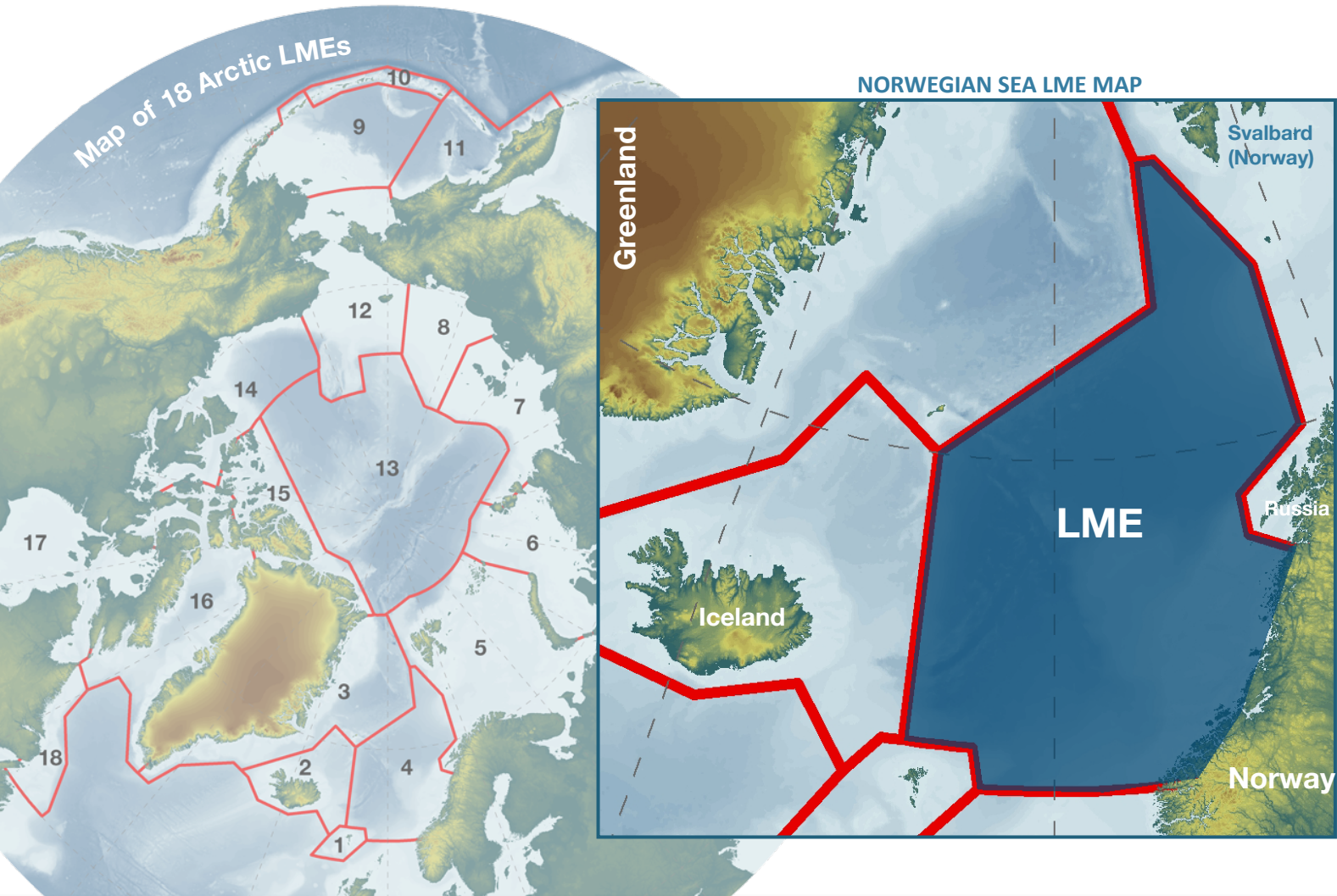


# NORWEGIAN SEA LME



# ARCTIC LMEs

Large Marine Ecosystems (LMEs) are defined as regions of ocean space of 200,000 km<sup>2</sup> 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.

