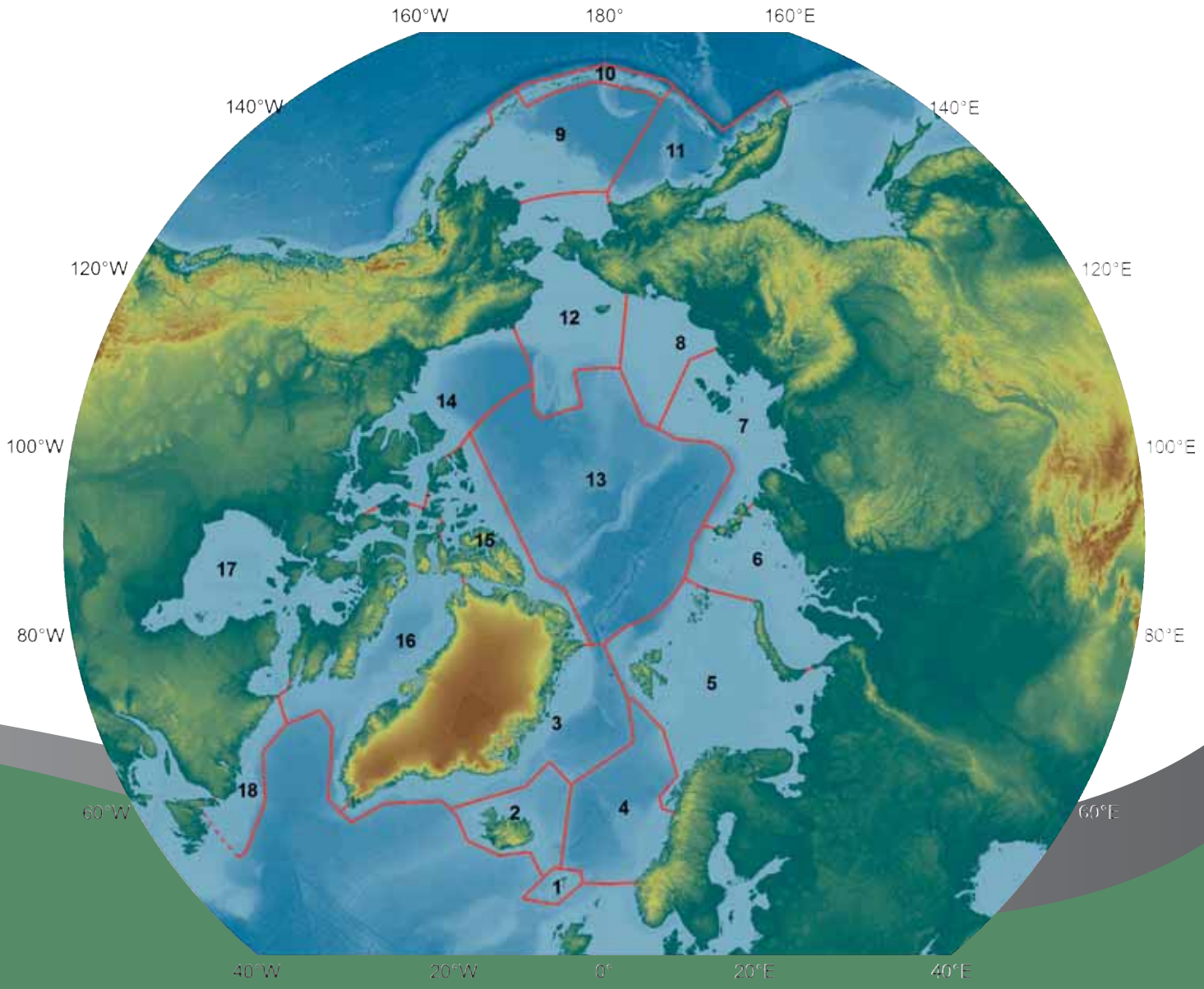

Large Marine Ecosystems (LMEs) of the Arctic area
Revision of the Arctic LME map
15th of May 2013

PAME
Protection of the Arctic Marine Environment

ARCTIC COUNCIL

Large Marine Ecosystems (LMEs) of the Arctic area

Revision of the Arctic LME map[1]

[1] by co-leads Hein Rune Skjoldal, Norway, and Phil Mundy, USA; PAME-led EA EG; 27 February 2013

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Figure 2. Adjusted 2006 LME working map used in the 2007 Assessment of Arctic oil and gas activities.

Figure 3. Revised Map of 18 Arctic LMEs (version 27 February 2013).

Table 1. List of the 18 Arctic Large Marine Ecosystems (LMEs) and their areas.

Background

The Arctic Council adopted in 2004 the management concept of an ecosystem approach as part of the Arctic Marine Strategic Plan (AMSP; PAME 2004). This approach is known by a number of different names; ecosystem-based management (EBM), ecosystem approach to management (EAM), or simply the ecosystem approach, EA, which is the term used here. The AMSP of 2004 recognized the definition of ecosystems as fundamental to implementing EA because of the necessity of knowing the geographic scope over which the negative consequences of human activities are to be identified, assessed, and addressed. One of the strategic actions of the AMSP was to identify the large marine ecosystems of the Arctic based on the best available ecological information.

The work on identifying Large Marine Ecosystems (LMEs) in the Arctic was led by the United States of America. Starting with a one-day workshop in Paris in July 2005 in conjunction with the LME Consultative Committee meeting at IOC-UNESCO, the work was followed up at break-out sessions at PAME meetings and by correspondence by national experts in an informal expert group. The resulting map delineating 17 Arctic LMEs was presented and agreed at the PAME meeting in spring 2006 and later endorsed by the Arctic Council Ministers at their meeting in Salekhard in October 2006. The map was described as a 'working map' in recognition of the potential need for revision and changes (PAME 2008 - PAME Progress Report on the Ecosystem Approach to Arctic Marine Assessment and Management 2006-2008).

Following up on the ministerial decision PAME established an Ecosystem Approach (EA) Expert Group on LMEs in 2007, with the USA as lead country. Norway later (in 2009) joined as a co-lead country. One of the tasks on the 2009-2011 workplan for the expert group (as part of the PAME work plan) was to review the working map of Arctic LMEs.

The 2006 working map of Arctic LMEs

The working map shows 17 identified Arctic LMEs (Fig. 1). This number includes the Sea of Okhotsk LME, which lies outside the Arctic area as used by the Arctic Council, but it does not include the Faroe Plateau LME which is included in the Arctic Council work.

The delineation of Arctic LMEs of the 2006 working map was used as a basis for ecosystem descriptions and assessment of vulnerable areas in the 2007 Assessment of Oil and Gas Activities in the Arctic (AMAP 2007, 2010a, b) with some slight modifications (Fig. 2). The Faroe Plateau LME was included as was the Southern Labrador Shelf as an additional LME. The West Greenland Shelf was treated along with Baffin Bay-Davis Strait as one LME. The Greenland Sea was treated as one LME, while the western part of the Denmark Strait and the SE Greenland shelf was treated together with the Iceland Shelf and Iceland Sea LME (although they were not considered part of the latter LME). The Sea of Okhotsk was not included. This kept the number of Arctic LMEs at 17. The LME boundaries were generally straightened and a few adjustments were made, e.g. between the Beaufort Sea and the Canadian Arctic Archipelago LMEs (see Figs 1 and 2).

