associated seal that occur with 3 stocks and possibly two subspecies: Northwest Atlantic, Greenland Sea/West Ice, and Barents Sea/White Sea stocks. The Northwest Atlantic is now the largest of these stocks (about 7-8 million individuals). The seals migrated long distances, one individual travelling more than 12,000 km over a 300-day period, amounting to an average daily swimming distance of about 40 km. Most seals dived to depths of from 50 to 300 m, the maximum diving depth recorded being 492 m. During their stay in the Greenland Sea pack ice, harps seals have been found to feed predominantly on pelagic crustaceans, mainly the amphipod *Parathemisto libellua*, but also krill and polar cod.

Hooded seal is a North Atlantic species found with two main populations in the northwestern and northeastern Atlantic. Hooded seal is a deep diver and most of the recorded dives were to depths between 100 and 600 m. They have been recorded to dive to more than 1000 m and almost 1 hour underwater. The hooded seals feed on squid, Greenland halibut, redfish, polar cod, herring, and blue whiting and others. Due to decline in population the commercial harvest from the population was stopped in 2007. Hooded seal is assessed as being 'Vulnerable' by IUCN due to the strong decline of the Greenland Sea population. The reason for the decline is not known but changes in sea ice conditions, changes in the ecosystem and the food base are also possible factors.

Ringed seal is of the circumpolar Arctic ringed seal subspecies (*hispida*) which is widely distributed in ice-covered waters around the Arctic. Ringed seals are distributed all along the coast of eastern Greenland and in the adjacent pack ice. Land-fast ice is generally considered to be the preferred breeding habitat. The breeding period is followed by the annual molt when the seals spend time hauled-out on ice. The ringed seal takes a variety of prey items among pelagic and ice-associated biota, mostly small fish (5-10 cm) and crustaceans. The predominant prey are often polar cod and amphipods, notably.

Bearded seal avoid thick sea ice in winter and are found in dynamic pack ice with cracks and leads. They are known to follow the seasonal retraction and advance of the ice in some areas, while they appear to be more resident and restricted to smaller home ranges in others. Bearded seals feed to a large extent

on mobile benthic animals but they do also take fish. They tend to be shallow divers feeding mainly at depths less than 100-200 m but they are capable to dive to 400 m or more.

Harbour seal is a valued species that has been harvested in Greenland for its fur and meat. This has led to a decline in distribution and numbers, and the total population in Greenland was estimated to be less than 1.000 individuals in 2007, down from about 3.000 in 1950. The southernmost part of Greenland appears now to be core area for the remaining harbour seals where some traditional haul-outs near the south-eastern tip are still in use. Harbour seals were protected from hunting in Greenland in 2010. Arctic char is considered to be an important prey for harbour seals in Greenland and the seals may pursue this prey up into rivers. Other prey include herring, polar cod, Atlantic cod, Greenland cod, golden redfish, and long-rough dab. The main mammals in the Greenland Sea are seals.

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Polar bear occurs regularly along the Greenland coast and in the offshore pack ice, but is rare in the area north of Nordostrundingen. The polar bears in

East Greenland are considered to belong to a single population, the East Greenland subpopulation. These bears are genetically different from polar bears on the western side of Greenland but differ little from bears from the Svalbard area in the Barents Sea. The polar bears spend most of the time in the pack ice zone extending 200-500 km east from the coast into the Greenland Sea.

Atlantic walrus occurs with a distinct subpopulation along East Greenland, the Eastern Greenland stock. Following establishment of the Inuit community of Ittoqqortoormiit (Scorebysund) in 1924, walrus became rare due to heavy hunting and it is likely that a resident group of walruses in the Scoresby Sund area was exterminated. Walrus still occur as single individuals or small groups (2-3 animals) at the entrance to Scoresby Sund, and it is possible that the numbers here are increasing reflecting protection of walrus in northeastern Greenland since the 1950s.

Walruses feed on a wide variety of bottom living invertebrates but target burrowing clams and other bivalves. Their preferred habitat is shallow banks (<50 m deep) with light ice cover. Walrus sucks out the soft tissues and leave the hard shells at the bottom. A foraging male walrus (1.200 kg) was estimated to consume about 600 g (wet weight) of soft bivalve tissue per dive (which lasted 5-7 min) and to consume 57 kg bivalve biomass per day as an average over a foraging cycle (a total of 412 dives). The population size of the Eastern Greenland stock of walrus has been estimated around 1.500 animals.

