

Final Report

Third Meeting of Scientific Experts on Fish Stocks in the Central Arctic Ocean

July 2015

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Introduction

The coastal states to the central Arctic Ocean (the Kingdom of Norway, the Russian Federation, the United States of America, Canada, and the Kingdom of Denmark) convened the Third Meeting of Scientific Experts on Fish Stocks in the Central Arctic Ocean in Seattle, Washington (April 14 – 16, 2015), as called for in the Chairman’s Statement from discussions regarding fish stocks in the central Arctic Ocean held in Nuuk, Greenland, in February 2014. The Chairman’s Statement from that meeting and Terms of Reference for the third meeting of scientific experts can be found in Appendix A.

In calling for a third meeting of scientific experts, the central Arctic Ocean coastal states noted that “though commercial fishing in the central Arctic Ocean is not imminent, there is a need for further scientific research and monitoring on the state and nature of living marine resources and associated ecosystems, and increased understanding of the impact of climate change on Arctic ecosystems in general and fish stocks in particular.”

The representatives from scientific institutions in the central Arctic Ocean coastal states were joined by some of those from other nations conducting Arctic research (China, Japan, Korea, Iceland). In addition, participation included members from international Arctic research organizations (International Arctic Science Committee (IASC), Sustaining Arctic Observing Network (SAON), International Council for the Exploration of the Sea (ICES)), the Ecosystem Approach Expert Group of the Protection of the Arctic Marine Environment Working Group of the Arctic Council, US domestic Arctic research organizations (the US Arctic Research Commission and the North Pacific Research Board), and organizations representing adjacent, high latitude oceans (e.g., North Pacific Marine Sciences Organization PICES). Appendix B contains a list of meeting participants.

The Hon. Fran Ulmer, Chair, US Arctic Research Commission, delivered the opening address on Arctic research needs. Jim Overland (US National Oceanic and Atmospheric Administration (NOAA) Office of Oceanic and Atmospheric Research) delivered a keynote address regarding Arctic climate change followed by Anne Hollowed (NOAA Fisheries Service) who discussed the impact of climate change on fisheries in relation to the Arctic. Copies of all presentations and submitted written remarks are available on the [meeting website](#).

Paul Niemeier (NOAA Fisheries Service) provided context for the meeting by presenting an overview of the Arctic international fishery management issues as developed by the 2014 diplomatic meeting of the Arctic coastal states in Nuuk, Greenland, followed by a presentation on findings from the Second Meeting of Scientific Experts on Arctic Fisheries by Alf Håkon Hoel (Institute of Marine Research, Norway).

Knut Sunnanå (Norway), Pavel Afanasyev (Russia), Libby Logerwell (U.S.), and Jim Reist (Canada) presented reviews of current programs for fish-relevant research and monitoring in the central Arctic Ocean and adjacent shelf areas and the status of research and monitoring in addressing gaps in knowledge on the distribution and abundance of fish in the central Arctic Ocean. Helle Siegstang (Greenland), although unable to attend, provided a presentation and written remarks on Arctic research of Greenland in advance of the meeting. Presentations by Olafur Ástþórsson (Iceland), Guoping Zhu (China), Taro Ichii (Japan), and SeokGwan Choi (Korea) described their nation’s research and monitoring activities in the Arctic.

Geographic Scope

Given the title of the meeting, “Third Meeting of Scientific Experts on Fish Stocks in the Central Arctic Ocean”, it is important to understand that the basic definition of the term “central Arctic Ocean” does not limit the geographic scope of scientific research that is of interest to the management of fish and shellfish stocks or other living marine resources. Following the guidance of the Nuuk deliberations, the term central Arctic Ocean is used herein to mean the extraterritorial waters of the Arctic (see Figure 2 in Appendix C). The coastal states identified the area as “the single high seas portion of the central Arctic Ocean that is entirely surrounded by waters under the fisheries jurisdiction of Canada, the Kingdom of Denmark in respect to Greenland, the Kingdom of Norway, the Russian Federation and the United States of America” (Chairman’s Statement from the February 2014 meeting in Nuuk, Greenland; see Appendix A).

Nonetheless, the geographic scope of scientific research was also defined in Nuuk to encompass an area broader than the central Arctic Ocean. The Chairman’s Statement adds that all parties agreed to continue to promote scientific research “with the aim of improving understanding of the living marine resources of the Arctic Ocean and the ecosystems in which they occur.” Consequently, the definitions of the Arctic Large Marine Ecosystems (LMEs) adopted by the Arctic Council in 2013 (see Figure 1 in Appendix C and the [Protection of the Arctic Marine Environment website](#)) were used as the starting point for defining the geographic scope of the ecosystems that are home to the living marine resources of the Arctic Ocean. Also in 2013, the Arctic Council adopted a revised definition of a concept closely related to LME known as ecosystem based management or the ecosystem approach to management (EA). EA recommends managing at the spatial scales of the Arctic LMEs. Both the geographic scope and the types of biological and physical observations (data) that are relevant to developing information products to support the management of Arctic fishes and shellfish are defined by the principles and practice of EA.