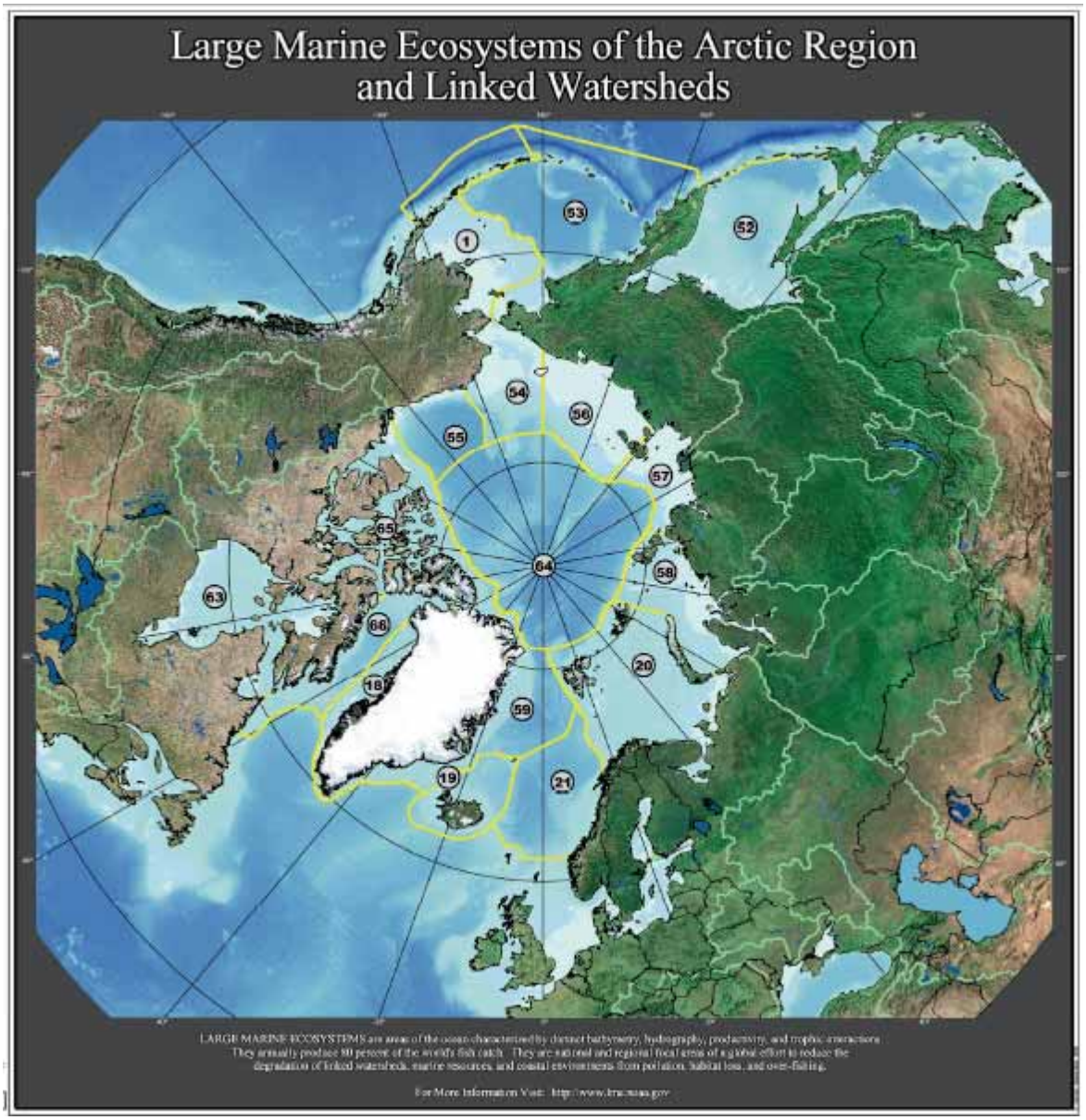

Figure 1. Working map of Arctic Large Marine Ecosystems (LMEs) from 2006.

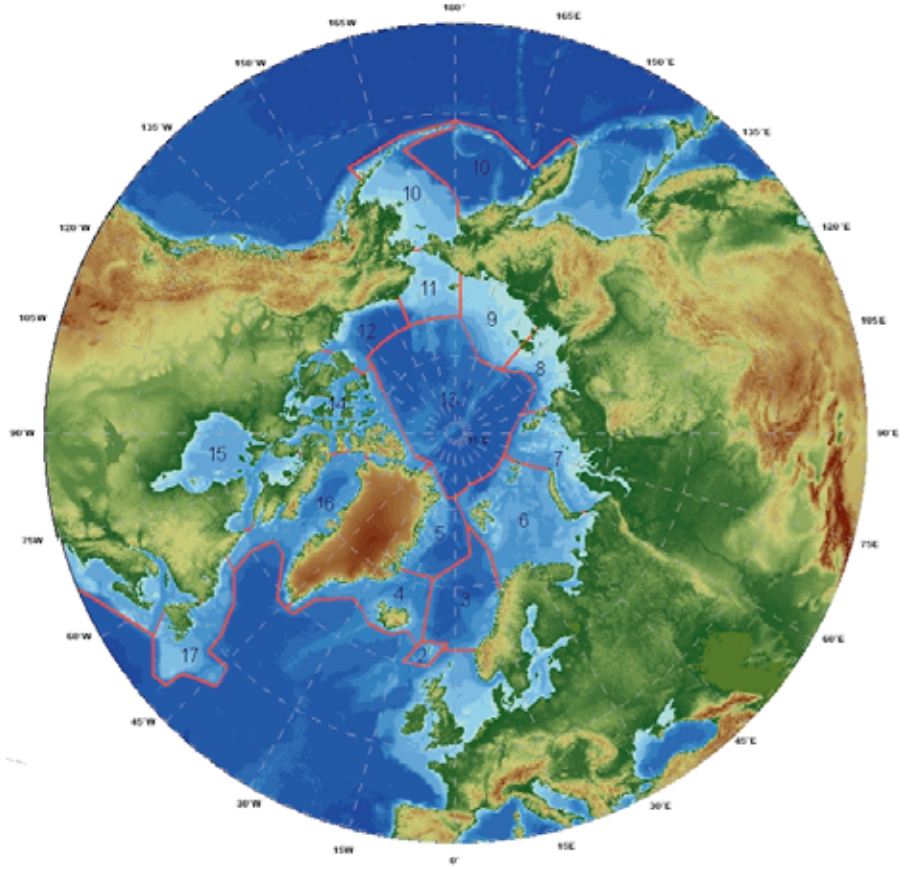

Figure 2. Adjusted 2006 LME working map used in the 2007 Assessment of Arctic oil and gas activities.

The 2006 map was further used in the Arctic Marine Shipping Assessment (AMSA) for displaying shipping activities and for evaluation of environmental sensitivities and threats from shipping (PAME 2009). In the follow-up of AMSA Recommendation IIC (to identify areas of heightened ecological and cultural significance), the LMEs were used as basic geographical units for description of the identified areas of heightened ecological significance.

Revision of the 2006 working map

Some of the boundaries of the 2006 working map proved problematic as ecosystem boundaries when they were used in the 2007 Oil and Gas Assessment (OGA) and the AMSA IIc project. The need for revisions became apparent when it was observed that boundaries were cutting through important ecological features to split them somewhat arbitrarily in two parts, in the absence of an actual natural ecological or geophysical discontinuity. For example the boundary between the Chukchi and Bering Seas LMEs across the Bering Strait was seen as contradictory to a natural connection between the Chukchi and northern Bering, as was the case for the boundaries between the Laptev, East Siberian and Chukchi Seas LMEs at the New Siberian Islands and Wrangel Island, respectively. In a practical sense, when using the LMEs as basic units for presenting information, this meant that information had to be repeated and included in the descriptions and analysis for two adjacent LMEs. It also became clear that shifting some of the boundaries better represented discontinuities in ecological and geophysical processes.

The issues mentioned above, and others, provided the rationale for revisiting the boundaries, and a review of the working map was included as an item on the 2009-2011 workplan for PAME and the EA Expert Group.

