Report of the Third Meeting of the Provisional Scientific Coordinating Group under the Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean

28-29 September 2022

Convened Virtually

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List of Acronyms and Abbreviations

CAO:	Central Arctic Ocean
CCAMLR:	Commission for the Conservation of Antarctic Marine Living Resources
COP:	Conference of the Parties
DOI:	Digital Object Identifier
DSP-WG:	Data Sharing Protocol Working Group
EU:	European Union
FiSCAO:	Scientific Experts on Fish Stocks in the Central Arctic Ocean
ICC:	Inuit Circumpolar Council
ICC AK:	Inuit Circumpolar Council Alaska
ICES:	International Council for the Exploration of the Sea
JPSRM:	Joint Program of Scientific Research and Monitoring
MM-WG:	Mapping and Monitoring Working Group
MOSAiC:	Multidisciplinary drifting Observatory for the Study of Arctic Climate
NOAA:	National Oceanic and Atmospheric Administration
PAME:	Protection of the Arctic Marine Environment
PICES:	North Pacific Marine Science Organization
PSCG:	Provisional Scientific Coordinating Group
SAS:	Synoptic Arctic Survey
ToRs:	Terms of Reference

Executive Summary

Delegations from Canada, the People's Republic of China, the Kingdom of Denmark in respect of the Faroe Islands and Greenland, the European Union (EU), Iceland, Japan, the Republic of Korea, the Kingdom of Norway, and the United States of America met virtually September 28-29, 2022, for the third meeting of the Provisional Scientific Coordinating Group (PSCG) to continue discussions and progress to ensure the Parties can meet the milestones in Article 4 of the *Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean* ("the Agreement") related to the Joint Program of Scientific Research and Monitoring (JPSRM). Due to an oversight of using the attendee list from the second PSCG meeting held in March 2022, in which the Russian Federation did not send any delegates to that second meeting, Russia did not receive the advance materials of this third meeting and therefore did not send any delegates to the meeting. Representatives of the International Council for the Exploration of the Sea (ICES) and the North Pacific Marine Science Organization (PICES) also attended portions of the meeting. Ms. Candace Nachman (United States) served as the provisional Chair for the meeting.

The COP Heads of Delegation approved several of the recommendations from the March 2022 PSCG at the May 31 COP meeting, which guided the agenda for this third PSCG meeting. Based on that approval, the primary topics of discussion at the third PSCG meeting included: the questions to be answered by the mapping and monitoring program of the JPSRM; development of a JPSRM data sharing protocol; and logistics for establishing the two working groups to advance the mapping and monitoring efforts and the development of the data sharing protocol.

The Chair provided a review of the terms of reference (ToRs) approved by the COP at the May 31, 2022, virtual meeting for the establishment of two PSCG working groups: a Mapping and Monitoring Working Group (MM-WG) and a Data Sharing Protocol Working Group (DSP-WG). The Chair noted that ToRs for both working groups were not able to be fulfilled within the timeline provided, as the working groups were not formally established and did not conduct intersessional work between the May 31, 2022, COP meeting and the time of the third PSCG meeting.

The Chair stated that one of the primary objectives of this PSCG meeting was to establish leadership and membership for the two working groups and to begin work prior to the November 23-25, 2022 COP meeting given that the work of the two groups needs to be ready for review and discussion at a spring 2023 PSCG meeting.

To begin the formal discussion on the next steps needed to complete the mapping and monitoring plan of the JPSRM, also referred to as the 'science plan' in the March 2022 second PSCG meeting report, the United States and China both presented overviews of the discussion papers provided by each delegation prior to the PSCG meeting. These discussion papers can be found in Annexes 3 and 4, respectively. The United States explained that section II of their discussion paper contains the questions discussed at the second PSCG meeting in March 2022. The black text contains the language as presented in advance of the March 2022 meeting with alterations based on discussions at the second PSCG meeting in blue text. The document does not include any new priorities for the PSCG to consider. China noted the overlap of their discussion paper with the one presented by the United States and that the two documents are complementary to one another. The Chinese paper contains a stepwise approach given the tight timeline to establish the JPSRM: (1) agree on a framework; (2) input priority elements and indicators;

and (3) develop standards and protocols to facilitate data sharing. China also noted that monitoring should be based on the mapping results.

Following the presentation of both papers, the EU noted they have already completed several expeditions in recent years that resulted in data collection relevant to the Agreement. The EU also has standard operating and sampling procedures in place that can provide a lot of information and input to the working groups moving forward. The EU shared a brief presentation of the results from some recent expeditions to provide a general perspective of the situation in the CAO and adjacent areas and to provide a better understanding of what the JPSRM monitoring program should look like.

The meeting attendees then discussed the proposed JPSRM questions based on the outcomes of the March 2022 PSCG meeting. The Chair reminded the meeting attendees that the overarching questions discussed at the second PSCG meeting have been developed over several years and a series of meetings of the PSCG and its predecessor discussions. The Chair also noted that there will need to be agreement on the overarching and sub-questions moving forward as they will guide the implementation of the JPSRM. The group reviewed and provided additional edits to the questions contained in Section II of the United States discussion paper. A clean version of the updates to the questions contained in the United States discussion paper based on the discussions at the meeting can be found in Annex 6.

One delegation requested to identify Indigenous and local communities separately instead of lumping them together. This distinction was made to emphasize the significance of Indigenous peoples' distinct status and rights recognized by their respective nation-states and by the international community. There was also a lot of discussion regarding including communities in the questions, and one delegation suggested striking the language altogether. Representatives from several delegations spoke to the linkages Arctic Indigenous communities have with the land and ocean and that they are a part of the ecosystem. Following robust discussion, a majority of the delegations agreed it was important to keep the language about both Indigenous communities and local communities in the questions where that language appears.

Other issues or items to note from the discussion include:

- The need to demarcate the extents or what is meant when talking about the Atlantic and Pacific Gateways;
- Having Parties provide updates of their recent research and scientific efforts in the CAO and surrounding ecosystems at the first meeting of the MM-WG;
- The need to be careful about being overly prescriptive in the questions with examples in parentheses (much of the detail would come out through discussions within the working groups);
- Since these questions are looking to provide answers about potential future scenarios, need to be careful about saying "will" versus "could" or "would"; and
- ICC requested to include a definition of Indigenous Knowledge in the U.S. discussion document moving forward. The definition appears on page 15 of the 2022 "*Circumpolar Inuit Protocols for Equitable and Ethical Engagement*" report.