The extraterritorial waters identified in Nuuk are largely covered by the ecosystem referred to as the Central Arctic LME (Figure 2 and Table 1 in Appendix C). Recognizing that biological and physical linkages between the Central Arctic LME and the ecosystems defined by adjacent LMEs are certain to exist, the starting point for geographic scoping also included all of the LMEs contiguous with the Central Arctic LME (Figure 1 in Appendix C).

Working with the foregoing considerations in mind, the subsequent discussions regarding geographic scoping at the third meeting of scientific experts made it clear that no fixed boundaries would be appropriate to circumscribe the geographic scope of scientific investigations to improve understanding of the living marine resources of the Arctic Ocean and the ecosystems in which they occur. Although ecological linkages between the Central Arctic LME and adjacent LMEs are likely to occur, the scientific understanding of the linkages is currently incomplete, which precludes understanding the geographic range over which any given linkage could be operable. Discussions among the meeting participants also revealed a desire for some specificity in geographic scoping due to concerns that broadly defining the geographic scope could result in future research leaving open critically important information gaps regarding the abundance and distribution of fishes and shellfish in the extraterritorial waters of the central Arctic Ocean (Figure 2 in Appendix C). Further elaborations of concerns with respect to geographic scope are found in the individual breakout group reports.

Summary of Outcomes in Response to the Terms of Reference

The Terms of Reference developed in April 2014 based on discussions at the meeting in Nuuk (Appendix A) identify three desired products for this third meeting of scientific experts. Meeting participants (and correspondents who participated remotely) were challenged to produce working drafts of: (1) an Inventory of Arctic Research and Monitoring Programs; (2) a Report on the Status and Gaps of Arctic Research and Monitoring; and (3) a Framework for a Joint Program of Scientific Research and Monitoring for the central Arctic Ocean. Meeting participants and correspondents worked from initial drafts in three breakout groups to develop the requested products. Complete information on the outcomes from the breakout groups can be found online at the meeting website.

The major findings and conclusions of the three breakout group sessions along with the associated language from the Terms of Reference are as follows.

ToR 1. Continuing the review of current programs for research and monitoring environmental parameters and patterns of fish distribution and abundance; establishing an inventory of research and monitoring programs and preparing a report on the status of and gaps in knowledge on the distribution and abundance of fish in the central Arctic Ocean. Such an inventory should include programs occurring in immediately adjacent shelf areas (i.e., within EEZs), which are linked and have relevance to the central Arctic Ocean (high seas).

ToR 2. Developing a framework for a Joint Program of Scientific Research and Monitoring for the Central Arctic Ocean, including the definition of baseline information needs and methods necessary to determine the likelihood of sustainable fisheries being present. Additionally, this framework should include one or more components that investigate the role of fishes and shellfish in the marine ecosystems (and vice versa) in the Central Arctic Ocean, as well as linkages with the shelf areas and likely impacts of climate change.

Inventory of Arctic Research and Monitoring

Information relevant to fish stocks in the central Arctic Ocean and adjacent areas varies widely by geographic locality and disciplinary subject. As a consequence, producing a complete inventory of such information remains difficult. Information is abundant in areas where fisheries occur but scarce or non-existent in areas without fishing. Because of the lack of fisheries and the fact that the area has been extensively ice-covered prior to this century, limited information of relevance to the management of living marine resources, especially fish, has been developed for the central Arctic Ocean. Nonetheless, the participants and correspondents identified currently available primary sources of information, and the inventory is supported by an extensive [bibliography](#) compiled from contributions by meeting participants and correspondents. In addition to the current list of primary information sources and the bibliography, a stand-alone white paper with recommendations on approaches and means of conducting routine inventories of Arctic research and monitoring in the future was provided by Peter Pulsifer, chair of the IASC Arctic Data Committee. A link to the white paper can be found in the report of this breakout group.