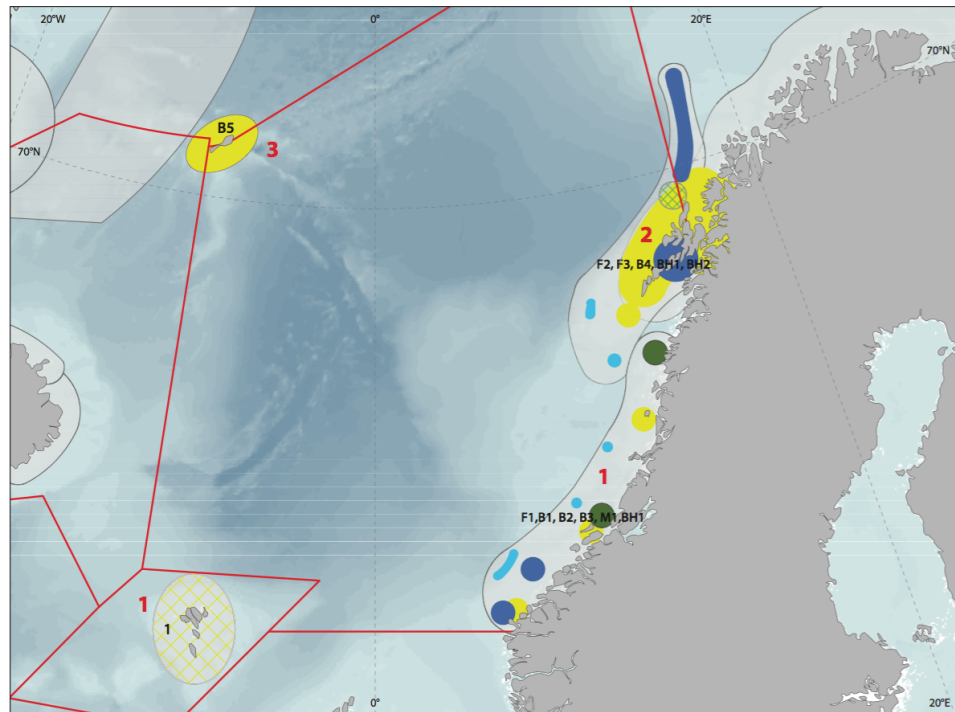
This factsheet is one of 18 in a series of the Arctic LMEs.

## OVERVIEW: NORWEGIAN SEA LME

The Norwegian Sea is a deep ocean basin area including the adjoining Norwegian shelf. It consists of the Norwegian and Lofoten Basins with depths of 3000-4.000m separated by a deep ridge extending from the Vøring Plateau towards the island of Jan Mayen. It is bounded in the west by the edge between the shallower Iceland Sea and the Norwegian Basin and by Mohn Ridge separating the Lofoten Basin from the Greenland Sea to the northwest. The Lofoten Basin extends north as an elongated deep area between the mid-ocean ridge and Svalbard, and this area is considered a part of the Norwegian Sea LME. In the northeast it is bounded by the shelf edge to the Barents Sea.

Positioned in the low-pressure belt, the Norwegian Sea is windy and cloudy. Most of the Norwegian Sea LME is covered by Atlantic water flowing in across the sill between Scotland and Iceland from the North Atlantic Drift. The East Icelandic Current is relatively cold and flows into the southwestern part of the Norwegian Sea, contributing to the gyre in the Norwegian basin. The relatively warm Atlantic water that flows into the Norwegian Sea extends down to 600-800m depth in the eastern part. It has a temperature of about 8-9 oC in the southern Norwegian Sea, being cooled as it flows northwards to about 4oC as it reaches the latitude of southern Svalbard.

The Atlantic water spreads out in the basins and becomes shallower towards the surface in a front separating it from the cold Arctic water in the



Faroe Plateau  
Seabirds Feeding and breeding  
Fish Spawning  
Marine mammals Feeding  
Breeding colonies  
Seabirds Breeding colonies  
Corals Lophelia reefs  
LME (AMSAIIC)

Figure A.5. Areas of heightened ecological significance in the Faroe Plateau LME and the Norwegian Sea LME.

Map: The Norwegian Sea LME.

Source: AMSAIIC

western part of the Norwegian Sea. The inflow of Atlantic water contributes to the relatively warm conditions in the Norwegian Sea as well as in the southern Barents Sea and the eastern Greenland Sea. There is a balance between the inflow of Atlantic water and the outflow of cold Arctic water to and from the Norwegian and the adjacent Iceland Seas. This is part of the global conveyor belt ocean circulation.