The closing topic of discussion regarding mapping and monitoring was leadership of and next steps for the MM-WG. The United States and the EU volunteered to co-chair the MM-WG. There was agreement that efforts of the MM-WG needed to get underway immediately. Finally, the delegates were asked to

consider the questions contained in section III part 1 of the United States' discussion paper and the concepts contained in China's mapping and monitoring draft framework document to help begin the conversations within the MM-WG.

To begin the formal discussion on the next steps needed to complete the data sharing protocol for the JPSRM, the United States and China both presented overviews of the discussion papers provided by each delegation prior to the PSCG meeting. These discussion papers can be found in Annexes 3 and 7, respectively. China noted the need for the DSP-WG to develop standard specifications and made reference to the system used by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). China described the hybrid framework proposed using both centralized and distributed systems. The United States noted many similarities exist between the two discussion papers on the topic of data sharing with a recommendation to combine the two papers to help guide the work of the DSP-WG. The United States provided a review of main issues discussed at the second PSCG meeting on this topic, provided proposed guidance for moving forward, and proposed a framework for holding data until the PSCG finalizes and operationalizes a formal data sharing protocol.

The United States recommended adopting the recommendations from reports of earlier science meetings related to the Agreement regarding data sharing. In the interim, the United States recommends building on the current arrangement: the United States hosted a website for sharing information and final reports among the Parties and public. The United States proposed to build a public and confidential website for the PSCG. The United States presented a prototype of such a website which would allow the PSCG to communicate globally. The United States offered the same for the COP. This would allow for a single location for delegations to share results and reports. The United States recommended including a section of the website that would require log-in credentials to protect the data collected through the implementation of the JPSRM. The website could also be used to create events, which can serve as a way for the working groups to organize themselves, which would make this a transparent process. The United States did not recommend this should be a centralized database; rather, it would allow information sharing in the interim.

Following these presentations, ICC noted the release of eight protocols for equitable and ethical engagement of Inuit and Indigenous Knowledge developed through a synthesis report of Inuit produced materials and voices that address existing rules, laws, values, guidelines, and protocols for the engagement of Inuit communities and Indigenous Knowledge and through a series of workshops convening Inuit Delegates that captured Indigenous Knowledge perspectives, needs, priorities, and guidance on future engagement processes. These protocols were developed to inform decision-makers, policymakers, researchers, and others operating in the Arctic on the ethical and equitable engagement of Inuit and their Indigenous Knowledge.

One delegation noted the need to develop policies regarding how to deal with public data, data sharing, and connectivity to existing data infrastructure. Additionally, given current data transparency, open data movements, and the pressure in the scientific community to make data public, there will likely be pressures to make the data public. ICES shared that they have policies that can accommodate both open and closed data systems and can share those with the DSP-WG if that would be helpful. One delegation noted the existence of many data sharing standards and that the PSCG should consider which one is most appropriate. There is no need to invent a standard just for the PSCG, but the one the PSCG selects should have broad applicability.

The closing topic of discussion regarding the data sharing protocol was leadership of and next steps for the DSP-WG. China volunteered to co-chair the DSP-WG. No other delegation offered to co-chair the DSP-WG with China at the time, but Canada, Norway, and the United States all agreed to consider co-chairmanship. There was agreement that efforts of the DSP-WG needed to get underway immediately. There was also a request and agreement by the PSCG delegations that the membership would be raised from two to three representatives to allow for inclusion of Indigenous Knowledge and local knowledge holders in addition to technical experts.

The PSCG delegations reiterated the request for the COP to approve a spring 2023 PSCG meeting to be held in-person. The PSCG also reiterates the recommendation shared at the May 31, 2022, virtual COP meeting for the COP to develop ToRs and other procedures for the function of the joint scientific meetings in accordance with Article 4 paragraph 6 of the Agreement, building on the ToR and the work of the PSCG, particularly to finalize the JPSRM and develop implementation plans for the JPSRM.

The PSCG appreciates that the topic of exploratory fishing is on the provisional agenda for the November 2022 COP meeting and requests that when discussing that agenda item, the COP identify milestones for establishing the exploratory fishing measures and provide a vision for PSCG involvement in their development. The PSCG also reiterates the need for the COP to identify resources and infrastructure to implement the JPSRM when it is approved. Lastly, the PSCG requests that the COP develop specific messaging regarding the importance of the Agreement and the value of Parties putting effort into moving the JPSRM forward.

The final agenda item was a preliminary discussion about who might serve as the first official Chair and Vice-Chair of the PSCG. The Chair reminded the meeting attendees that according to the draft PSCG rules of procedure, it is up to the PSCG to nominate a Chair and Vice-Chair and for those nominations to be decided upon by the Heads of Delegation at the COP.

1 Introduction

Delegations from Canada, the People's Republic of China, the Kingdom of Denmark in respect of the Faroe Islands and Greenland, the European Union (EU), Iceland, Japan, the Republic of Korea, the Kingdom of Norway, and the United States of America met virtually September 28-29, 2022, for the third meeting of the Provisional Scientific Coordinating Group (PSCG) to continue discussions and progress to ensure the Parties can meet the milestones in Article 4 of the *Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean* ("the Agreement") related to the Joint Program of Scientific Research and Monitoring (JPSRM). Due to an oversight of using the attendee list from the second PSCG meeting held in March 2022, in which the Russian Federation did not send any delegates to that second meeting, Russia did not receive the advance materials of this third meeting and therefore did not send any delegates to the meeting. Representatives of the International Council for the Exploration of the Sea (ICES) and the North Pacific Marine Science Organization (PICES) also attended portions of the meeting. Ms. Candace Nachman (United States) served as the provisional Chair for the meeting.

The meeting followed the second PSCG meeting hosted by the United States and held virtually on March 1-3, 2022, and the first PSCG meeting hosted by the EU and held in Ispra, Italy on February 11-13, 2020. The meeting also followed virtual meetings of the Conference of the Parties (COP) held on May 31, 2022, and August 31, 2022.

The COP Heads of Delegation approved several of the recommendations from the March 2022 PSCG at the May 31 COP meeting, which guided the agenda for this third PSCG meeting. Based on that approval, the primary topics of discussion at the third PSCG meeting included: the questions to be answered by the mapping and monitoring program of the JPSRM; development of a JPSRM data sharing protocol; and logistics for establishing the two working groups to advance the mapping and monitoring efforts and the development of the data sharing protocol.

This report summarizes the discussions and decisions of the third PSCG meeting in relation to the agenda (Annex 1). A full list of meeting attendees is available in Annex 2.