Meeting participants came to the following conclusions with regard to observations, model data, and information products (information) relevant to fish stocks in the central Arctic Ocean and adjacent areas, referred to below as “Arctic”:

1. There are many sources of information on living marine resources in the Arctic; however, the information available from Arctic research and monitoring is highly variable along several dimensions, including geography.
2. Sources of information have not been exhaustively, systematically identified; there is no identifiable starting point for locating information on Arctic marine environments and living marine resources there.
3. Geographic variation in information is pronounced, with information more available from areas without permanent ice.
4. Areas with commercial fisheries adjacent to the central Arctic Ocean have more biological information than others.
5. Physical disciplines (ocean and atmosphere) have more information than do biological, economic, and human dimensions disciplines. Also, physical information in regards to the surface and upper water column is much more comprehensive than that for sub-surface and deeper water column. The information is also spatially biased in general towards shelf seas; thus, only limited data are available for the central Arctic Ocean.
6. The volume of knowledge on the Arctic is very large and growing rapidly; nonetheless, with respect to knowledge of direct interest to this forum, the growth is not necessarily organized or directed toward types of information most suitable to understanding management of fish stocks in the central Arctic Ocean and relevant adjacent areas.
7. A timely (regularly updated) and complete inventory of information on living marine resources and supporting ecosystems is essential to advise status reporting and joint monitoring and research activities.
8. Mechanisms and/or structures that allow for an ongoing and timely inventory of Arctic research and monitoring are essential. ICES could serve as a model in this regard.
9. The inventory format that is most useful and practical is a web-based directory of Arctic research, such as has been completed for the Antarctic. See for example the Antarctic Master Directory, part of the Global Change Master Directory ([GCMD](#)) hosted by NASA. See also the associated white paper by Pulsifer.
10. It is essential to develop the means of fostering international coordination and cooperation in the matter of Arctic data in view of potentially ongoing scientific efforts in monitoring at the regional, national, and international levels.

Report on the Status and Gaps of Arctic Research and Monitoring

Very few observations (data) have been gathered from the habitats of the central Arctic Ocean where commercial fishing operations would be feasible using fishing gear optimized for the likely target species (i.e. *Boreogadus* sp., *Arctogadus* sp., *Reinhardtius hippoglossoides*, and *Chionoecetes opilio*). No surveys capable of quantifying biomass or abundance of likely target species in these fishable habitats have so far been reported. Hence, on the basis of oceanographic features and life history aspects of relevant fish and shellfish species and the limited amount of qualitative survey information available from fishable habitats of the central Arctic Ocean, it is inferred that quantities of such fish stocks are

presently very limited and may be non-existent in the deeper waters of the Arctic Ocean beyond the shelf break (waters deeper than 1,000 meters). Occurrence of these species may be expected to increase when moving from the central Arctic Ocean toward the continental shelf areas.

Similarly, little research has been conducted in the central Arctic Ocean to investigate ecosystem functionality and the possible role of fishes and shellfish in the marine ecosystems there. Thus, a second major information gap is the information necessary to understand where the subject fish species could potentially fit into the food webs of the area. However, both lower trophic level organisms (e.g., phytoplankton and invertebrates) and higher trophic level species (e.g., birds and mammals) are better known because there have been some multi-national and multi-institutional Arctic scientific surveys.

A third information gap is related to the baseline data used to formulate scenarios, which, to-date, has been based upon a limited amount of observations mainly in the adjacent waters. The future role of any pelagic fish species in the central Arctic Ocean is currently unknown.

Participants in the first scientific meeting in Anchorage, Alaska, in 2011 noted: “Within the Arctic, current information on distribution and abundance of concentrations of these species, uncertainty in the ecosystem effects of fishing, and the technical and logistical challenges of conducting fishing operations in remote regions all suggest that commercial fisheries are not likely to emerge in the short term.” The conclusions made by meeting participants at this third scientific meeting continue to uphold these initial conclusions.

Taking into consideration that much of the general knowledge of the Arctic marine environment is still model-based and that survey data are lacking for most of the central Arctic Ocean, meeting participants reached the following conclusions regarding the status of and gaps in Arctic research and monitoring, with a focus on identifying actions to be taken based on knowledge gaps.

1. There is a dearth of basic information as to the species (fish and shellfish in particular) found in the central Arctic Ocean and their geographic distribution. Surveys and research activities in the central Arctic Ocean and adjacent areas should be oriented to produce and report information on all relevant species. Several fish and shellfish atlas projects are ongoing, and efforts should be made to coordinate these atlas projects on a regular basis, as well as coordinating surveys delivering relevant data.
2. Recognizing the potential large effort needed to provide a full picture of fish and shellfish in the central Arctic Ocean, should they exist there, it is strongly encouraged that surveys of the central Arctic Ocean focus on potential commercial stocks. Due to a lack of data relevant to an advice process, in the interim period, we recommend applying precautionary measures on activities impacting living marine resources in the central Arctic Ocean.
3. As the lack of knowledge, in particular on fish and shellfish, is most profound in the waters beyond national jurisdiction of the central Arctic Ocean, it is important for research to focus on these waters and also to focus on linkages with surrounding areas of national jurisdiction in order to respond to the overall question regarding possible presence of commercial quantities of fish and shellfish in the central Arctic Ocean.