## MARINE MAMMALS

A total of 16 species of marine mammals occur in the Norwegian Sea LME more or less regularly. These are 5 species of baleen whales, 7 species of toothed whales, 3 species of seals, and European river otter. The fin whale is globally listed as endangered although it is fairly abundant in the Norwegian Sea, with a total number of the order of 10.000 individuals here and in the adjacent Barents and Iceland Seas. Fin whale feeds both on zooplankton (mainly krill) and small pelagic fish. Three stock units are recognised, the East Greenland- Iceland stock, the North Norway stock, and the West Norway-Faroe Islands stock. Fin whales from the East Greenland-Iceland stock may occur quite abundantly in the area of Jan Mayen in the western Norwegian Sea.

**Sei whale** is also globally listed as endangered. This species used to be common in the eastern Norwegian Sea where it was feeding mainly on aggregations of *Calanus finmarchicus* off Møre and occasionally further north. Following depletion by the former whaling, it is now rarely seen and there may be only about 100 individuals.

**The humpback whale** is listed globally as vulnerable and occurs with about 1000 individuals in the Norwegian and Barents Seas. It is a mixed feeder that takes both krill and small fish. Humpbacks are sighted regularly in the eastern and northern Norwegian Sea during the summer season.

The smallest of the **baleen whale species**, the minke whale, is abundant in the Norwegian and Barent Seas. The total population has been estimated to be about 89.000. The minke whale is like the humpback, a mixed feeder that takes a variety of zooplankton and fish prey. Minke whales are found mainly along the eastern side and in the frontal areas in the western Norwegian Sea, and herring constitutes an important part of its diet in this area. Norway has resumed whaling for minke whales with a total quota set at 1.052 individuals for 2006.

In the Norwegian Sea, male **sperm whales** are common in the eastern and northern areas and their numbers are estimated to be at least a few thousand individuals. In previous years of whaling, the largest sperm whale catches were made in the slope waters off Møre and off Vesterålen. The area off Vesterålen is today an area where sperm whales are regularly seen and form the basis for a tourist industry with "whale safaris". The reason why sperm whales aggregate in these areas are presumably because

they dive to feed on the very abundant squid *Gonatus fabricii* that occurs here in deep water.

Another toothed whale that feeds largely on the squid *Gonatus fabricii* in the Norwegian Sea is the northern **bottlenose whale**. This species is a summer visitor to the Norwegian Sea, assumed to migrate into the area between Shetland and the Faroe Isles. The current number of bottlenose whales is estimated to be around 12.000 individuals but they used to be more abundant prior to depletion by whaling.

**Pilot whale** is a southern species that occasionally extends its distribution into the southern Norwegian Sea, as does also white-sided dolphin. White beaked dolphin is more common and distributed over much of the Norwegian Sea except the northern part. The Norwegian Sea is home for a population of about 5.000 killer whales that feeds primarily on herring in this sea area. The harbour porpoise is the smallest of the whales in the Norwegian Sea, reaching a length of up to 1.8 m. It is common mainly in the coastal areas and is widely distributed along the coast of Norway with total numbers probably being around 100.000 individuals.

**Several seal species** occur in the Norwegian Sea distributed mainly along the coast of Norway and in the northern and western parts of the area. There is little or no ice in the Norwegian Sea and therefore typical ice associated seals are absent from the Norwegian Sea. One noticeable exception is hooded seal. Harp seals from the Greenland stock may also migrate into or through the northern most extension of the Norwegian Sea. Individual ringed seals may also occasionally occur along the coast of Norway. Also walruses are regularly sighted along the Norwegian coast.

**Harbour seal** is a common species living along the coast of Norway. They are estimated to number about 6,700 individuals and live scattered with many small breeding colonies along the coast. Gray seal is also common and lives in the outermost exposed coastal areas. Their number is estimated to be about 6,000 individuals in Norway. A few places these seals make up larger colonies. One of these areas is the Froan Archipelago in Trøndelag which is a Protected area (IUCN categories I and V). European river otter has its core area of distribution in Norway along the coast to the Norwegian Sea and also along rivers and freshwater systems in the region.