2 Science-related Milestones in the Agreement and PSCG Tasks

The provisional PSCG meeting Chair ("Chair") provided a brief review of the deadlines and milestones contained in the Agreement related to Article 4. In accordance with Article 11 of the Agreement, the Agreement entered into force on June 25, 2021, 30 days after ratification of the Agreement by all 10 Signatories. Article 4 states the Parties agree to establish, within two years of the entry into force of the Agreement, a JPSRM with the aim of improving the understanding of the ecosystems of the Agreement Area and, in particular, of determining whether fish stocks might exist in the Agreement Area now or in the future that could be harvested on a sustainable basis and the possible impacts of such fisheries on the ecosystem in the Agreement Area. Additionally, Article 4 requires the adoption of a data sharing protocol as part of the JPSRM within two years of entry into force of the Agreement. Therefore, the Parties need to establish both the JPSRM and finalize the associated data sharing protocol by June 25, 2023.

While not contained in the article specific to the JPSRM, the Agreement also requires the Parties to establish, within three years of entry into force of the Agreement, conservation and management measures for exploratory fishing in the Agreement Area (see Article 5 paragraph (1)(d)). While the issue of exploratory fishing will be discussed at the November 2022 COP meeting, the PSCG delegates anticipate receiving direction from the COP at a future date to assist with the development of any such measures as they relate to the execution of exploratory fishing operations. The deadline for establishing such measures is June 25, 2024.

The Chair provided a review of the terms of reference (ToRs) approved by the COP at the May 31, 2022, virtual meeting for the establishment of two PSCG working groups: a Mapping and Monitoring Working Group (MM-WG) and a Data Sharing Protocol Working Group (DSP-WG). The ToRs for the two working groups as agreed upon by the PSCG at the second meeting in March 2022 and approved by the COP on May 31, 2022 are as follows:

1. **Establish a PSCG Mapping and Monitoring Working Group (MM-WG)** to develop the mapping and monitoring plans for the JPSRM to achieve its aim, for approval by the PSCG, building on the draft plans from the 4th and 5th FiSCAO meetings and the 1st PSCG meeting and based on the questions and discussions from the 2nd PSCG meeting with the following Terms of Reference:
    a. The MM-WG will consist of multiple representatives from each Party with expertise, including scientific, Indigenous and Local Knowledge, as well as appropriate external experts, of ecosystem components of the JPSRM (e.g. fish, marine mammals, oceanography, ecosystem production, birds, lower trophic level species).
    b. The MM-WG will meet on a timeline determined by the working group with draft plans available for review and discussion at the Fall 2022 PSCG.
    c. The MM-WG may form smaller teams to meet separately with similar objectives and products to contribute to the overall draft plans.
    d. The MM-WG will focus efforts on scientific, Indigenous and Local Knowledge activities concerned with:
        i. Mapping requirements in the CAO, Atlantic, and Pacific gateways.
        ii. Monitoring requirements consistent with Article 4 of the Agreement.
        iii. Data collection (e.g. gear type) and data format standardization.
        iv. Prioritization of mapping and monitoring parameters as well as spatial and temporal sampling scales.

2. **Establish a PSCG Data Sharing Protocol Working Group (DSP-WG)** of Party representatives and appropriate external experts to develop an agreement on a data management policy and sharing protocols as part of the JPSRM, for approval by the PSCG, building on the draft plan from the 5th FiSCAO meeting and informed by the discussions during the 2nd PSCG meeting with the following Terms of Reference:
    a. The DSP-WG will consist of no more than two representatives from each Party including a technical expert, and no more than two representatives from any one external group, as appropriate.
    b. The DSP-WG will meet on a timeline determined by the working group with a data management policy and sharing protocols plan available for review and discussion at the Fall 2022 PSCG.
    c. The DSP-WG will meet in two phases to 1) identify the framework and specific policy components to be developed and 2) identify appropriate technical requirements.
        i. The DSP-WG will draft a hybrid framework that recognizes
        ii. A centralized data management system collected specifically for the JPSRM and
        iii. A distributed data management system for relevant accessible data collected in the JPSRM area.
    d. The DSP-WG will consider other international data management policies and sharing protocols to benefit from state-of-the-art agreements already in use.

The Chair noted that ToRs for both working groups were not able to be fulfilled within the timeline provided, as the working groups were not formally established and did not conduct intersessional work between the May 31, 2022, COP meeting and the time of the third PSCG meeting.

The Chair stated that one of the primary objectives of this PSCG meeting was to establish leadership and membership for the two working groups and to begin work prior to the November 23-25, 2022 COP meeting given that the work of the two groups needs to be ready for review and discussion at a spring 2023 PSCG meeting.

3 Mapping and Monitoring

To begin the formal discussion on the next steps needed to complete the mapping and monitoring plan of the JPSRM, also referred to as the 'science plan' in the March 2022 second PSCG meeting report, the United States and China both presented overviews of the discussion papers provided by each delegation prior to the PSCG meeting. These discussion papers can be found in Annexes 3 and 4, respectively.

The United States explained that section II of their discussion paper contains the questions discussed at the second PSCG meeting in March 2022. The black text contains the language as presented in advance of the March 2022 meeting with alterations based on discussions at the second PSCG meeting in blue text. The document does not include any new priorities for the PSCG to consider. Section III part 1 includes mapping and monitoring priorities and draft discussion questions to help guide the discussions on this effort within the PSCG and the MM-WG. Following the presentation by the United States, Canada indicated the Inuit Circumpolar Council (ICC) would like to develop an Indigenous Knowledge map for the Central Arctic Ocean (CAO), something ICC has done for other regions as part of the International Polar Year and recently for the North Water Polynya (i.e., Pikialasorsuaq). The Chair noted that this would be a very helpful addition for the development of the JPSRM.

China noted the overlap of their discussion paper with the one presented by the United States and that the two documents are complementary to one another. The Chinese paper contains a stepwise approach given the tight timeline to establish the JPSRM: (1) agree on a framework; (2) input priority elements and indicators; and (3) develop standards and protocols to facilitate data sharing. China also noted that monitoring should be based on the mapping results.