4. Data and knowledge of other parts of the Arctic ecosystems (other than fish and shellfish) are obtained to a large extent in the areas of national jurisdiction, and meeting participants expect that this kind of knowledge will be obtained in the central Arctic Ocean in the near future. It is therefore important to start developing an appropriate assessment process to synthesize and integrate existing and new knowledge with respect to the ecosystem in the central Arctic Ocean.
5. At present, we observed, there is a preponderance of research and monitoring that focuses on ecosystem structure and processes. It is recommended to continue this effort. Collection of data (i.e. stock structure, age / size composition, abundance, growth, diet, natural mortality and reproductive potential) necessary to develop single species and fishery stock assessments is, however, also essential in order to provide advice on potential harvesting.
6. We realize it is challenging to conduct comprehensive monitoring of the whole central Arctic Ocean. Therefore, effective coordination among coastal states and other nations is critical with respect to monitoring, research, and survey efforts.
7. Recognizing that the marine ecosystems in the central Arctic Ocean and adjacent waters are changing with respect to climate impacts, focus should be on the need for projecting likely future scenarios with respect to species movements, colonization, and related changes. Appropriate modeling and studies to develop these scenarios are required.

Framework for a Joint Program of Scientific Research and Monitoring for the Central Arctic Ocean

Meeting participants spent a significant amount of time discussing the purpose of such a framework and what questions it should be designed to answer, including making this broader than just fish stocks as mandated in the Terms of Appendix (see Appendix A) and more towards an integrated ecosystem approach. The key questions identified by the breakout group and discussed by the plenary are outlined below. The group also determined that conducting a thorough synthesis and integration analysis of “where we are now” regarding understanding fish stocks of the central Arctic Ocean is a crucial first step to designing a robust joint framework.

A joint international program of monitoring and research could improve the information on fish and shellfish stocks in the central Arctic Ocean. Survey designs and sampling protocols should be oriented toward understanding the distribution and abundance of stocks of subject fish species (i.e., pelagic species *Boreogadus* and *Arctogadus* spp., as well as benthic species such as *Reinhardtius hippoglossoides* and *Chionoectes opilio* that may occur in some locations) in the central Arctic Ocean and adjacent shelf areas. Determination of trophic linkages of the subject species to predators and prey, as well as the ontogenetic phenology of the fish stocks in relation to geographic distribution, would also be essential to assessment of potential stocks.

Meeting participants agreed that the main framework document should be brief and merely outline the general guiding principles and key questions to be answered by such a program. Details of how to implement the joint program of scientific research and monitoring (such as protocols and data collection) should be included in appendices to the framework document. These appendices will require separate workshops to be developed. The participants

identified the following key questions to be answered through a joint research and monitoring program:

1. Are there harvestable fish resources in the central Arctic Ocean at present? If fishable concentrations of commercial species of interest are observed in the central Arctic Ocean, what are their distributions and abundances?
2. If so, can the central Arctic Ocean fish resources be harvested sustainably with respect to both the target fish stocks and the dependent parts of the ecosystem? If not, what are the prospects for the development of fisheries in the future?
3. What are the mechanisms that enable key ecological linkages between the fish stocks of the central Arctic Ocean and adjacent shelf ecosystems? What do those mechanisms teach about how fisheries in the central Arctic Ocean may affect the adjacent shelf ecosystems, including fish stocks, marine mammals, birds, and fisheries dependent communities (which include those communities that are dependent on subsistence harvests of fish, birds, and mammals)?
4. Over the next 20-30 years, what changes in fish populations, dependent species, and the supporting ecosystems may occur in the central Arctic Ocean and the adjacent shelf ecosystems?

In addition to the three requested products noted above in ToR1 and ToR2, ToR3 addressed an action plan for the Joint Program of Scientific Research and Monitoring.

ToR 3. Considering the development of an action plan (e.g., notional schedules, areas of operations, costs) for the Joint Program of Scientific Research and Monitoring.

Meeting participants noted that an action plan should include a timeline and general activities to be conducted to implement the joint program of scientific research and monitoring. The timeline would capture generalities for the next 1-5 years, the next 5-10 years, and a longer timeframe looking at 20+ years into the future. However, participants determined that it would be best to develop the action plan after the framework was fully developed.

The final two topics of discussion based on the Terms of Reference related to the promotion of cooperation and the potential need for additional workshops to address specific issues identified in this third meeting of scientific experts.

ToR 4. Considering how to promote cooperation with the International Council for the Exploration of the Sea (ICES) and the North Pacific Marine Science Organization (PICES), as well as other relevant scientific entities and academic programs.