Review of the LME working map was the main topic at a Workshop on Ecosystem Approach to Management, held in Tromsø, 22-23 January 2011. The report from the workshop was finalized and made available by PAME for the 7th Ministerial Meeting in Nuuk, 12 May 2011. (The report is available from the PAME webpage at: [http://www.pame.is/images/PAME_NEW/Ecosystem Approach/Reports/EA_workshop_report_22-23_Jan_2011.pdf]

A follow-up meeting was held in Rostov-on-Don in Russia, 18-19 August 2011 with Prof. Matishov and other Russian experts to discuss the LME boundaries in the Russian Arctic. A report from the meeting is included in the Progress Report from the EA expert group to PAME in autumn 2011 (PAME II-2011) [http://www.pame.is/images/Documents/Ecosystem Approach Progress Report to PAME II-20111.pdf]

A meeting on the LME boundaries in the Bering Sea region was held with US NOAA experts in Seattle, 3 February 2012. A report from this meeting is included in the EA Progress Report to PAME I-2012 [http://www.pame.is/images/Documents/Ecosystem_Approach_Progress Report to PAME I-2012.pdf]. Further consultations on Bering Sea boundaries have continued in late 2012 and early 2013. A discussion document was prepared by the co-leads from Norway and the USA as a basis for these consultations that included also Russian experts.

After the PAME II-2012 meeting, informal consultations on the proposed LME boundary changes in the Canadian Arctic were held with Canadian members of the EA and Arctic Council EBM experts groups (Carl Wenghofer and Martine Gianoppi). A discussion document was prepared by the Norwegian co-chair as a basis for these consultations.

Finally, the Norwegian co-chair has had consultations with experts from the Faroe Isles and from Norway regarding the boundaries of the Faroe Plateau LME and of the Norwegian Sea LME (the boundary in the Jan Mayen area and between the Norwegian and Barents seas LMEs).

The outcome of the consultations is reflected in the revised map of Arctic LMEs.

Revised map of Arctic LMEs

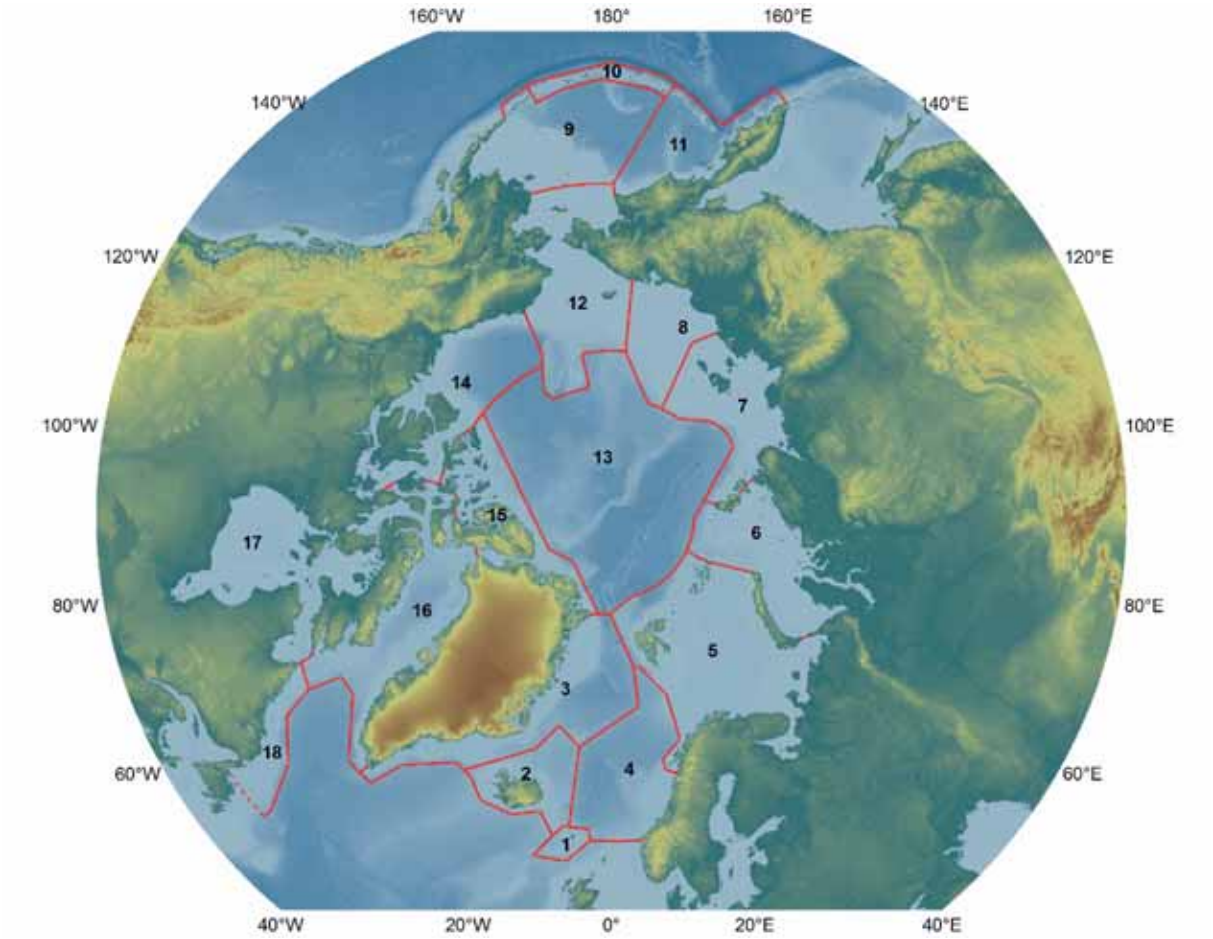

Figure. 3. Revised Map of 18 Arctic LMEs (version 17 April 2013).

The revisions resulted in 18 LMEs for the Arctic (Fig. 3) by addition of a new LME in the Bering Sea area: the *Aleutian Archipelago LME*. As described below, most of the other substantive changes to boundaries were made in waters contiguous with the USA, Russia and Canada. A summary of the 18 LMEs with information on their areal extent is given in Table 1.

Brief descriptions of some of the key features and characteristics of the Arctic LMEs and their boundaries are given in Annex 1. The descriptions highlight features which are particularly relevant in relation to the four general criteria for identification of LMEs: bathymetry, hydrography, productivity, and trophic linkages.

The western and northern boundaries of the East Bering Sea LME have changed

The East Bering Sea LME has been expanded to the west and contracted from the north (see Chukchi Sea LME changes, below). The expansion to the west places much of the Bering Sea basin and Bowers Ridge inside the EB LME, reflecting hydrographic structure, and emphasizing the importance of the deep waters as a source of nutrients and oceanic copepods to drive productivity for the shelf and shelf break areas. The shallower, more southerly area of Bowers Ridge is included in the new Aleutian Achipelago LME, reflecting the distribution of the fish species assemblage.

Aleutian Archipelago LME recognized as distinct from eastern Bering Sea

Much new information has become available on the Aleutian Archipelago in the past decade. The new Aleutian Archipelago LME recognizes distinct features of productivity and trophic structure that are shaped by the interaction of currents and bottom topography of the many passes between volcanic islands of the archipelago. The LME is bounded on the south by the Alaska Stream flowing westward and on the north by the Aleutian North Slope Current flowing eastward. The eastern extent has been set as Samalga Pass based on breaks in ichthyofauna and productivity, leaving the waters between Samalga and Unimak passes in the East Bering Sea LME. The western boundary of the Aleutian Archipelago LME is at Near Strait which represents a major oceanographic divide to the West Bering Sea LME.

Chukchi LME southern boundary moves farther south into northern Bering Sea

The boundary between the Chukchi Sea and Bering Sea LMEs has been moved south from the Bering Strait to 61.5 ^{o}N so that the northern Bering Sea would be part of the new *Northern Bering-Chukchi Seas LME*. The extension of the Chukchi LME to the south reflects the role of the waters known as the "cold pool" in shaping the trophic structure and productivity of the northern Bering Sea. The new southern boundary of the Chukchi reflects the transition to an ecosystem of decreasing pelagic productivity and increasing benthic productivity that is defined by the average annual summer extent of the cold pool waters. The change also recognizes the combined roles of nutrient-rich water flowing north through shallow topography that drive high rates of primary production from the Anadyr Gulf through Chirikov Basin and Bering Strait into the southern Chukchi Sea.