Following the presentation of both papers, the EU noted they have already completed several expeditions in recent years that resulted in data collection relevant to the Agreement. The EU also has standard operating and sampling procedures in place that can provide a lot of information and input to the working groups moving forward. The EU shared a brief presentation of the results from some recent expeditions to provide a general perspective of the situation in the CAO and adjacent areas and to provide a better understanding of what the JPSRM monitoring program should look like. In summary, the EU presentation focused on a 2016 Oden expedition, the 2019-2020 Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC) expedition, and from EU-supported surveys in 2021 as part of the Synoptic Arctic Survey (SAS). Some of the conclusions presented based on the results from these three expeditions are:

- There is a deep scattering layer everywhere;
- Fish density is extremely low;
- Most fish are small (10-15 cm) with very few larger predatory fish (40-60 cm);
- There is just enough fish to feed the few seals and polar bears in the CAO; and
- The Arctic shelf seas are highly productive, but the CAO is not.

The EU presented a few thoughts and recommendations for the PSCG to consider as the group moves forward, including:

- Study the shallower areas, especially the Chukchi plateau area;
- Pelagic fish are crucial in the ecosystem and should be monitored;

- Utilize standard sampling protocols based on experience from the CAO; and
- Utilize eDNA sampling buoys, acoustic devices and gliders in the High Seas and gateway areas.

A copy of the EU science presentation can be found in Annex 5, including the complete list of conclusions and recommendations for moving forward.

Following the presentation by the EU, the United States noted that the Indigenous peoples who live along the Arctic coast, especially on the North Slope of Alaska, are very familiar with the Pacific Gateway and are involved in guiding the research together with science in the region. They have a lot of Indigenous Knowledge of the region, such as related to bowhead whales, other marine mammals, ship strikes, ocean currents, the emergence of new species, and other topics. This Indigenous Knowledge is an important component to help accomplish the efforts of the PSCG. Canada added that in the Inuvialuit settlement region, the Inuit and the government of Canada co-manage the resources and that the people living in these areas see the changes that are occurring first-hand, especially when there are extreme events.

The meeting attendees then discussed the proposed JPSRM questions based on the outcomes of the March 2022 PSCG meeting. The Chair reminded the meeting attendees that the overarching questions discussed at the second PSCG meeting have been developed over several years and a series of meetings of the PSCG and its predecessor discussions. The Chair also noted that there will need to be agreement on the overarching and sub-questions moving forward as they will guide the implementation of the JPSRM. The group reviewed and provided additional edits to the questions contained in Section II of the United States discussion paper. A clean version of the updates to the questions contained in the United States discussion paper based on the discussions at the meeting can be found in Annex 6.

There was a lot of discussion around question 2.a. and the desire by several delegations to include language about extreme events given the impact such events are having with respect to changes in the region. One delegation requested to identify Indigenous and local communities separately instead of lumping them together. This distinction was made to emphasize the significance of Indigenous peoples' distinct status and rights recognized by their respective nation-states and by the international community. There was also a lot of discussion regarding including communities in the questions, and one delegation suggested striking the language altogether. Representatives from several delegations spoke to the linkages Arctic Indigenous communities have with the land and ocean and that they are a part of the ecosystem. In research with Inuit and scientists, Inuit have always grouped themselves as a part of the Arctic ecosystem. Following robust discussion, a majority of the delegations agreed it was important to keep the language about both Indigenous communities and local communities in the questions where that language appears.

Other issues or items to note from the discussion include:

- The need to demarcate the extents or what is meant when talking about the Atlantic and Pacific Gateways;
- Having Parties provide updates of their recent research and scientific efforts in the CAO and surrounding ecosystems at the first meeting of the MM-WG;
- The need to be careful about being overly prescriptive in the questions with examples in parentheses (much of the detail would come out through discussions within the working groups);

- Since these questions are looking to provide answers about potential future scenarios, need to be careful about saying "will" versus "could" or "would"; and
- ICC requested to include a definition of Indigenous Knowledge in the U.S. discussion document moving forward. The definition appears on page 15 of the 2022 "*Circumpolar Inuit Protocols for Equitable and Ethical Engagement*" report.

Several delegates shared links to documents that may help with the work of the PSCG moving forward, including:

- In reference to the discussion about the Indigenous Knowledge maps, a link to a recent example, the Pikialasorsuaq Atlas and the IPY Circumpolar Flaw Lead Study; and
- ICES reports "*Ecosystem Assessment of the Central Arctic Ocean: Description of the Ecosystem*" and "*Central Arctic Ocean ecoregion – Ecosystem Overview*".

The closing topic of discussion regarding mapping and monitoring was leadership of and next steps for the MM-WG. The United States and the EU volunteered to co-chair the MM-WG. Canada noted their ability to provide a level of leadership within some of the subgroups that will likely need to be established under the MM-WG. Norway also noted their willingness to participate in the group and asked if all Parties had submitted names for participation in the working groups in June following a request to do so at the May 31, 2022, COP meeting. Only half of the Parties had provided names prior to the third PSCG meeting. All Parties and other organizations were asked to share names of participants in the MM-WG within one week of the conclusion of the meeting. There was agreement that efforts of the MM-WG needed to get underway immediately and that an early update on the efforts would be shared at the November 2022 COP meeting. Finally, the delegates were asked to consider the questions contained in section III part 1 of the United States' discussion paper and the concepts contained in China's mapping and monitoring draft framework document to help begin the conversations within the MM-WG.

4 Data Sharing Protocol

To begin the formal discussion on the next steps needed to complete the data sharing protocol for the JPSRM, the United States and China both presented overviews of the discussion papers provided by each delegation prior to the PSCG meeting. These discussion papers can be found in Annexes 3 and 7, respectively.

China noted the need for the DSP-WG to develop standard specifications and made reference to the system used by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). All scientific data in CCAMLR is centralized from Member contributions with some submissions being mandatory while others are voluntary. CCAMLR could provide a model regarding data ownership and dissemination. China recommended using lessons from CCAMLR and MOSAiC to inform the work of the PSCG. China described the hybrid framework proposed using both centralized and distributed systems. The United States noted many similarities exist between the two discussion papers on the topic of data sharing with a recommendation to combine the two papers to help guide the work of the DSP-WG. The United States provided a review of main issues discussed at the second PSCG meeting on this topic, provided proposed guidance for moving forward, and proposed a framework for holding data until the PSCG finalizes and operationalizes a formal data sharing protocol.

The United States recommended adopting the recommendations from reports of earlier science meetings related to the Agreement regarding data sharing:

- Ensure data is made available;
- Data centers part of the JPSRM need to coordinate activities if we have a distributed process.
- Adopt international agreements for Arctic data management and adhere to existing data policies.
- Respect national and international data policies.
- Citations need to address data origin (speaks to concerns about use of data without attribution).
- Digital object identification (DOI) standards will be important.
- Address the issue of co-authorship on shared data.
- On data collection: meta-data and data included in the data sharing protocol, address standards used in measurements. Spoke to this a bit at the first PSCG meeting in February 2020. Need to agree on standards of measurement.