Meeting participants identified several means for promoting more international cooperation, including:

- Continuing these Meetings of Scientific Experts on Fish Stocks in the Central Arctic Ocean;
- The Pacific Arctic Group;
- European Polar Board EU-Polar Net (specifically [task 3.1](#));
- Coordination with domestic programs of nations conducting research in the Arctic (e.g., China, Korea, Iceland, Japan)

- o Bilateral scientific cooperation
- o North Pacific Research Board [Arctic Integrated Ecosystem Research Program](#) now being developed
- Ecosystem Studies of Sub-Arctic Seas (ESSAS);
- IASC;
- ICES;
- PICES; and
- Arctic Council working groups as appropriate (noting the Arctic Council does not address fisheries-related issues).

Of these groups, only ICES currently has a formal, advisory role in relation to management authorities. Also, the groups vary in importance, with only the meetings of scientific experts having an explicit and exclusive focus on fish stocks in the central Arctic Ocean. There are important linkages between these bodies, which should be used for the purpose of enhancing scientific understanding of the issues at hand.

The meeting participants also identified several workshops or scientific meetings occurring shortly after this meeting where efforts on better coordination could occur, such as:

- Lowell Wakefield Symposium in Anchorage, Alaska, on Data Limited Fisheries in May 2015;
- PICES-ICES Effects of Climate on Fisheries Scientific Meeting series;
- ESSAS, including the June 2015 conference in Seattle on the role of ice in the sea;
- PICES [2015 Annual Meeting](#) in Qianqdao, China (October 2015) sessions “S6 Ocean Acidification Observation Network for the North Pacific and adjacent areas of the Arctic Ocean”;
- Polar Data Forum at University of Waterloo (October 2015);
- Conference on [Arctic Marine Resource Governance](#) in Iceland (October 2015); and
- Arctic Observing Summit in Fairbanks (March 2016).

ToR 5. Considering workshops to address specific issues, including questions relating to modelling of ecosystem properties, survey design, sampling methods and projecting future states of the Central Arctic Ocean, its biota and ecosystems.

Meeting participants identified the following as needed follow-up meetings and workshops to advance the issues and documents forward from this meeting, in particular the Joint Program of Scientific Research and Monitoring and the associated action plan:

- A workshop to examine ways and means to carry out surveys for stock assessment in ice-infested waters, including technological solutions for fishery surveys in ice-infested waters (e.g., AUVs, sonar). This would contribute to enhancing our ability to make statements regarding the abundance of fish in the central Arctic Ocean.
- A workshop to develop the research program commissioned by the Nuuk meeting (February 2014) and for which the key questions were identified at the scientific meeting in Seattle (April 2015). The workshop would elaborate upon the research questions and provide a plan of implementation, as well as allow for the development of a more detailed Action and Scientific Plan for the Joint Research and Monitoring

Program, including a discussion of common sampling protocols and standardized submission of data; and

- Fisheries Technology and Economics of Arctic fisheries.

Appendix A : Chairman's Statement from the February 2014 Nuuk, Greenland, Meeting and the Terms of Reference for the Third Meeting of Scientific Experts

MEETING ON ARCTIC FISHERIES Nuuk, Greenland, 24-26 February 2014

CHAIRMAN'S STATEMENT

Officials from Canada, the Kingdom of Denmark, the Kingdom of Norway, the Russian Federation and the United States of America met in Nuuk, Greenland from 24-26 February 2014 to continue discussions toward the development of interim measures to prevent unregulated fishing in the central Arctic Ocean and to continue discussion of related scientific matters.

Scientific Matters

At the meeting in Nuuk, officials reviewed the outcomes of the 2nd Scientific Meeting on Arctic Fish Stocks held in Tromsø, Norway 28-31 October 2013 and decided on next steps to continue to advance scientific understanding of living marine resources and their ecosystems in the Arctic Ocean. They agreed:

- to continue to promote scientific research, and to integrate scientific knowledge with traditional and local knowledge, with the aim of improving understanding of the living marine resources of the Arctic Ocean and the ecosystems in which they occur;
- to promote cooperation with relevant scientific bodies, including but not limited to the International Council for the Exploration of the Sea (ICES) and the North Pacific Marine Science Organization (PICES); and
- to hold a 3rd Scientific Meeting no later than the end of 2015 and to finalize in the coming weeks terms of reference for that meeting.

Interim Measures

The meeting reaffirmed that, based on available scientific information, commercial fishing in the high seas area of the central Arctic Ocean is unlikely to occur in the near future. The meeting therefore also reaffirmed that there is no need at present to develop any additional regional fisheries management organization (RFMO) or arrangement for this area.

The meeting agreed on the desirability of developing appropriate interim measures to deter unregulated fishing in the future in the high seas area of the central Arctic Ocean.

Such interim measures will recognize that at least one existing RFMO – the North-East Atlantic Fisheries Commission (NEAFC) – has the competence to adopt fisheries conservation and management measures in a portion of this high seas area, should such fisheries take place there. The interim measures will neither undermine nor conflict with the role and mandate of any existing international mechanism relating to fisheries, including NEAFC.