Chukchi LME northern boundary moves further north to include Chukchi Plateau

The boundary between the Northern Bering-Chukchi LME and the Arctic Ocean LME has been moved north so that the Chukchi Plateau is included with the Chukchi system. The Chukchi Plateau is a geological formation extending out from the Chukchi shelf, and there are ecological connections between the plateau and shelf in terms of fluxes of organic matter.

A new LME: the Canadian High Arctic-North Greenland LME

The former Canadian Arctic Archipelago LME boundaries have changed substantially to reflect the Biogeographic classification system established in Canada. The northern part, corresponding to the Canadian Arctic Archipelago bioregion, has been identified as a separate LME along with the adjacent area of North Greenland: the *Canadian High Arctic-North Greenland LME*. This area is strongly influenced by heavy multi-year pack ice and is characterized as a high arctic area with generally low production. There is limited ecological connectivity between this LME and the regions south of it in the Northwest Passage and northern Baffin Bay.

Beaufort Sea LME eastern boundary has been moved eastward

The eastern boundary has been moved further east into the archipelago so that the Western Arctic bioregion of Canada is now a component of the larger Beaufort Sea LME (or Beaufort Sea-Western Arctic LME). This is justified by migratory trophic connections where belugas move into Viscount Melville Sound and eiders, loons and other birds migrate into breeding and feeding areas in the Coronation and Queen Maud Gulf areas.

Baffin Bay-Davis Strait LME has been enlarged westward

The boundaries across the openings from Baffin Bay into Jones and Lancaster sounds have been removed so that a larger LME is now identified: the *Eastern Canadian Arctic-West Greenland LME* (or Lancaster Sound-Baffin Bay-Davis Strait LME). The western boundary is

at Franklin Strait and eastern Viscount Melville Sound, including the main summering areas of belugas, narwhals and bowheads from eastern populations in this LME and separating them from western populations by heavy ice areas. The southern boundary on the Canadian side is at the northern tip of Labrador, and the Canadian portion of this LME corresponds to the Eastern Arctic bioregion of Canada. Important and defining features of the Eastern Canadian Arctic-West Greenland LME are migrations of major stocks of marine mammals between wintering areas in Baffin Bay and Davis Strait and summering areas in the eastern Canadian archipelago.

The Labrador coast and shelf is located within the sub-Arctic and Arctic parts of Canada. This area is a part of the Labrador-Newfoundland bioregion of Canada, corresponding to the Labrador-Newfoundland LME.

The boundary between the Norwegian Sea and Barents SE LMEs has been adjusted

The boundary has been changed to include the Lofoten Islands in the Barents Sea LME. This region is the main spawning area of the Barents Sea cod stock which is a major component of this ecosystem. The boundary has further been shifted west to include the upper slope region from the Barents Sea into the Norwegian Sea as part of the Barents Sea LME. There is a current of Atlantic water flowing north along the slope in this region which hold the main spawning areas for Greenland halibut and other fishes that are trophically linked and parts of the Barents Sea LME.

Jan Mayen is included in the Greenland Sea-East Greenland LME

The Jan Mayen Island is situated on the mid-Atlantic ridge between the Norwegian and the Greenland seas. Some water of the cold Jan Mayen Current turns south along the eastern side, leaving Jan Mayen generally in a cold ocreanographic domain influenced by conditions in the Greenland Sea. The boundary between the Greenland Sea and Norwegian Sea LMEs has been shifted somewhat east of Jan Mayen to correspond more closely to the position of Mohn Ridge.

Boundary adjustments of LMEs in the Russian Arctic

The boundary between the Kara Sea and Laptev Sea LMEs has been shifted west along the Severnaya Zemlya archipelago so that the waters off the northeastern side of the islands become part of the Laptev Sea LME.

The boundary between the Laptev Sea and East Siberian Sea LMEs has been shifted east to include all of the New Siberian Islands and the polynya system associated with them as part of the Laptev Sea LME.

The boundary between the East Siberian Sea LME and the Chukchi Sea has been shifted west so that all of Wrangel Island and the waters around it is included in the Northern Bering-Chukchi Seas LME.

Table 1. List of the 18 Arctic Large Marine Ecosystems (LMEs) and their areas.

No	Name	Area (million km^2)
1	Faroe Plateau LME	0.11
2	Iceland Shelf and Sea LME	0.51
3	Greenland Sea LME	1.20
4	Norwegian Sea LME	1.11
5	Barents Sea LME	2.01
6	Kara Sea LME	1.00
7	Laptev Sea LME	0.92
8	East Siberian Sea LME	0.64
9	East Bering Sea LME	1.38
10	Alutian Islands LME	0.22
11	West Bering Sea LME	0.76
12	Northern Bering-Chukchi Seas LME	1.36
13	Central Arctic LME	3.33
14	Beaufort Sea LME	1.11
15	Canadian High Arctic-North Greenland LME	0.60
16	Canadian Eastern Arctic-West Greenland LME	1.40
17	Hudson Bay Complex LME	1.31
18	Labrador-Newfoundland LME	0.41

References:

DFO. 2009. Development of a Framework and Principles for the Biogeographic Classification of Canadian Marine Areas. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/056.

http://www.dfo-mpo.gc.ca/csas-sccs/publications/sar-as/2009/2009_056-eng.htm

PAME 2004. Arctic Council Arctic Marine Strategic Plan. PAME International Secretariat, Akureyri, Iceland. 13 pp.

Annex 1 - Characteristics of the LMEs and their boundaries

1 - Faroe Plateau LME

The shelf around the Faroe Isles and the shallow Faroe Bank to the southwest form a distinct ecological unit with characteristic circulation pattern, plankton production and composition, and self-contained fish populations of cod, haddock and other species. The slopes around the shelf and bank areas are included in the LME.

2 - Iceland Shelf and Sea LME

The water circulation is clockwise around Iceland with the northward flowing warm Irminger Current on the western side and the cold East Iceland Current flowing south on the eastern side. These currents are associated with distinct plankton communities and production regimes. Several major commercial fish populations including Atlantic cod, herring, and capelin are important defining components of this LME. These fish stocks have life cycles adapted to the circulation system, with spawning migrations to spawning areas along southwestern Iceland and larval drift and seasonal feeding migrations to areas north of Iceland. Capelin plays a particularly large role in the ecosystem and the stock migrates north to feed on plankton in the Iceland Sea in summer.

The southern boundary includes the slope from the Iceland Shelf in the LME. The western boundary to the Greenland Sea-East Greenland LME is through the Denmark Strait where the cold and arctic East Greenland Current runs south on the Greenland side, separated from the warmer Atlantic water of the Irminger Current flowing north along the western side of Iceland. The northern boundary is along the deep ridge that separates the Iceland Sea from the Greenland Sea. The eastern boundary to the Norwegian Sea LME follows the edge of the deep ridge that separates the Iceland Sea from the deep basin of the Norwegian Sea.

3 - Greenland Sea-East Greenland 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^{o}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.

4 - Norwegian Sea LME

This LME consists of two deep basins and the Norwegian shelf along the eastern rim. The northward flow of Atlantic water as the Norwegian Atlantic Current and recirculation in the two basins contribute to a mostly boreal ocean climate and the LME is largely ice-free in

winter. Below the warmer upper layer is cold deepwater (about -1^{o}C) which is continuous with the deep water of the Arctic Ocean. The copepod *Calanus finmarchicus* and krill are important zooplankton species and the LME is the feeding area for some of the largest pelagic fish stocks in the world: the Norwegian spring spawning herring, blue whiting and mackerel.

The southern boundary is along the slopes to the North Sea (at 62^{o}N) and the Faroe Plateau. The western boundary to the Iceland Shelf and Sea LME follows the edge of the deep ridge the separates the Norwegian basin (3.5-4 km deep) from the shallower but still deep (about 2 km) Iceland Sea. This deep ridge and slope steers the recirculating currents of the Norwegian Sea gyre and determines the position of the oceanic polar front between warmer Atlantic and colder waters in the western Norwegian Sea. The northwestern boundary to the Greenland Sea-East Greenland LME follows along Mohns and Knipowitch ridges that are associated with strong oceanic fronts between circulating water masses in the two LMEs. The northwestern boundary is along the slope to the Barents Sea shelf from 77^{o}N west of Spitsbergen south to the Lofoten area in northwestern Norway. The northernmost part of the LME up to Spitsbergen is an extension of the Lofoten Basin bounded by the mid Atlantic ridge (Knipowitch Ridge) and the Barents Sea shelf.