In the interim, the United States recommends building on the current arrangement: the United States hosted a website for sharing information and final reports among the Parties and public. The United States proposed to build a public and confidential website for the PSCG. The United States presented a prototype of such a website which would allow the PSCG to communicate globally. The United States offered the same for the COP. This would allow for a single location for delegations to share results and reports. The United States recommended including a section of the website that would require log-in credentials to protect the data collected through the implementation of the JPSRM. The website could also be used to create events, which can serve as a way for the working groups to organize themselves, which would make this a transparent process. The United States did not recommend this should be a centralized database; rather, it would allow information sharing in the interim. The United States welcomed views from other delegations about this proposal.

Following these presentations, ICC noted the release of eight protocols for equitable and ethical engagement of Inuit and Indigenous Knowledge developed through a synthesis report of Inuit produced materials and voices that address existing rules, laws, values, guidelines, and protocols for the engagement of Inuit communities and Indigenous Knowledge and through a series of workshops convening Inuit Delegates that captured Indigenous Knowledge perspectives, needs, priorities, and guidance on future engagement processes. These protocols were developed to inform decision-makers, policymakers, researchers, and others operating in the Arctic on the ethical and equitable engagement of Inuit and their Indigenous Knowledge. The link to the ICC report appears in Section 3, Mapping and Monitoring, of this PSCG report.

One delegation noted the need to develop policies regarding how to deal with public data, data sharing, and connectivity to existing data infrastructure. Additionally, given current data transparency, open data movements, and the pressure in the scientific community to make data public, there will likely be pressures to make the data public. ICES shared that they have policies that can accommodate both open and closed data systems and can share those with the DSP-WG if that would be helpful. One delegation noted the existence of many data sharing standards and that the PSCG should consider which one is most appropriate. There is no need to invent a standard just for the PSCG, but the one the PSCG selects should have broad applicability. The meeting participants agreed that there were a lot of detailed issues that needed to be discussed for this topic, and the large PSCG meeting was not the right place to do so. The Chair encouraged the members to move the discussion to the DSP-WG.

The closing topic of discussion regarding the data sharing protocol was leadership of and next steps for the DSP-WG. China volunteered to co-chair the DSP-WG. No other delegation offered to co-chair the DSP-WG with China at the time, but Canada, Norway, and the United States all agreed to consider co-chairmanship. All Parties and other organizations were asked to share names of participants in the DSP-WG within one week of the conclusion of the meeting. There was agreement that efforts of the DSP-WG needed to get underway immediately and that an early update on the efforts would be shared at the November 2022 COP meeting. There was also a request and agreement by the PSCG delegations that the membership would be raised from two to three representatives to allow for inclusion of Indigenous Knowledge and local knowledge holders in addition to technical experts.

5 Recommendations and Next Steps

The PSCG delegations reiterated the request for the COP to approve a spring 2023 PSCG meeting to be held in-person. The PSCG also reiterates the recommendation shared at the May 31, 2022, virtual COP meeting for the COP to develop ToRs and other procedures for the function of the joint scientific meetings in accordance with Article 4 paragraph 6 of the Agreement, building on the ToR and the work of the PSCG, particularly to finalize the JPSRM and develop implementation plans for the JPSRM.

The PSCG appreciates that the topic of exploratory fishing is on the provisional agenda for the November 2022 COP meeting and requests that when discussing that agenda item, the COP identify milestones for establishing the exploratory fishing measures and provide a vision for PSCG involvement in their development. The PSCG also reiterates the need for the COP to identify resources and infrastructure to implement the JPSRM when it is approved. Lastly, the PSCG requests that the COP develop specific messaging regarding the importance of the Agreement and the value of Parties putting effort into moving the JPSRM forward.

Regarding the spring 2023 meeting, no delegation offered to serve as host. Parties are asked to consider their willingness and ability to host the meeting. Given the June 25, 2023, deadlines for establishing the JPSRM and finalizing the associated data sharing protocol, the delegations agreed the meeting would need to occur in late February or early March 2023.

The final agenda item was a preliminary discussion about who might serve as the first official Chair and Vice-Chair of the PSCG. The Chair reminded the meeting attendees that according to the draft PSCG rules of procedure, it is up to the PSCG to nominate a Chair and Vice-Chair and for those nominations to be decided upon by the Heads of Delegation at the COP. While no delegation offered a formal nomination, the United States indicated their interest in potentially serving as the first Chair, and the EU indicated their interest in potentially serving as the first Vice-Chair.

Finally, meeting attendees thanked the Chair for her leadership during the meeting.

Annex 1: Final Meeting Agenda

Meeting of the Provisional Scientific Coordinating Group of the Agreement to Prevent Unregulated High Seas Fisheries of the Central Arctic Ocean
28 - 29 September 2022
8:00 AM to 12:00 PM New York Time each day
FINAL AGENDA

Meeting Documents (To be made available prior to meeting)

1. Meeting Agenda
2. China Draft Framework for the Development of a Mapping and Monitoring program
3. China Draft Framework for the Development of a Data Sharing Protocol
4. U.S.A. Proposed JPSRM Strategic Plan
5. Current PSCG Terms of Reference

<u>Wednesday, 28 September 2022</u>

8:00-8:30 Welcomes, Housekeeping and Agenda Review
- Welcome from Meeting Chair, Candace Nachman
- Technical WebEx Overview (Daniel Harris)
- Review of Agenda and Rules of Procedure for this Meeting (Candace Nachman)

8:30-9:00 Brief Introduction of Delegations
- The head of each delegation will introduce themselves and the members of their delegations.