Walrus has been protected north of 74°24'N since 1951 and is now totally protected within the National Park in northeastern Greenland. South of here walrus are harvested with an annual kill by Inuits of 20-30 walruses, mainly males. The quota has been reduced and the catch has been around 10 animals per year in recent years. The population is listed as 'Near threatened' on the Greenland Red List, mainly due to the small population size.

The former large population of Greenland **bowhead whale** was hunted to near extinction and is now assessed to be 'Critically endangered' by IUCN. Over 100,000 animals of this population were harvested during the 300-years period of whaling from 1611 to 1911. The bowhead is considered to be an exclusive plankton feeder.

Minke whales migrate seasonally from Arctic and sub-Arctic waters in summer to warmer waters in winter. They feed on a variety of prey, including small herding fish and krill and summer feeding grounds extend from northern Europe and North America, including Iceland and Greenland, to the ice edge. The conservation status of the population occurring in the Greenland Sea LME is favourable. Both the global Red List (IUCN 2011) and the Greenland Red List categorise the minke whale as least concern (LC).

Sei whales feed on small fish, krill, copepods and squid. Their distribution is worldwide, from subtropical or tropical waters in winter to high latitudes of the sub-Arctic or sub-Antarctic during summer. It is not known to what extent sei whales use the Greenland Sea LME, but they probably occur within the same areas as fin whales. The sei whale population was depleted by commercial whaling in the 20th century and has been protected since the 1970s and 80s. The extent of the population recovery is uncertain because it has been subject to relatively little research.

The blue whale was regularly observed in the Greenland Sea LME prior to the depletion by whaling. They seasonally migrate to the waters west of Svalbard and the northern Greenland Sea to feed on plankton, presumably krill and possibly *Calanus*, however, no important areas are known for blue whales within the Greenland Sea LME. The conservation status of blue whales is unfavourable. This is because they were heavily hunted by commercial whalers during the first half of the 20th century. The population shows some signs of recovery since global protection was applied in 1966, but the population levels are still low. There are roughly approximately 1500 blue whales in the entire North Atlantic Waters. Blue whales are categorized as 'Data Deficient' (DD) on the Greenland red list and as endangered (EN) on the global Red List (IUCN 2011).

Fin whales are the second largest baleen whale after blue whales, and are probably the most common and widespread baleen whale within the Greenland Sea LME. Their main diet consists of krill and small schooling fish, such as herring and capelin. Little is

known about the distribution and biology of fin whales in the Greenland Sea LME, but they are mainly present during summer and autumn to the east side of the drift ice.

Humpback whales have a global distribution, seasonally distributed through all oceans from the Arctic to the Antarctic. The importance of the Greenland Sea LME is unknown, as little information of their abundance, ecology or distribution exists for the area. The population in the Greenland Sea LME has a favourable conservation status due to the abundance and increase in population numbers. The numbers around Iceland has been reported an increase of as much as 11% per year. Stocks worldwide were seriously depleted by the whaling industry, and have been protected worldwide since the 1980s. The population has recovered and is now listed as Least Concern (LC) on both the global IUCN Red List and the Greenland Red List.

The long-finned pilot whale is social and is generally found in groups of 20-100 individuals. They feed on squid, but also small to medium sized fished are taken, such as cod and herring. Pilot whales observed in the Greenland Sea LME are probably vagrants from a single large North Atlantic population of which the exact size is unknown. But, the population size in the northeast Atlantic was estimated at 778,000 whales in 1993. Pilot whales are occasionally caught by local hunters with an annual catch between 0-19 animals.

Whitebeaked dolphins are the most common dolphin off southeast Greenland, but their distribution only overlap with the Greenland Sea LME in the southern parts. Their primary habitat is in waters less than 200 m deep, especially along the edges of the continental slope, but can also be encountered in deeper oceans. In Greenland whitebeaked dolphins are hunted, but there are only records of this are from Tasiilaq, south of the LME.

Killer whales are top predators and found in all oceans. An unknown portion of Icelandic killer whales and the majority of Norwegian killer whales belong to a Scandinavian ecotype of herring-eating killer whales that migrate by following major herring stocks: the Icelandic summer spawning herring and the Norwegian spring spawning herring. The range of the Icelandic summer spawning herring and the Norwegian spring spawning herring overlap with the Greenland Sea LME. Killer whales that feed on marine mammals have been observed in Tasiilaq. Killer whales are listed as 'Data Deficient' (DD), both on the global IUCN Red List and on the Greenland Red List.