5 - Barents Sea LME

The Barents Sea is a relatively deep (mean depth 230 m) shelf area. The LME includes the slopes along the western and northern margins. Atlantic water flows with two main branches into the Arctic Ocean, one branch flowing across the Barents shelf and exiting via the northern Kara Sea, and the other flowing around the shelf plateau west and north of Svalbard. This flow pattern determines the oceanographic regimes with warmer boreal and ice-free conditions in the southwestern part and cold and ice-infested conditions in the northern and eastern parts of the Barents Sea. There are distinct differences in plankton composition and communities, with *Calanus finmarchicus* being a dominant copepod in the Atlantic water while *Calanus glacialis* is its counterpart in the Arctic water. Large fish populations including cod, haddock, Greenland halibut, capelin and polar cod contribute to the system characteristics of the LME. Capelin performs a seasonal feeding migration north into the cold waters to feed on zooplankton in summer, causing a strong ecological linkage between the northern and southern parts. Seasonal migrations are also characteristic for most other fish populations.

The Barents Sea LME contains a large population of harp seals that whelp at the entrance to the White Sea. The LME is also home to the Barents Sea subpopulation of polar bears and two populations of walrus, the Svalbard-Franz Josef Land population and the Kara Sea-southern Barents Sea-Novaya Zemlya population which extends into the Kara Sea LME. Several subpopulations of belugas or white whales are found in the White Sea and the eastern and northern parts of the Barents Sea.

The western boundary to the Norwegian Sea is from 67.5 ^{o}N across the Vestfjord and then north to the shelf edge off Vesterålen. The justification for including this part of the Norwegian Shelf in the Barents Sea LME is that this includes the main spawning areas of the Barents Sea cod stock in the Lofoten area. The boundary continues north along the slope to the Norwegian Sea so that the slope where the Atlantic water flows north along Spitsbergen is included as part of the Barents Sea LME. The slope off the Barents shelf is the main spawning area for Greenland halibut which is a major species in the Barents Sea LME. The boundary continues north along the western slope of the Yarmak Plateau in the Fram Strait region to about 83^{o}N. The boundary continues east into the Arctic Ocean so that the slope from the Barents shelf where the Atlantic water flows is included as part of the Barents Sea LME. The

northeastern boundary to the Kara Sea LME is a line from the northern tip of Novaya Zemlya passing just east of the Franz Josef Land archipelago. This is a fairly open ecosystem boundary without a clear distinguishing topographic or oceanographic feature. The southeastern boundary to the Kara Sea LME is at the narrow Kara Gate south of Novaya Zemlya. The White Sea is included as a part of the Barents Sea LME.

6- Kara Sea LME

This LME is a mostly shallow shelf region bounded in south by low-lying coasts where the estuaries of two of the major Arctic rivers, the Ob and Yenisei, are found. These rivers discharge large volumes of freshwater which have strong influence on the hydrography, resulting in extensive areas of brackish waters in the summer season. The LME is ice-covered in winter but generally clears of ice in summer except for the northernmost areas in most years. The Kara Sea LME is home to the Kara Sea subpopulation of polar bears and it contains important feeding areas for summer aggregations of belugas (possibly separate subpopulations) of the larger Karskaya population. The northern Kara Sea is the breeding area for the large majority of the world population of ivory gulls.

The Kara Sea LME is bounded in west by Novaya Zemlya with boundaries to the Barents Sea LME at the Kara Gate in southwest and from the northern tip of Novaya Zemlya to east of Franz Josef Land in northwest. The northern boundary is along the outer slope with the slope current of Atlantic water (from the Fram Strait branch) located within the Kara Sea LME. The eastern boundary is at Vilkitskyi Strait and then across the Severnaya Zemlya archipelago so that the western side is part of the Kara Sea while the eastern side belongs to the Laptev Sea LME.

7- Laptev Sea LME

This is a High Arctic LME situated in the central part of the Russian Arctic. A prominent feature is the ‘Great Siberian Polynya’ which is a system of leads and polynyas stretching from off the Taymyr Peninsula in west to off the New Siberian Islands in east. This polynya system provides important spring staging and feeding habitats for migratory birds. It is also probably important for the Laptev walrus population, which is a distinct type of walrus. The LME is also home to the Laptev Sea subpopulation of polar bears. There is possibly a migratory population of polar cod in the western part of the LME that serve as a summer feeding area for belugas of the Karskaya population wintering in the Barents Sea. There are several river deltas and estuaries along the southern mainland, with the Lena delta as the most prominent and unique feature. These estuaries and deltas constitute important breeding, feeding and staging habitats for migratory birds.

The western boundary of the LME to the Kara Sea LME is at the Vilkitskyi Strait and across the Severnaya Semlya archipelago. The leads and polynya off the northeastern side of the Severnaya Zemlya are spring staging and feeding areas for seabirds breeding on the islands and constitute also a migration corridor for belugas moving into the Laptev Sea. The northern boundary follows along the outer slope to the Arctic Ocean basins. This area constitutes the eastern margin of the Eurasian Basins (Nansen and Amundsen) and steers the flow of Atlantic water on its way into the Arctic Ocean. The eastern boundary is set east of the New Siberian Islands so that the leads and polynya off the fast ice associated with the archipelago are contained in the Laptev Sea LME.

8 - East Siberian Sea LME

This area is characterized as a transition zone for the Pacific influence from the eastern side. The southern coast with the deltas and estuaries of Indigirka and Kolyma rivers constitute

important breeding, feeding and staging areas for birds of migratory populations that winter on the Pacific side. Bowheads and belugas from the migratory populations that winter in the Bering Sea may also move into this area in the summer season. The East Siberian Sea LME is a High Arctic and low productive area and there are no separate subpopulations of polar bears or other marine mammals in this LME.

The western boundary to the Laptev Sea LME is to the east of the New Siberian Island leaving that archipelago as part of the Laptev Sea LME. The northern boundary follows along the outer slope. The eastern boundary to the Northern Bering-Chukchi Seas LME is located west of Wrangle Island, leaving that island and the waters around it as part of the latter LME.

9 - East Bering Sea LME

The LME consists of three main parts: the broad and relatively shallow East Bering shelf, the slope region, and the adjacent deep basins of the eastern Bering Sea. The shelf is sloping gradually from the Alaskan coast to the shelf edge at about 100-150 m depth. It can be subdivided into inner, mid, and outer shelf domains in terms of hydrography and productivity. A coastal current from Gulf of Alaska flows onto the inner part of the shelf through Unimak Pass and continues north as a sluggish flow. The Aleutian North Slope Current is deflected north and flows as the strong East Bering Slope Current along the slope and partly onto the outer shelf. The productivity in this region is very high as part of the 'Green Belt' around the rim of the Bering Sea basins. Oceanic copepods (*Neocalanus* spp., *Eucalanus bungii*, and *Metridia pacifica*) are advected from the basins along the slope and onto the outer shelf. They represent an important ecological connection between the basin and the shelf in terms of productivity, and they constitute an important link to higher trophic levels.

The East Bering shelf and slope are homes to some major commercial fish populations. The most important in terms of biomass and fisheries yield is walleye pollock that spawns along the slope and at Bogoslov Island just north of Unimak Pass. Several species of flatfishes are important on the shelf, such as yellow-fin sole and arrow tooth flounder. Other important commercial fish species include Pacific cod, Pacific herring, Atka mackerel, Greenland halibut, sablefish, and several species of rockfishes (*Sebastes* spp.). Capelin and eulachon (a species of smelt) are important 'forage fish' species. Seasonal migrations onto and off the shelf are characteristic features of the dynamics of the ecosystem. The Bristol Bay area in the southeastern corner of the LME is a major area for Pacific salmon, particularly for sockeye salmon. Ten-30 million salmon are caught annually in this area when they return to spawn in the rivers.