9:00-9:30 Review of Agreement timeline, PSCG tasks, and milestones
- Questions and Group Discussion

9:30-10:00 Mapping and Monitoring Revised Research Questions

10:00-10:15 Break

10:15-10:45 Mapping and Monitoring Next Steps
- Review document from China delegation
- Review document from U.S.A. delegation

10:45-11:50 Mapping and Monitoring discussion

11:50-12:00 Day 1 wrap up and plan for Day 2

<u>Thursday, 29 September 2022</u>

8:00-8:05 Day 2 Welcome (Candace Nachman)

8:05-8:35 Mapping and Monitoring agreements and next steps for WG

8:35-9:00 Data Sharing Protocol discussion
- Review document from China delegation
- Review document from U.S.A. delegation

09:00-10:00 Data Sharing Protocol discussion

10:00-10:15 Break

10:15-10:45 Data Sharing Protocol agreements and next steps for WGs

10:45-11:30 PSCG recommendations for the November COP
- Development of talking points

11:30-11:50 PSCG Chairman and host considerations
- Discussion of interest and leadership needs

11:50-12:00 Concluding Remarks and Meeting Close

Annex 2: List of Meeting Participants

Canada:

1. Robert Apro, HoD, Senior Policy Advisor, International Fisheries Policy, Department of Fisheries and Oceans
2. Alain Dupuis, Science Advisor, Environment and Biodiversity Science, DFO
3. Chris Rooper, Research Scientist, Pacific Region, DFO
4. Jennifer Blanchard, Manager, Intellectual Property and Licensing, Canadian Hydrographic Service
5. Kristen Westfall, Research Scientist, Pacific Region, DFO
6. Lisa Loseto, Research Scientist, Ontario and Prairie Region, DFO
7. Herb Nakimayak, ICC Canada VP International
8. Stephanie Meakin, Senior Science Advisor, ICC Canada
9. Jeremy Ellsworth, Environment and Research Coordinator, ICC Canada
10. Matthew Zammit-Maempel, ICC Canada
11. Colin Webb, Fisheries Specialist, Lands & Natural Resources Division, Nunatsiavut Government
12. Ezra Greene, Senior Research and Technical Advisor, Department of Wildlife and Environment, Nunavut Tunngavik Inc.
13. Kiyo Campbell, Canada/Inuvialuit Fisheries Joint Management Committee, Fisheries Management Biologist
14. Burton Ayles Ph.D., Canada/Inuvialuit Fisheries Joint Management Committee, Canada Member

China:

1. YANG Lei, PSCG Representative, International Cooperation Division, Chinese Arctic and Antarctic Administration
2. LI Honglei, Deputy Director, the Division of Science Programs, Chinese Arctic and Antarctic Administration
3. ZHAO Xianyong, Senior Researcher, Yellow Sea Fisheries Research Institute, Chinese Academy of Fishery Sciences
4. WANG Lumin, Senior Researcher, East China Sea Fisheries Research Institute, Chinese Academy of Fishery Sciences
5. SHAN Yanyan , Senior Advisor, Polar Development and International Cooperation Division, Polar Research Institute of China
6. YU Yong, Senior Researcher, Polar Ecology Division, Polar Research Institute of China
7. WU Lizong, Senior Researcher, Data Center, Polar Research Institute of China
8. JIN Haiyan, Senior Researcher, Second Institute of Oceanography, Ministry of Natural Resources
9. LI Hai, Associate Researcher, Third Institute of Oceanography, Ministry of Natural Resources
10. ZHANG Guangtao, Professor, Institute of Oceanology, Chinese Academy of Sciences
11. TIAN Yongjun, Professor, Ocean University of China
12. SHI Ximu, Official, Department of Treaty and Law, Ministry of Foreign Affairs

Kingdom of Denmark in respect of Greenland and the Faroe Islands:

1. Birgitte Jacobsen, HoD, Chief Advisor, Ministry of Fisheries and Hunting, Greenland
2. Kuupik Kleist, President ICC Greenland

European Union:

1. Mr. Stanislovas Jonusas, Policy Officer, Directorate-General for Maritime Affairs and Fisheries, European Commission (Stanislovas.JONUSAS@ec.europa.eu)
2. Mr. Roderick Harte, International Relations and Legal Officer, Directorate-General for Maritime Affairs and Fisheries, European Commission (Roderick.HARTE@ec.europa.eu)
3. Professor Pauline Snoeijs-Leijonmalm, Professor in Marine Ecology, Stockholm University (pauline.snoeijs-leijonmalm@su.se)
4. Dr. Hauke Flores, Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforsschung (Hauke.Flores@awi.de)
5. Dr. Szymon Smoliński, Department of Fisheries Resources, National Marine Fisheries Research Institute (ssmolinski@mir.gdynia.pl)

Iceland:

1. Lisa Libungan, Fisheries Scientist, Marine and Freshwater Research Institute

Japan:

1. Dr. Kenji Taki, Principal Researcher, Japan National Fisheries Research and Education Agency (takisan@affrc.go.jp)
2. Mr. Kengo Tanaka, Senior Expert, International Affairs Division, Fisheries Agency (kengo_tanaka860@maff.go.jp)
3. Dr. Yugo Shimizu, Principal Research Coordinator, Research and Technological Guidance Division, Fisheries Agency (yugo_shimizu980@maff.go.jp)

Korea:

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4. Dr. Hyoung Chul Shin, hcshin@kopri.re.kr
5. Mr. Jihoon Jeong, jj@kopri.re.kr

Norway:

1. Maria Fossheim, Programme Director, Institute of Marine Research, HoD
2. Randi Ingvaldsen, Senior researcher, Institute of Marine Research
3. Benjamin Planque, Senior researcher, Institute of Marine Research
4. Lis Lindal Jørgensen, Senior researcher, Institute of Marine Research
5. Alf Håkon Hoel, professor, UiT-The Arctic University of Norway and Institute of Marine Research

United States:

1. Robert Foy, NOAA Alaska Fisheries Science Center (NOAA/AFSC)
2. Kelly Kryc, NOAA Headquarters (HQ)
3. Lauren Fields (NOAA/HQ)
4. Eleanor Bors (NOAA/HQ)
5. Tyler Loughran (NOAA/HQ)
6. Kathryn Patterson (NOAA/HQ)
7. Mark Zimmermann (NOAA/AFSC)
8. Esther Goldstein (NOAA/AFSC)
9. Johanna Vollenweider (NOAA/AFSC)
10. Sarah Wise (NOAA/AFSC)

11. John Bengston (NOAA/AFSC)
12. Kelley Uhlig (NOAA/AFSC)
13. Libby Logerwell (NOAA/AFSC)
14. Elana Mendelson, Department of State
15. Erika Carlsen, Department of State
16. Taqulik Hepa, Inuit Circumpolar Council Alaska (ICC-AK)
17. Marie Greene, ICC-AK
18. Nicole Wojciechowski, ICC-AK
19. Cyrus Harris, ICC-AK
20. Vernae Angnaboogok, ICC-AK
21. Brandon Ahmasuk, ICC-AK
22. Leandra Sousa, North Slope Borough Department of Wildlife Management
23. John Citta, North Slope Borough Department of Wildlife Management

Observers:

1. Jörn Schmidt (ICES)
2. Sonia Batten, PICES, sonia.batten@pices.int

Chair:

Candace Nachman

Annex 3: U.S. Discussion Paper

Proposed Next steps towards establishing a Joint Program of Scientific Research and Monitoring of the Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean

Considerations for the Provisional Scientific Coordinating Group: A U.S.A. Delegation proposal for discussion.