## FISH

The dominant planktivorous fish species in the Norwegian Sea are herring, blue whiting, and mackerel. These have large-scale feeding migrations to exploit the seasonal occurrence of zooplankton before *Calanus finmarchicus* descends into the relatively safe deep and dark ocean interior. Ecological conversion efficiencies between primary, secondary and tertiary trophic levels are about 20 %, explaining the occurrence of some of the world's largest fish stocks feeding in a relatively restricted ocean area (about 1.1 million km<sup>2</sup>). Herring, blue whiting and mackerel have together made up a total biomass of about 20 million tonnes of pelagic fish feeding in the Norwegian Sea during the summer season.

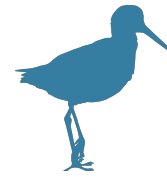
Herring of the Norwegian spring spawning stock spawns on coastal banks along the west coast of Norway. Their migration is typically clockwise, where herring has turned northwards in the frontal region of the western Norwegian Sea and followed the front northwards during summer to end the feeding season in the northern Norwegian Sea. Landings reach the peak of 2 million tonnes in 1966 and led to a herring stock collapse

Blue whiting is one of the most abundant fish stocks in the middle water layers in the Northeast Atlantic. Catches exceeded 1 million tonnes from 1998 to 2008. According to the United Nations Food and Agriculture Organization of the United Nations (FAO), blue whiting was 5th most important capture fish species in 2006. The blue whiting stock has been 5-10 million tonnes over the recent decades and constitutes an important component in the Norwegian Sea ecosystem.

Mackerel, a pelagic and fast swimming fish, is easy to recognize by its round, completely round shaped and streamlined body. They become sexually mature at about 30 cm in length. The mature part of the North Sea component, which the mackerel along the Norwegian coast belong, overwinters outside the western part of Norway and in the outer part of the Norwegian Trench, reaching north up to Viking bank.

Some of the major fish stocks in the Norwegian Sea LME are migratory across borders of adjacent LMEs. The squid *Gonatus fabricii* is a particularly important species in the Norwegian Sea ecosystem. The biomass of *Gonatus* in the Norwegian Sea has

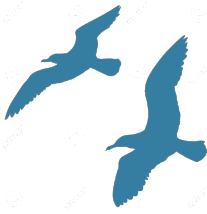
been estimated to be about 8 million tonnes, with an annual production of the order of 20 million tonnes. Several stocks of demersal fish including saithe, redfish, ling, tusk and Greenland halibut have the Norwegian Sea as their main area of distribution.



## SHOREBIRDS

A total of about 27 species of shorebirds breed in Norway adjacent to the Norwegian Sea. Some of them breed in coastal areas but many breed mainly inland in mountainous areas away from the coast. However, most of the species may be found in coastal habitats, particularly in the post-breeding period and during migration. About half of the number of species (14) are in the groups of relatively large shorebirds, including 6 species of shanks, 4 godwits and, 3 snipes. The remaining species are 4 plovers, 5 calidrine sandpipers, ruddy turnstone, and red-necked phalarope.





## SEABIRDS

The Norwegian Sea constitutes the feeding area for a large number of seabirds that breed around its periphery, particularly in Norway and the Faroe Islands. It is also the wintering area for many of the seabirds that breed in this area as well as for northern breeders from the Barents Sea and adjacent areas. The total population of seabirds staying in the Norwegian Sea for various parts of the year is about 9.5 million birds. The most common breeding bird is by far Atlantic puffin with about 1.5 million individuals, followed by northern fulmar, herring gull, mew gull, black-legged kittiwake, thick-billed murre, and dovekie, which all occur with numbers in the range of 100-200 thousand individuals.

Considering the vast ocean areas of this LME, it is not surprising that the most numerous members of its seabird communities are pelagic species. Northern fulmar is the most abundant seabird offshore in the Norwegian Sea with roughly 2 million visiting fulmars. Wintering little auks occurs with about equally many individuals. The breeding areas for seabirds are distributed along the mostly rocky coast of Norway in east and the Jan Mayen Island in northwest. Jan Mayen (71°00'N 08°30'W) is the most remote island in the Arctic in terms of distance to other land. The remote location surrounded with productive waters makes this volcanic island a very important breeding habitat for seabirds.