Based on a proposal from the United States, which was developed further during the meeting, officials of the five States agreed that the necessary interim measures will:

- Apply to the single high seas portion of the central Arctic Ocean that is entirely surrounded by waters under the fisheries jurisdiction of Canada, the Kingdom of Denmark in respect of Greenland, the Kingdom of Norway, the Russian Federation and the United States of America.
- Commit States participating in the interim measures to:
 - authorize their vessels to conduct commercial fishing in this high seas area only pursuant to one or more regional or subregional fisheries management organizations or arrangements that are or may be established to manage such fishing in accordance with modern international standards;
 - establish a joint program of scientific research with the aim of improving understanding of the ecosystems of this area;
 - coordinate their monitoring, control and surveillance activities in this area; and
 - ensure that any non-commercial fishing in this area does not undermine the purpose of the interim measures, is based on scientific advice and is monitored, and that data obtained through any such fishing is shared;
 - encourage other States to take measures in respect of vessels entitled to fly their flags that are consistent with the interim measures; and
- not prejudice the rights, jurisdiction and duties of States under relevant provisions of international law as reflected in the 1982 United Nations Convention on the Law of the Sea, or the 1995 UN Fish Stocks Agreement, nor alter the rights and obligations of States that arise from relevant international agreements.

The Way Forward

The meeting agreed that it is appropriate for the States whose exclusive economic zones border the high seas area in question to take the initiative on this matter. They also continued to recognize the interests of Arctic residents, particularly the Arctic indigenous peoples, in these matters and to engage with them as appropriate.

The meeting agreed to develop a Ministerial Declaration for signature or adoption by the five States based on the provisions described above. The meeting expressed the desire to finalize the Ministerial Declaration for signature or adoption in June 2014.

The meeting also reaffirmed that other States may have an interest in this topic and looked forward to a broader process involving additional States beginning before the end of 2014. The purpose would be to develop a set of interim measures, compatible with the Ministerial Declaration, that would include commitments by additional States. The final outcome could be a binding international agreement.

21 April 2014

Terms of Reference for A Third Meeting of Scientific Experts on Fish Stocks in the Central Arctic Ocean

Though commercial fishing in the central Arctic Ocean is not imminent, there is a need for further scientific research and monitoring on the state and nature of living marine resources and associated ecosystems, and increased understanding of the impact of climate change on Arctic ecosystems in general and fish stocks in particular.

Following discussions in Oslo, Norway, on 22 June 2010, and in Washington, D.C. in April-May 2013, where senior officials of Canada, the Kingdom of Denmark, Norway, the Russian Federation and the United States of America (the Arctic Ocean coastal States) stressed the need for further scientific research on fish stocks and their ecosystems in the Arctic Ocean, two Meetings of Scientific Experts on Fish Stocks in the Arctic Ocean were held--in Anchorage, Alaska, on 15-17 June 2011, and in Tromsø, Norway, on 28-31 October 2013.

The Anchorage workshop addressed current information on fish stocks, reviewed ongoing and planned scientific activities, identified current information gaps and indicated priorities in research requirements. The Tromsø workshop continued the consideration of these issues, and also discussed developments in other international scientific fora and ways to strengthen scientific cooperation with existing initiatives.

At a meeting of senior officials of the five Arctic Ocean coastal States in Nuuk, Greenland, on 24-26 February 2014, the outcomes of the Tromsø meeting were reviewed. Representatives of the States agreed that the scientific dialogue on living marine resources in the central Arctic Ocean should be continued.

Building on the Terms of Reference that were agreed before the Anchorage and Tromsø meetings, the purpose of these supplementary Terms of Reference is to describe the issues which the scientific experts are requested to consider in a third meeting. With the need for continuity in mind, this meeting will follow up on the previous meetings by:

1. Continuing the review of current programs for research and monitoring environmental parameters and patterns of fish distribution and abundance; establishing an inventory of research and monitoring programs and preparing a report on the status of and gaps in knowledge on the distribution and abundance of fish in the central Arctic Ocean. Such an inventory should include programs occurring in immediately adjacent shelf areas (i.e., within EEZs), which are linked and have relevance to the central Arctic Ocean (high seas).
2. Developing a framework for a Joint Program of Scientific Research and Monitoring for the Central Arctic Ocean, including the definition of baseline information needs and methods necessary to determine the likelihood of sustainable fisheries being present. Additionally, this framework should include one or more components that investigate the role of fishes and shellfish in the marine ecosystems (and vice versa) in the Central Arctic Ocean, as well as linkages with the shelf areas and likely impacts of climate change.
3. Considering the development of an action plan (e.g., notional schedules, areas of operations, costs) for the Joint Program of Scientific Research and Monitoring.