The East Bering LME is the main breeding and summer feeding area for the global population of northern fur seal which breeds in large colonies on the Pribilof and Bogoslof islands. They live dispersed in the North Pacific in winter and migrate into and out of the East Bering Sea through Unimak Pass. This is also the main migration route for grey whales (of the eastern population) on their way between winter areas in Mexico and feeding areas in the northern Bering and Chukchi seas. The southeastern Bering Sea is summer feeding area for the critically endangered eastern stock of North Pacific right whale. Pacific walrus winter in the northern part of the LME and some males summer in the northern Bristol Bay area.

The Pribilofs Islands hold large breeding colonies of seabirds with thick-billed murre, black-legged kittiwake, northern fulmar, least auklet, crested auklet, and common murre as the dominant species. There are also important breeding colonies of seabirds on St. Matthews and Nunivak Islands, and in the northern Bristol Bay area on the mainland. Red-legged kittiwake is endemic to the Bering Sea and breeds with the major portion of the global population at the Pribilof Islands. The eastern Bering slope and shelf is a major feeding area for austral

wintering shearwaters (short-tailed and sooty) from the southern hemisphere and also for the endangered short-tailed albatross. Lagoons along the northern Alaska Peninsula (e.g. Izembek Bay, Nelson Lagoon, Port Moller, and others) constitute very important staging and migratory habitats for many different species of birds including ducks, geese and shorebirds (e.g. Steller's eider, black brant, cackling goose, rock sandpiper, and bar-tailed godwit).

The southern boundary of the East Bering Sea LME is along the north side of the Alaska Peninsula but includes the southern side of the easternmost Aleutian Islands east to Samalga Pass. This area includes Unimak Pass and Bogoslov Island which are features ecologically connected to the East Bering slope and shelf. From Samalga Pass the boundary follows on the north side of the Aleutian Islands LME west to the end of the Aleutian Islands chain at the edge of Near Strait, which is the main inflow region from the North Pacific into the Bering Sea. The western boundary to the West Bering Sea LME is set as a straight line from the westernmost Aleutian Island (Attu, 172.5^{o}E) towards the shelf edge south of Cape Navarin. This boundary includes Bowers Basin and the southern and central parts of the Aleutian Basin as parts of the East Bering Sea LME. The massive inflow through the wide Near Strait (nearly 10 Sv on average) represents a major oceanographic divide between the western Aleutian Islands and the Commander Islands. Much of this inflow continues north and west to become part of the south-flowing Kamchatka Current. The East Bering Slope Current flows across the northern part of the Aleutian Basin and continues south also as part of the Kamchatka Current in the western Bering Sea. The East Bering Sea LME includes the adjacent parts of the Aleutian Basin which is expected to hold the reservoir of large oceanic copepods which are important for the overall productivity of this LME.

The northern boundary to the Northern Bering-Chukchi seas LME goes along 61.5 ^{o}N from the outer shelf south of Cape Navarin to the Alaska coast north of the Kuskokwim estuary. This boundary separates the main distribution areas of the commercial fish stocks of the East Bering Sea LME from the more Arctic region with main wintering areas of ice-associated marine mammals to the north.

10 - Aleutian Islands LME

This is a new LME consisting of the Aleutian Islands with the surrounding deep waters. This ecosystem includes two major current systems: the Alaska Stream flowing westwards along the southern side, and the Aleutian North Slope Current flowing eastward on the northern side. These two currents flow along the slopes of the Aleutian Islands range, with some connecting flows through passages between island groups. The main flow into the Bering Sea is through the deep Near Strait between the westernmost Aleutian Islands (the Near Islands group) and the Commander Islands on the Russian side. A part of this water turns east and forms the beginning of the Aleutian North Slope Current, which receives further inflows through Amchitka and Amukta Passes. The productivity of these waters is high due to high content and availability of nutrients through physical processes.

The basic productivity and advection of oceanic copepods and other zooplankton in the two currents on each side of the Aleutian Islands chain represent defining characteristics of the ecology in this area. The Aleutian Islands have limited ecological connectivity to the East Bering Shelf and so they constitute a very special environment with many local fish stocks, seabird colonies and rookeries for Steller Sea lions. Fish stocks spawn and live along the archipelago nourished by the productivity associated with the current systems. Large numbers of seabirds from many breeding colonies along the Aleutians forage in passages between the islands and in the currents out over deeper waters. Steller sea lions from many rookeries also feed on different fish and squid in these waters.

The boundaries for the Aleutian Islands LME are located at Samalga Pass (169^{o}W) in the east and at 170^{o}E in west, and bounded to the north and south of the archipelago by a pair of lines each about 50 km seaward of the islands, approximating the LME criteria of bathymetric features and trophic relationships. Samalga Pass has been identified as an ecological boundary between the adjacent Gulf of Alaska and eastern Bering Sea ecosystems. The western boundary is at the eastern end of Near Strait which represents a major oceanographic divide to the West Bering Sea LME.

11 - West Bering Sea LME

A prominent oceanographic feature in this LME is the Kamchatka Current which is a continuation and confluence of the East Bering Slope Current and the current branch flowing northwest from the inflow through Near Strait. The West Bering shelf is relatively narrow along the Koryak coast and the Kamchatka Peninsula, widening somewhat in the Karaginski Bay area. The Commander Islands is separated from the mainland by the deep Kamchatka Strait and the Kamchatka Current and from the western Aleutian Islands by the Near Strait and the massive inflow of water through that opening. Oceanic copepods (*Neocalanus* species and others) associated with the deep basins deep play important roles for the overall productivity of the area.

Several commercial fish populations are important components of the West Bering Sea LME, including walleye pollock, Pacific herring, Pacific cod, and yellowfin sole. Spawning areas are located in the Olyutorski and Karaginski bays, and the fishes have seasonal migrations to feed on the outer shelf and slope waters. Capelin and several species of smelts (Arctic rainbow smelt, pond smelt) are important 'forage fishes' in the food webs, as are vertically migrating mesopelagic fishes and squid. Steller sea lions, harbor seals, and sea otters are among the marine mammals that are inhabitants of this LME. There are also breeding colonies and feeding areas for seabirds along the coasts and on the Commander Islands.

The southern boundary of the West Bering Sea LME is from the southern end of the Kamchatka Peninsula, north along the outer slope of Kamchatka, and then east south of the Commander Islands and the submarine 'mountain' ridge to the westernmost Aleutian Islands at the eastern side of Near Strait. The northern boundary (to the Northern Bering-Chukchi seas LME) is at Cape Navarin, while the eastern boundary to the East Bering Sea LME is a line from the shelf south of Cape Navarin to just west of the western Aleutian Islands. This boundary includes the northwestern part of the Aleutian Basin and the Kamchatka Basin in the West Bering Sea LME.

12 - Northern Bering-Chukchi Sea LME

This LME is a shallow shelf environment with depths of 50-70 m or less extending for more than 1.000 km from the shelf edge in the northern Bering Sea to the shelf edge of the northern Chukchi Sea. The area is characterized by a persistent northward flow of water driven by higher water level in the Bering Sea than in the Arctic Ocean. The mean transport or flushing time is of the order of one year or less. The Pacific water is nutrient-rich (about 3-fold compared to North Atlantic water), and the combination of northward flow and shallow topography drives very high primary production rates in the Bering Strait region (from northern Gulf of Anadyr to the southern Chukchi Sea). The rates are up to 500 g C m^{-2} per year or more, which makes the wider Bering Strait region a global hot spot in terms of production, comparable to upwelling systems. Transport of oceanic copepods and other zooplankton in this productive water is an important characteristic as is a high energy input to the benthic part of the ecosystem. Polar cod is an important fish species and occurs possibly with one or more migratory populations.