Narwhals are high arctic animals that feed primarily on Greenland halibut and other species of Arctic fish, shrimp and squid. Narwhals undertake regular migrations between shallower summer grounds in fjords and wintering grounds over deep and densely ice covered waters. Foraging is thought to only take place in wintering areas. Narwhals are gregarious, occurring in groups of a few to more than a hundred individuals.

They occur throughout the Greenland Sea LME and in winter primarily in the wide drift ice belt off the coast. In summer they occur along the coast, ice edges and in fjords. Several of the fjord systems in East Greenland must be considered very important for the narwhals, including the Northeast Water, Dove bugt, Young Sund area and the Scoresby Sund fjord, as well as fjords along the Blosseville Kyst, Kangerlussuaq and Sermilik. The latest population estimate of the area from Scoresby Sund south to Tasiilaq was 6444.

Sperm whales are the largest of the toothed whales and are found in all oceans, from the ice edge to the equator. Females and calves stay in temperate areas, while males segregate to high latitudes at the onset of puberty (between 4-15 years of age). They occupy deep waters, often off the continental shelf and near submarine canyons.

Sperm whales are rarely observed in the Greenland Sea LME, although sperm whales have been observed in the Denmark Strait, close to the southern limit of the LME, or south, east and northeast of Iceland. Sperm whales in Norway have been observed as far as 80°N, but in the Greenland Sea LME they have only been observed as far north as 68°N. The number of sperm whales between East Greenland and the Faroe Islands have been estimated to 11,185.

The northern bottlenose whale are deep divers, often found off the continental shelf and near submarine canyons, from the ice edge to approximately 30°N. This is the most frequently observed cetacean species around the Jan Mayen Ridge, just east of the Greenland Sea LME. They can here be observed in summer in deep waters east of the East Greenland Current, especially associated with abrupt changes in bottom topography, such as underwater canyons and sea mounts. No such areas have, however, been located in the Greenland Sea LME area.

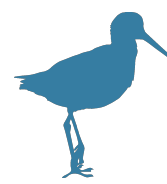


FISH

There are no major pelagic fish stocks in the Greenland Sea. This is an ecosystem where invertebrates provide the main links up to higher trophic levels. Pelagic amphipods play an important role in this respect. The arctic species *Themisto libellula* is dominant and can grow to a length of 6 cm. This species, as most other pelagic amphipods, is a carnivore feeding on other zooplankton. It therefore takes the trophic position of pelagic plankton-feeding fish (such as capelin) in subarctic ecosystems. The smaller species *Parathemisto abyssorum* is found mainly in the Atlantic water masses. However, both species co-occur over much of the Greenland Sea and they make up a considerable biomass. Sea ice amphipods may also play an important role in the Greenland Sea ecosystem.

The ice transport from the Arctic Ocean, and the melting of the ice as it is transported south in the Greenland Sea, may represent a considerable input of ice amphipods to this ecosystem. With an ice transport of the order of 1 million km² per year and a concentration of 5 g m⁻², this represents an input of the order of 5 million tonnes of ice amphipods that could be available to consumers such as seals and birds.

Krill occur in the Greenland Sea, particularly in the warmer eastern part where they are advected with the West Spitsbergen Current. *Meganyctiphanes norvegica* may extend its distribution up along the slope of Svalbard, while *Thysanoessa inermis* is common in the waters around Jan Mayen and in the southwestern Greenland Sea. These krill species are presumably expatriated and do not reproduce in the colder part of the Greenland Sea. They seem therefore to play a more modest role in this ecosystem compared for example with the Norwegian Sea to the south. Macrozooplankton including amphipods and krill were found to occur with low abundance in the Northeast Water polynya, but sampling revealed the presence of *Meganyctiphanes norvegica* in the deeper part of the Fram Strait area.



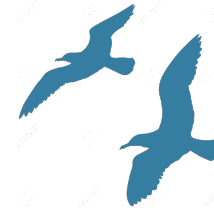
SHOREBIRDS

The coasts of northeastern and northern Greenland are ice-bound year round. Despite this, the area offers breeding habitats for several species of high arctic shorebirds. Ten species of shorebirds breed regularly in northeast Greenland adjacent to the Greenland Sea LME. These are four species of sandpipers, ruddy turnstone, two plovers, two phalaropes, and whimbrel. Four of these are high Arctic species which are found also in northern Greenland. Dunlin, red phalarope and purple sandpiper are distributed over much of northeast Greenland north to Germania Land, while Eurasian golden plover and whimbrel breed only in the southern part at Scoresby Sound.