4. Considering how to promote cooperation with the International Council for the Exploration of the Sea (ICES) and the North Pacific Marine Science Organization (PICES), as well as other relevant scientific entities and academic programs.

5. Considering workshops to address specific issues, including questions relating to modelling of ecosystem properties, survey design, sampling methods and projecting future states of the Central Arctic Ocean, its biota and ecosystems.

The meetings should include relevant scientific expertise from the Arctic Ocean coastal States, as well as other relevant scientific expertise from ICES, PICES, and other relevant bodies. The meetings will continue to consider the traditional and local knowledge held by the indigenous peoples of the Arctic region.

The third meeting of scientific experts should be held no later than June 2015, at a venue yet to be determined.

The outcomes of this third scientific workshop will advance scientific understanding of the status of fish stocks in the Central Arctic Ocean, their role in Arctic marine ecosystems, and linkages with adjacent seas.

The scientific experts will report back to their respective Governments, who will decide on further steps to be taken.

Appendix B: List of Participants and Correspondents*

Last Name	First Name	Country	Email Address
Afanasyev	Pavel	Russia	
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* Correspondents were unable to attend the meeting in person but participated either remotely or by reviewing documents prior to and after the meeting.

Appendix C: Figures and Tables

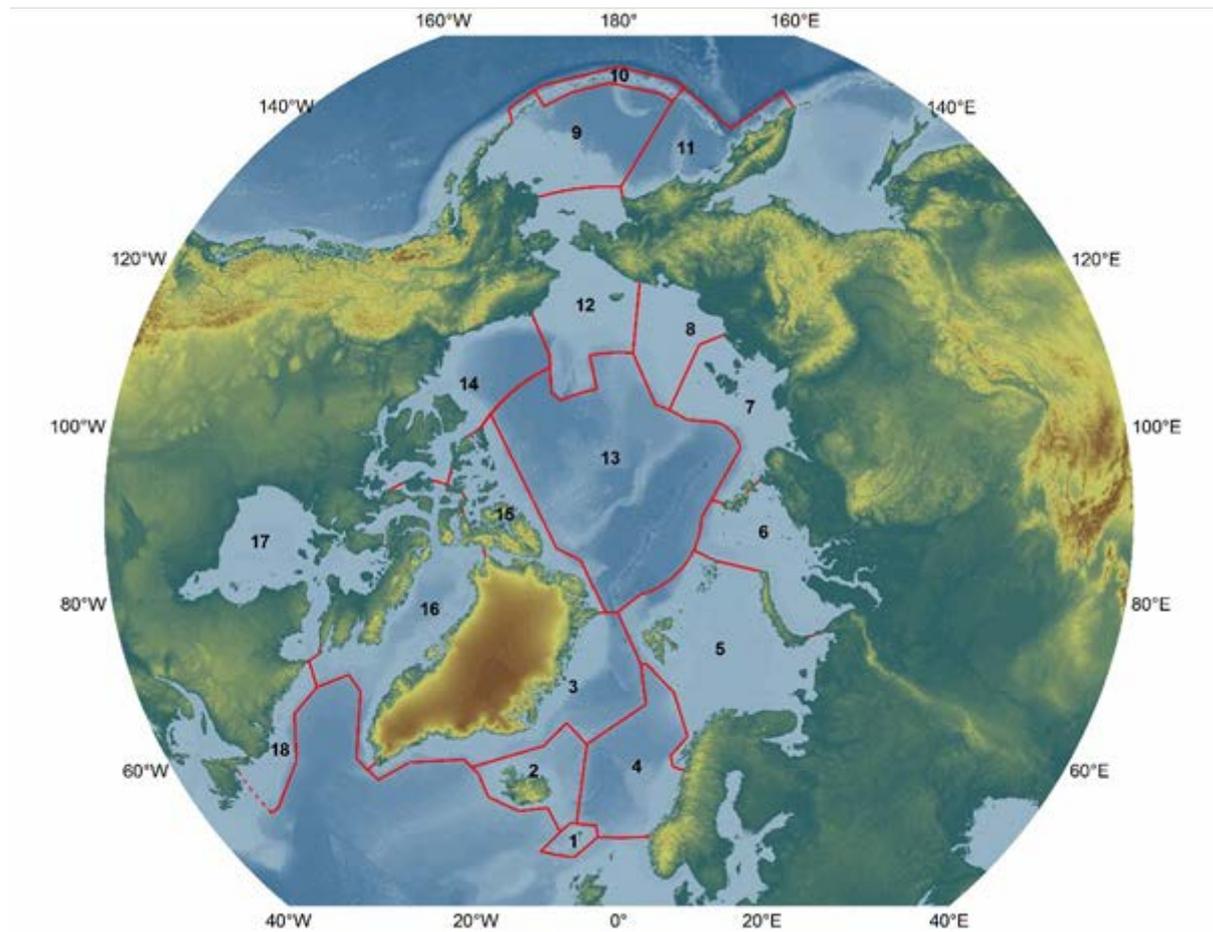


Figure 1. Revised map of 18 Arctic LMEs (version 17 April 2013). The revisions resulted in 18 LMEs for the Arctic by addition of a new LME in the Bering Sea area: the *Aleutian Archipelago LME*. A summary of the 18 LMEs with information on their areal extent is given in Table 1 below.