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 St. Lawrence and Sireniki polynyas (south of St. Lawrence Island and the Chukchi Peninsula) are important features within the wintering areas. The northern Bering Sea is important also for Ice-breeding seals (ribbon, spotted, ringed and bearded seals). 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 including the areas around Wrangel Island in the northwestern part. Grey whales (of the eastern population) come north from wintering and breeding areas in Mexico to benthic feeding areas in the northern Bering and the Chukchi seas. Many spotted seals as well as ringed and bearded seals also migrate north from the northern Bering to the Chukchi Sea as the ice retreat north during summer.

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 murres. Wrangel and Herold islands also hold large breeding colonies, mainly of thick-billed murres. The leads in spring and shallow waters along Alaska and Chukotka in fall are important migration habitats for many seabirds, sea ducks, and divers or loons. The drifting pack ice south of St. Lawrence Island is a particularly important winter habitat for the global population of spectacled eiders that can be found concentrated within a relatively small area for 6 months of the year.

The southern boundary is along 61.5^{o}N from the Alaskan coast at the Yukon-Kuskokwim Delta to the outer shelf south of Cape Navarin and then north to this cape. This boundary includes the Gulf of Anadyr and Norton Sound as well as the waters around St. Lawrence Island in the Northern Bering-Chukchi seas LME. The area on the eastern shelf between St. Lawrence and St. Matthews islands is a transition zone between boreal and Arctic conditions, characterized by large interannual variation. The chosen boundary approximates the average position of the southern extent of the ‘cold pool’, which is a characteristic but variable feature of the northeastern Bering shelf. The boundary separates the main areas of distribution for the major commercial fish species in the East Bering Sea LME to the south, and core wintering areas for ice-associated marine mammals to the north.

The northern boundary is at 76^{o}N along the outer Chukchi slope across the Chukchi Rise and Northwind Ridge. This boundary is somewhat arbitrary but approximates the southern extent of heavy ice at the minimum in late summer. It includes the slope region with exchanges between the Chukchi shelf and the Canada Basin in the Northern Bering-Chukchi seas LME, and also presumably the major summer feeding area for polar bears of the Chukchi subpopulation. The northwestern boundary to the East Siberian Sea LME is west of Wrangel Island, leaving the shallow waters around the island as part of the LME. The northeastern boundary to the Beaufort Sea LME is north from Point Barrow, leaving Barrow Canyon within the N Bering-Chukchi LME.

13 - Central Arctic Ocean LME

This is the largest of the Arctic LMEs with an area of about 3.5 million km^2 and it comprises essentially the deep basins of the Arctic Ocean with the Lomonosov Ridge separating the Eurasian basins from the Canada basin. The most prominent feature of this LME is the drifting polar pack ice that covers the whole area during most summers except for some of the

more recent warm years with especially low ice cover. The sea ice constitute habitat for a very special biota made up of ice algae and a partly endemic fauna of ice amphipods and other small animals. Shrinking ice cover due to global warming is probably changing some ecological features of this ecosystem. A large and migratory population of Arctic cod (*Arctogadus glacialis*) probably exists in the Canada Basin and is the only known population that lives predominantly in this LME. Polar bears of several subpopulations move with the ice to live in the peripheral portions of the pack ice during the late summer season. This habitat is also used by two of the high arctic ice-associated gulls, ivory gull and Ross's gull.

The boundaries of the Central Arctic Ocean LME to the surrounding shelf LMEs follow the outer slopes on the Eurasian side from the Barents Sea to the Chukchi Sea LMEs. In the Canadian Basin the boundary to the Beaufort Sea is along 76^{o}N leaving the southern portion of the basin as part of the Beaufort Sea LME. The boundary to the Canadian High Arctic-North Greenland LME is along the shelf edge.

14 - Beaufort Sea LME

The Beaufort Sea LME consists of three main area components: the southern part of the deep Canada Basin, the shelf along northern Alaska and northwestern Canada including Amundsen Gulf, and the southwestern part of the Canadian archipelago including the gulfs and channels around Victoria Island. Prominent features are the Mackenzie delta and estuary and the Bathurst Polynya in the Amundsen Gulf. The primary production is relatively high due to influence of nutrient-rich Pacific water, and zooplankton residing in the deeper offshore areas provides important couplings to higher trophic levels. There is probably a large migratory population of polar cod in the eastern Beaufort Sea, which is a major summer feeding area for large numbers of bowheads and belugas from migratory populations wintering in the Bering Sea. Belugas also migrate further east to a late summer feeding area in Viscount Melville Sound. The Mackenzie and Amundsen Gulf region provides important breeding, feeding and migration habitats for birds, as do areas in the Coronation and Queen Maud gulfs south of Victoria Island. Three subpopulations of polar bears inhabit this LME: the southern and northern Beaufort and M'Clintock subpopulations.

The western boundary to the Northern Bering-Chukchi Seas LME is just east of Barrow, separating the narrow western Beaufort shelf from the Barrow Canyon and the wider Chukchi shelf. The boundary extends north to 76^{o}N along the eastern edge of the Northwind Ridge. The northern boundary is along 76^{o}N across to the northern side of M'Lure Strait. This boundary is somewhat arbitrary but approximates the mean position of the ice edge in summer, representing a transition in productivity between the seasonally opened and the permanently ice-covered waters. The northern boundary continues across the openings from north into M'Clure Strait and Viscount Melville Sound (between the Prince Patrick, Melville and Bathurst islands). The eastern boundary to the Canadian Eastern Arctic-West Greenland LME is across the eastern Viscount Melville Sound and Franklin Strait (north and south of Prince of Wales Island). This boundary represents the region with the heaviest ice conditions separating migratory marine mammals from Atlantic and Pacific populations.

15 - Canadian High Arctic-North Greenland LME

This new LME consists of the northernmost and high arctic part of Canada (Canada's bioregion 7 - Arctic Archipelago) along with the adjacent part of North Greenland. This area is strongly influenced by heavy multi-year pack ice that is transported into the 'Sverdrup Basin' from the Arctic Ocean through the openings between the northern Queen Elisabeth Islands (east of Ellesmere Island). The Nares Strait between Ellesmere Island and Greenland is one of the connections between the Arctic Ocean and Baffin Bay. The production in the

LME is generally low due to the heavy ice conditions. Two polar bear subpopulations live in this LME, one on each side of Ellesmere Island: the Norwegian Bay and Kane Basin subpopulations. Narwhals that summer in Smith Sound move into Kane Basin and possible further north in the Nares Strait. Otherwise the whales and seals of large stocks of the Baffin Bay region do not move into this ice choked high arctic LME. The coasts of northern Greenland along with Ellesmere and Axel Heiberg islands are breeding grounds for brent geese (of the light-bellied subspecies *hrota*) and several species of high Arctic shorebirds (red knot, sanderling, purple sandpiper, ruddy turnstone, common ringed plover). These birds belong to populations that fly east to winter in western Europe or West Africa.

The southern boundary of this LME is along the southern end of the passages that lead into M'Clure Strait and Viscount Melville Sound in the western part of the area (between Prince Patrick, Melville and Bathurst islands). Byam Martin Channel, where there is considerable ice export into Viscount Melville Sound, is included in this northern LME. Further east the boundary is across the northern end of Penny Strait (between Bathurst Island and the Grinnell Peninsula of Devon Island), and just north of Hell Gate and Cardigan Strait between Devon and Ellesmere islands. The polynyas in these passages and the channels south of Penny Strait are used as important feeding areas for walrus of the Baffin Bay (High Arctic) population and are included as parts of the Canadian Eastern Arctic-West Greenland LME. Between Ellesmere and Greenland the boundary is at Smith Sound. The western boundary is across the shelf from the western end of Prince Patrick Island out to the shelf edge. The northern boundary approximates the shelf edge north of the Queen Elisabeth Islands, Ellesmere, and North Greenland, east to Nordostrundingen at the northeastern corner of Greenland in the Fram Strait.