September 2022

The intent of this document is to:

I. Update milestones related to science objectives of the Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean (Agreement).
II. Propose next steps for the Provisional Scientific Coordinating Group (PSCG) to provide science recommendations regarding development of the Joint Program of Scientific Research and Monitoring (JPSRM) to the Conference of Parties in time to support Agreement deadline requirements.
    - Propose PSCG priorities for Mapping and Monitoring based on scientific questions defined at March 2022 PSCG meeting.
    - Propose PSCG priorities for Data Sharing Protocol based on positions raised at March 2022 PSCG meeting.

I. Agreement-Science Coordinating Group Milestones (Proposed milestones in blue)

- **2018, October 3**. Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean signed.
- **2019, April 12-13**. Arkhangelsk, Russian Federation. Conference of the CAOF Member Countries scientific experts on the Central Arctic Ocean marine bio resources stocks condition research plan and their management in the Agreement area. Researcher conference of Scientific Experts.
- **2019, May 29-30**. Ottawa, Canada. First Preparatory Meeting of Signatories to the Agreement formed the Provisional Scientific Coordinating Group (PSCG)
- **2019, November 13-14**. Yellowknife, Canada. Co-Production of Indigenous and Science Knowledge Workshop, which Signatories agreed to hold prior to first PSCG meeting.
- **2020, February 11-13**. Ispra, Italy. First meeting of the PSCG.
- **2020, June, October and December**. Virtual. Series of Round Tables hosted by Inuit Circumpolar Council-Canada regarding Inuit Engagement in the Agreement.
- **2021, June 25**. Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean entered into force.
- **2022, March 1-3**. Virtual. Second meeting of the PSCG.
- **2022. September 28-29**. Virtual. Third meeting of the PSCG.
- **2023. Spring.** Location TBD. Proposed fourth meeting of the PSCG.
- **October 2022 - April 2023.** Mapping and Monitoring (MM-WG) and Data Sharing Plan (DSP-WG) workgroups (approved at May 2022 COP) meet virtually to complete Joint Program of Scientific Research and Monitoring (JPSRM) and draft proposed costs and infrastructure requirements to implement the JPSRM.

- **2023, June 25**. Deadlines contained in Article 4 of the Agreement for establishing a JPSRM and for developing data sharing protocol.
- **2024, June 25**. Deadline contained in Article 5 of the Agreement for establish exploratory fishing conservation and management measures.

II. Proposed JPSRM questions based on outcomes of the March 2022 PSCG meeting

Breakout groups were formed to update the questions that guide further strategic development of the JPSRM. A proposed revision from the U.S.A. Delegation. The intent of the review was to assess relevancy of previously discussed questions during FiSCAO meetings (see Appendix I) and to change or add question to support the final Agreement. Track changes represent recommendations based on the breakout discussions.

1. What are the distributions of species with a potential for future commercial harvests in the Central Arctic Ocean?
    a. What fish species are currently present in the high seas?
    b. Do fishable concentrations of commercial species exist in the high seas?
    c. What are their distributions and abundance patterns?
    d. What are their local life-history strategies, habitat associations, and demographic patterns?
    e. Do these strategies, associations, or patterns differ among regions of the Arctic?
2. What other information is needed to provide advice necessary for future sustainable harvests of commercial fish stocks and maintenance of dependent ecosystem components?
    a. What are the trophic linkages among fishes and between fishes and other taxonomic groups (i.e. quantify food webs identifying keystone forage species)?
    b. How do fish species abundances and distributions vary as a function of climate variability (**e.g. timing of change, extreme events**, declining sea ice, and biogeochemical changes)?
    c. Can the species be harvested sustainably with respect to both target fish stocks and dependent parts of the ecosystem? If not, what are the prospects for the development of fisheries in the future?
3. What are the likely key ecological linkages between potentially harvestable fish stocks of the central Arctic Ocean and the adjacent shelf ecosystems **that support** Indigenous **and local** communities?
    a. What are the connections between fish in the High Seas and those in the adjacent regions?
    b. What are the mechanisms that establish and maintain these linkages?
    c. How might fisheries in the High Seas affect adjacent and congruent portions of shelf ecosystems, including fish stocks, fishable invertebrates (crabs, shrimp, mollusks), marine mammals, birds, and fisheries-dependent communities (which include those communities that are dependent on subsistence harvests of fish, invertebrates, and mammals)?
4. Over the next 10-30 years, what changes in fish populations, dependent species and the supporting ecosystems may occur in the central Arctic Ocean and the adjacent shelf ecosystems?
    a. **What marine species will be productive in the CAO** in the next 10-30 years?
    b. What changes in production and key linkages are expected in the coming 10-30 years?
    c. What northward population expansions are expected in the next 10-30 years?
    d. What are the anticipated impacts of changes in ocean acidification in the next 10-30 years?

e. How will increased human activity in the region (**e.g.** ship noise, **ship traffic, industrial activity**, and pollution, affect fish populations, ecosystem health, **and communities** in the next 10-30 years?
f. How will increased fishing activity affect **other species bycatch**, migratory and wide-ranging marine mammals, and the Indigenous and local communities that depend upon these species to sustain their ways of living?

5. **What** Traditional Ecological Knowledge **is available to** inform ecological baselines?

III. Proposed discussions on Mapping and Monitoring for the September 2022 PSCG meeting

1. Proposed PSCG Mapping and Monitoring for the MM-WG to consider.

Mapping and Monitoring priorities (developed from the 5th FiSCAO meeting; October 24-26, 2017):

The mapping phase of the JPSRM will continue to provide a current understanding of species distributions, relative abundances, and population structure in relation to biotic and abiotic factors. The monitoring phase of the JPSRM will focus on identifications of temporal variability or trends in species distribution or ecosystem productivity.