Table 1. List of the 18 Arctic LMEs and their areas.

No	Name	Area (million km²)
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	Aleutian 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

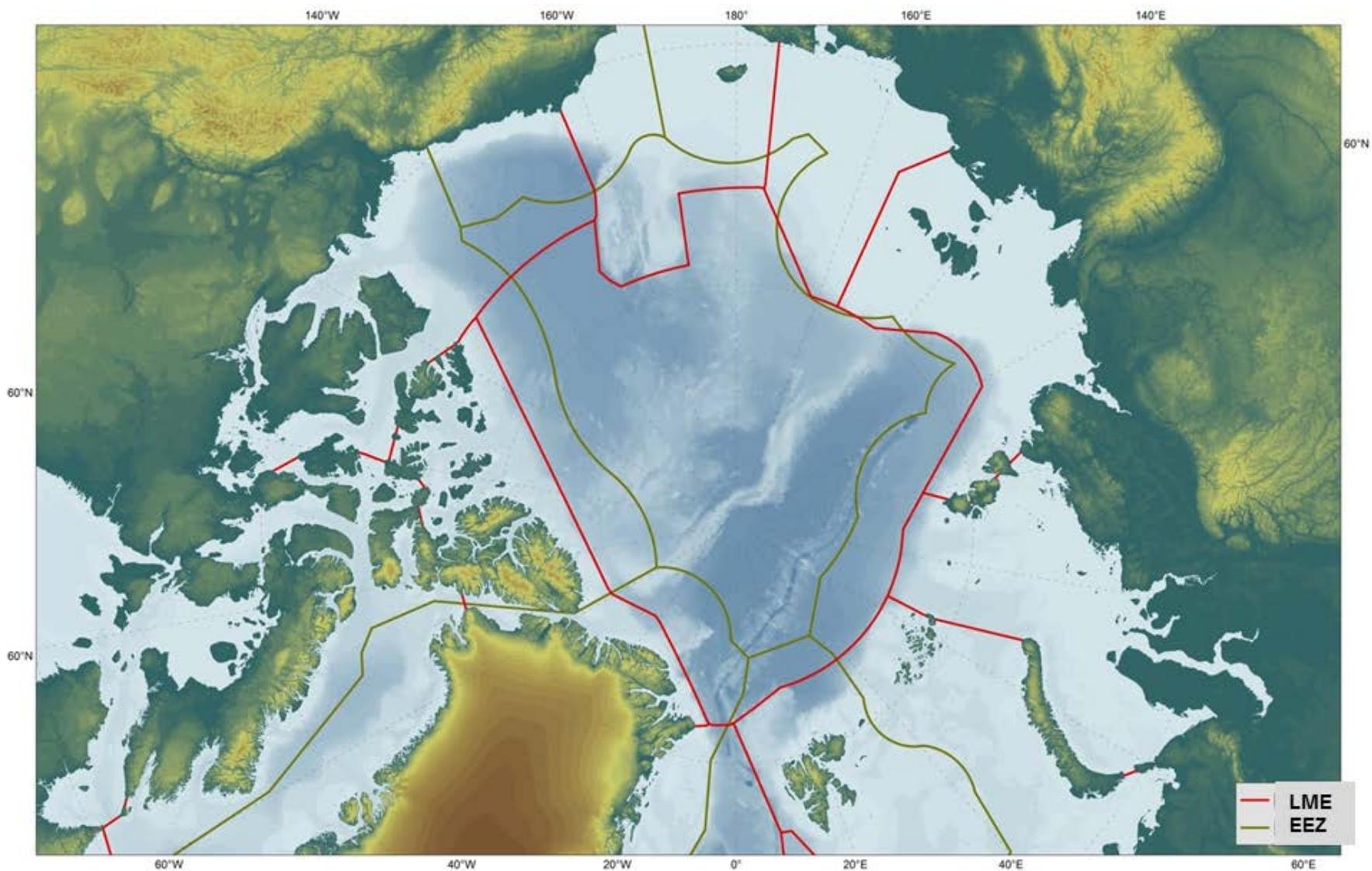


Figure 2. LME and Exclusive Economic Zone boundaries of the Arctic Ocean.