16 - Canadian Eastern Arctic-West Greenland LME

This is a large and diverse LME made up of several subregions: Lancaster Sound and adjacent inlets including Peel Sound, Prince Regent Inlet and Gulf of Boothia; the North Water polynya in northern Baffin Bay; the deep basin of Baffin Bay; the coast and shelf along eastern Baffin Island; the coast and shelf along West Greenland along Baffin Bay; the coast and shelf of southwestern Greenland; and Davis Strait and the areas off southern Baffin Island. Most of the LME is ice-covered in winter and clears of ice in summer. Exceptions are along southwestern Greenland where open waters prevail, and some of the inner parts of the eastern part of the archipelago (e.g. Gulf of Boothia) and northwestern Baffin Bay where ice may persist through summer. The hydrography is characterized by circulation of Atlantic water through Baffin Bay and Lancaster Sound, and flow of Pacific water from the Arctic Ocean through passages in the Canadian archipelago and Nares Strait. The Pacific water is nutrient-rich and is one factor why the primary production is relatively high in this LME. Polar cod is an important fish species in this LME and probably exists with several large populations although the stock structure has not been clearly identified yet. The shelf along Greenland contains several fish stocks including capelin and Atlantic cod and supports commercial fisheries. Greenland halibut and the squid *Gonatus fabricii* are important deepwater species in Baffin Bay and Davis Strait region.

Large migratory populations of marine mammals are conspicuous and important components of the Canadian Eastern Arctic-West Greenland LME. Species include bowhead, beluga, narwhal, harp seal, and hooded seal. The general pattern is that the marine mammals move north to summer feeding areas in the Lancaster Sound region and northern Baffin Bay and return south in fall to wintering areas in Davis Strait and adjacent areas. Bowheads (of the Eastern Canada-West Greenland population) migrate north in spring through Baffin Bay and Lancaster Sound to a main feeding and nursery area in Prince Regent Inlet. They return in fall

to wintering areas in the Davis Strait region and many of them move further into Hudson Strait. Belugas (of the Eastern High Arctic-Baffin Bay population) winter off Greenland in the Davis Strait and in the North Water and move through Lancaster Sound in spring to main summer areas in Peel Sound and Price Regent Inlet. Narwhals (of 6 or more subpopulations) winter in the heavy pack ice of Baffin Bay (where they dive deep to feed on Greenland halibut and other prey) and possibly also in the North Water region. They move north in spring to summering areas in the Canadian archipelago (around Somerset Island, Admiralty Inlet, Ecclipse Sound, eastern Baffin Island, Jones Sound-Smith Sound) and along northern Greenland (Inglefield Bredning, Melville Bay). The migratory marine mammals provide strong ecological connections between northern and southern parts of this LME.

Walrus from three populations are found in this LME. The Baffin Bay (High Arctic) population winters in the North Water region in the northern Baffin Bay and migrates west into Lancaster and Jones sounds in summer. Walrus of the West Greenland population are found on the eastern side, while walrus of the Northern Hudson Bay-Davis Strait population are found along southern Baffin Bay and in western Davis Strait. Four subpopulations of polar bear live within the LME: Lancaster Sound, Gulf of Boothia, Baffin Bay, and Davis Strait subpopulations.

The western boundary to the Beaufort Sea LME is at Franklin Strait south of Peel Sound and across eastern Viscount Melville Sound north of Prince of Wales Islands. This boundary is in the region of heaviest ice conditions that separates migratory stocks of belugas and bowheads from the Atlantic and Pacific sides. The northern boundary to the Canadian High Arctic-North Greenland LME is across the northern end of Penny Strait (between Bathurst Island and the Grinnell Peninsula of Devon Island), just north of Hell Gate and Cardigan Strait between Devon and Ellesmere islands, and across Smith Sound between Ellesmere and Greenland. With these boundaries the main feeding areas of walrus are contained within the Canadian Eastern Arctic-West Greenland LME. The southern boundary is from the southern tip of Greenland along the slope of southwestern Greenland and southern Davis Strait across to the northern end of the Labrador shelf. The western boundary to the Hudson Bay Complex LME is across the opening to Hudson Strait. There is also a boundary to this LME at Fury and Hecla Strait between the Gulf of Boothia and Foxe Basin.

17 - Hudson Bay Complex LME

This LME consists of three major areas: Hudson Bay, Foxe Basin, and Hudson Strait. Hudson Bay is a large and relatively shallow inland sea that receives much freshwater from rivers discharging mainly in the southern part. Foxe Basin is also a mostly shallow area, while the Hudson Strait is a deep channel extending into Foxe Channel that separates the Foxe Basin from Hudson Bay. The hydrography of the LME is influenced by Atlantic water circulating through the deeper parts of Hudson Strait and water of Pacific origin entering from the Baffin Current and from north into Foxe Basin through the Fury and Hecla Strait. The LME is ice-covered in winter with heavy ice conditions in Foxe Basin. All of Hudson Bay and most of Foxe Basin and Hudson Strait clear of ice during summer, with a relatively short open water period in Foxe Basin and Foxe Strait. The tides are strong and results in a dynamic pack ice in Hudson Strait and adjacent areas.

The Hudson Bay Complex LME contains many fish species with polar cod and capelin as important links in the food webs between plankton and higher trophic levels. The majority of bowheads of the Eastern Canada-West Greenland population are believed to winter in Hudson Strait, and a component of the stock migrates west to summer feeding areas in northwestern Hudson Bay and northern Foxe Basin. Narwhals of the Hudson Bay population have their

summering areas in northwestern Hudson Bay and wintering area in eastern Hudson Strait. Beluga whales of 3 (or possibly more) populations are found in the Hudson Bay Complex. The *Western Hudson Bay population* is the largest, with its main summering areas along the coast of southwestern Hudson Bay. The *Eastern Hudson Bay population* has its summering area along the coast of the Nastapoka Arc, inside of Belcher Islands. These two populations have their main wintering areas in Hudson Strait and adjacent areas. The *Ungava Bay population* had a restricted distribution in Ungava Bay along southeastern Hudson Strait but is now very low and possibly extirpated. There are two populations of walrus in this LME. Walrus of the Northern Hudson Bay-Davis Strait population summer in northwestern Hudson Bay and winter along Hudson Strait and further east along southern Baffin Island. Walrus of the Foxe Basin population is resident year-round in northern Foxe Basin. Three subpopulations of polar bears reside within the LME: Foxe Basin, Western Hudson Bay, and Southern Hudson Bay subpopulations.

The low-lying coasts along southwestern Hudson Bay and James Bay are important migratory habitats for shorebirds, geese and other birds breeding further north in the Canadian Arctic. Large numbers of lesser snow geese breed in the area, with the largest aggregations on the Great Plain of the Koukdjuak on Baffin Island adjacent to Foxe Basin, and on Southampton Island in northern Hudson Bay. Hudson eiders, which constitute a distinct subspecies of common eider, are year-round residents of Hudson Bay, wintering in polynyas near Belcher Islands.

The boundaries of this LME is at Fury and Hecla Strait connecting Gulf of Boothia with Foxe Basin, and at the eastern end of Hudson Strait across from the northern tip of Labrador via Resolution Island to the end of the Meta Incognita Peninsula.

18 - Labrador-Newfoundland LME

Only the northern portion of this LME, the Labrador shelf, lies within the Arctic area of Canada. The Labrador shelf is characterized hydrographically by the cold Labrador Current that flows south. The area is ice-covered in winter and generally remains fairly cold in summer. Along the slope there is a southward flow of cool Atlantic water as part of the circulation in the Labrador Sea. While the LME further south contains major fish stocks of Atlantic cod and capelin in the Newfoundland area, the Labrador shelf is a peripheral area in terms of seasonal fish migrations. Along the slope there are Greenland halibut and other deepwater species.

PAME

Protection of the Arctic Marine Environment

Borgir, Nordurslod / 600 Akureyri / ICELAND
Tel: +354 461 1355 / Fax: +354 462 3390
Email: pame@pame.is / Homepage: www.pame.is