WATERFOWL

The coast of northeastern Greenland is a high Arctic environment with sea-ice present for much of the year. There is a limited number of waterfowl species that come to breed in this area. Seven species are regular inhabitants here: three seaducks, 3 species of geese, and red-throated diver. Jameson Land to the north of Scoresby Sund is an important breeding and molting area for geese.

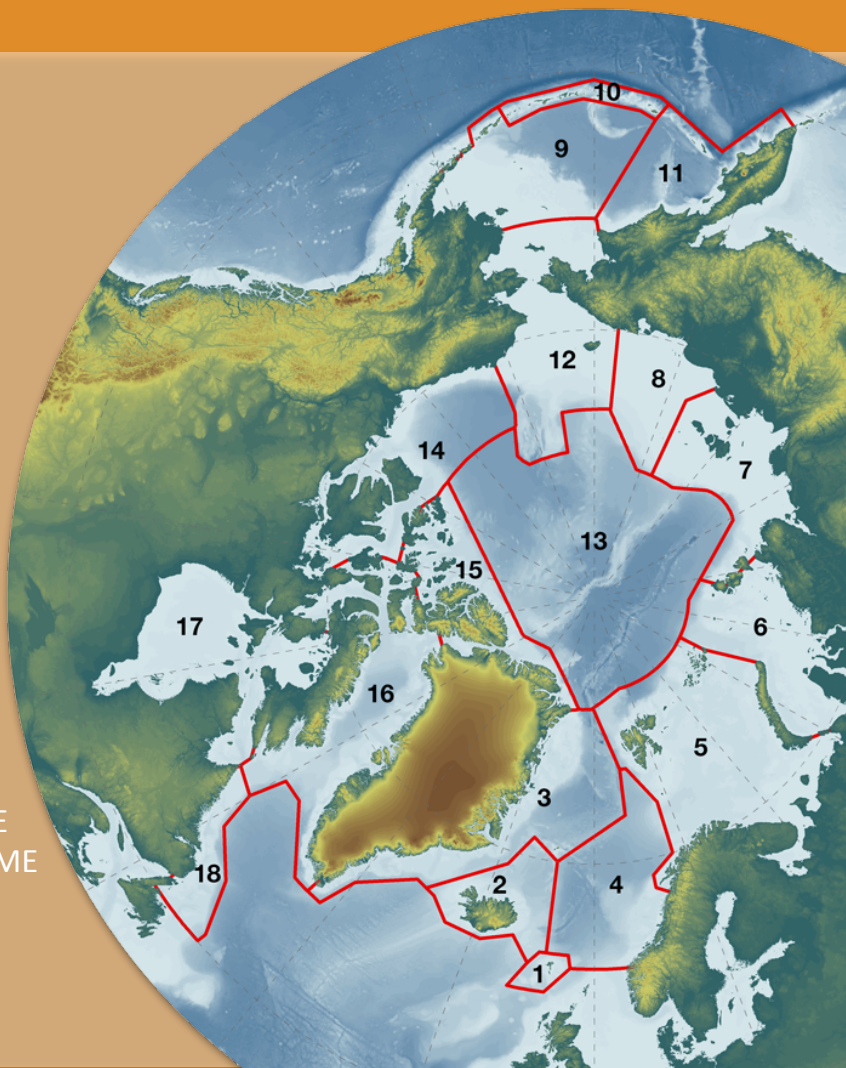


SEABIRDS

The majority of the breeding seabirds utilising the Greenland Sea in summer have their breeding grounds on Svalbard, where and thick-billed murres are the most numerous, numbering at least one million pairs each. The western side of the Greenland Sea is bordered by the coast of East Greenland, where generally very few seabirds breed. The outer coasts of East Greenland are usually blocked in summer by multi-year drift ice transported by the East Greenland Current. a). Much higher numbers and higher diversity are found at some of the major polynyas off the East Greenland coast. The most important polynya is located at the mouth of Scoresby Sund, where an estimated 3.5 million pairs of little auks breed and large colonies with northern fulmars, thick-billed murres, and black-legged kittiwakes are also found.

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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