## WATERFOWL

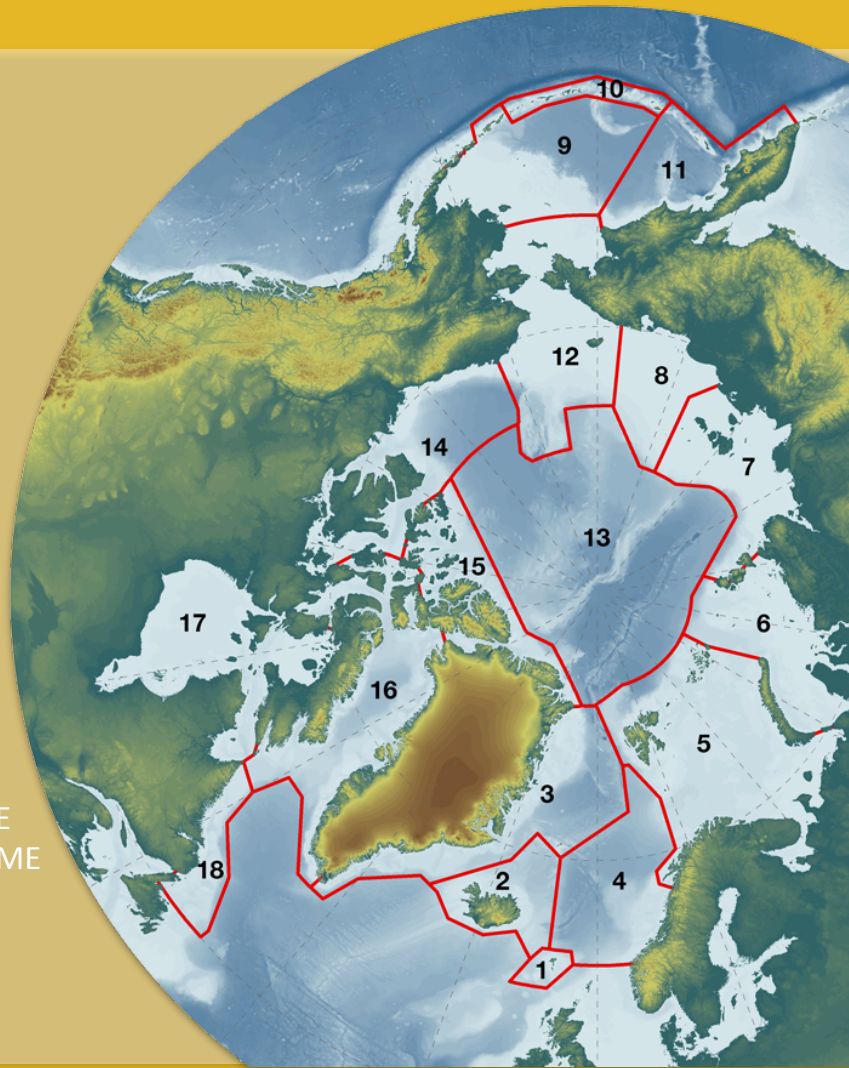
The Norwegian coast along the Norwegian Sea constitutes the habitat for a number of waterfowl species during the breeding season and/or during migration or wintering. About 25 species are common or regular inhabitants or visitors during migration, while some more may occur here as vagrants or stragglers. The regularly occurring species are 8 seaducks, 4 dabbling ducks, two diving ducks or pochards, one shellduck, 4 geese, one swan, 4 divers, and one grebe species. The most common and abundant species is the common eider breeds in coastal habitats and is a year-round resident.





## 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



## LITERATURE REFERENCES

- *The 2007 assessment of Oil and Gas in the Arctic (OGA) - AMAP (2007)*
- *AMAP OGA 2007 - Updated description of the Barents Sea LME. Lead author: Hein Rune Skjoldal.*
- *Arctic Marine Areas of Heightened Ecological and Cultural Significance: Arctic Marine Shipping Assessment (AMSA) IIC - AMAP/CAFF/SDWG (2013)*
- *Large Marine Ecosystems (LMEs) of the Arctic area Revision of the Arctic LME map - PAME (2013)*

## Acknowledgements

PAME gratefully acknowledges the financial support provided to this project by the Nordic Council of Ministers and the OAK Foundation.



Text: David J. Prieto

PAME INTERNATIONAL SECRETARIAT  
BORGIR  
NORDURSLÓÐ  
600 AKUREYRI  
ICELAND

TEL.: +354 4611355  
EMAIL: [PAME@PAME.IS](mailto:PAME@PAME.IS)  
[WWW.PAME.IS](http://WWW.PAME.IS)