Proposed Mapping and Monitoring priorities to refine:

a. Document the current physical, chemical and biological oceanographic conditions and the distributions of marine invertebrates, fishes, mammals, and birds in the High Seas portion of the CAO and surrounding waters.
b. Subareas of the High Seas CAO and adjoining seas will need to be prioritized for sampling. Criteria for prioritizing subareas include relative availability (or lack) of information, degree of sea ice loss, and water depth. Potential demersal areas include East Siberian Sea including the Chukchi Borderlands and waters northwest of Wrangel Island. Pelagic surveys should be conducted in areas where there have been documented, observed, or expected northward range expansions by potentially harvestable species.
c. Surveys should also include areas where environmental changes have been documented or are expected to occur.
d. Refuge areas for polar fishes from climate change effects, both physical and biological, within which species can complete their lifecycles are of particular ecological importance.
e. Ideally, synoptic mapping surveys should be conducted over as much of the High Seas CAO as possible following standardized sampling protocols and use consistent data formats.
f. Data collection priorities will focus on 1) identifying fish species distributions and relative abundances, 2) understanding population structure and the factors affecting species distributions and productivity and 3) managing fisheries in an ecosystem context.
g. Historic and contemporary baseline data on species distributions and abundances, and environmental conditions in waters adjacent to the High Seas CAO, and to a lesser extent within the High Seas CAO, may be available through indigenous and local knowledge holders.
h. Monitoring will focus on existing data collections with priorities for new data collection in the High Seas CAO, Atlantic gateway, and the Pacific gateway.

i. Indicators for detecting change in the availability and viability of species of commercial interest are prioritized:
   i. Distributions of potential commercial fishes and invertebrates.
   ii. Fishing vessel activity in waters adjacent to the High Seas CAO
   iii. Marine mammal and seabird abundance, distributions, diets, condition or foraging behaviors.
   iv. Zooplankton transport and potential establishment into the High Seas CAO.
   v. Deep scattering layer.
   vi. Primary productivity and associated variables.
   vii. Sea ice.
   viii. Currents in the gateways.
   ix. Temperature.
   x. Ocean acidification.

Potential discussion questions:

a. Should the timing of the mapping program to capture the current state of the High Seas CAO ecosystem, adjacent ecosystems be limited (e.g. 1-3 years) or should it be an ongoing effort given resource realities?
b. How should the PSCG improve communication regarding vessels of opportunity and other platforms of opportunity to supplement data collected by a dedicated mapping program?
c. How should the PSCG better leverage existing analytical groups that are conducting relevant assessments of how to monitor the CAO (e.g., the ICES/PICES/PAME)?
d. The Atlantic and Pacific gateways were recognized as priority subareas to monitor because of their strong influences on the Arctic Ocean through the transport of water, heat, nutrients and plankton from subarctic to Arctic waters. Both gateways may also be important conduits for fish movement and northward distributional shifts. How should data collections be identified and prioritized in these specific regions that have some existing data collection programs?
e. What are the next steps to operationalize the monitoring program based on identification of individual indicators that inform on the current and potential future status of fish stocks in the High Seas CAO?

2. PSCG Data Sharing Protocol for the DSP-WG to consider

Proposed next steps (based on PSCG March 2022 meeting):

a. General agreement on next steps
   i. Identify options for data archiving and data management of the JPSRM data after discussing data policies, a data sharing framework, and data management options with other international organizations.
   ii. Identify protocols for archiving and management of Indigenous knowledge and observations collected through the mapping and monitoring efforts.
   iii. Identify an existing organization to help data providers develop DOIs if their institutional or national data archive cannot provide the service.
   iv. Identify a data-hosting source accessed through a website and develop sharing protocols to test sharing of the fish observation dataset developed during the Fourth

Meeting of Scientific Experts on Fish Stocks in the Central Arctic Ocean, and the inventory of monitoring programs in the High Seas CAO and adjacent water.

b. Aspects of data sharing structure:
   i. Version control
   ii. Data and knowledge confidentiality
   iii. No consensus on distributed vs centralized database. There was some call for a hybrid approach that acknowledges data from multiple sources.
      1. High seas CAO collected jointly may be stored in central location
      2. Metadata from State-specific data collected on Arctic shelves and High seas CAO
      3. Linkages to metadata from sources external to the PSCG and the Agreement.
   iv. No consensus on using existing database or data protocols from external to PSCG sources.
c. Develop protocols for archiving and management of Indigenous knowledge, local knowledge, and observations.
d. Identify geographic scope of data or metadata to include.
e. Compile a survey of existing data sharing protocols.
f. Develop a list of existing, relevant data from CAO and extending to adjacent shelfs and areas outside the CAO. Potential sources include Arctic Council Working Groups, PICES/ICES, PAG, SAS, DBO, MOSAIC, SHEBA, and RUSALCA.

<u>Proposed Data Sharing Protocol priorities (developed from the 5th FiSCAO meeting; October 24-26, 2017; [Based on DBO Data policy and release guidelines - 2015]):</u>

1. Data to be available to Agreement researchers in a timely manner for analysis, and to the larger community once initial analyses are completed. The first step in submitting data will be the completion of a metadata profile for the dataset. The data will then be submitted to a national or institutional data archive that is part of the JPSRM distributed data archive. Metadata should be submitted as soon as possible (i.e. within one month) after completion of a sampling program. Data should be made available as soon as possible after collection and completion of quality assurance programs. A common, password protected shared data archive may be established (e.g., Circumpolar Biodiversity Monitoring Programme, SAON data portals) to facilitate analyses upon completion of the mapping phase of the JPSRM and repeated analyses throughout the monitoring phase.
2. Data centers that are part of the JPSRM distributed data archive will need to coordinate their data management activities, including developing consistent metadata generation, curation and interoperability. When data submitted directly to an institutional or national archive are deemed ready for long-term storage and distribution, a final version of the data and metadata will be uploaded or linked to a shared-archive.
3. The JPSRM Data Sharing Protocol should be consistent and compliant with international standards and agreements such as the IASC Statement of Principles and Practices for Arctic Data Management. That is, free, timely, and unrestricted exchange of essential data and products to the maximum extent possible. The proposed JPSRM data policy approach is fully compatible with the World Meteorological Organization (WMO) Climate Variability and Predictability (CLIVAR) Data Policy. The proposed JPSRM data archive will follow the WMO Core Profile of the ISO 19115: Geographic Information --- Metadata standard.
4. A JPSRM policy would not conflict with or supersede any national or international agency policy related to public access to these data.

5. Citations from data downloaded from the archive and used in publications would include the data's origin should be acknowledged and referenced. Every user is responsible for referencing the Principle Investigator (PI) responsible for creating the dataset that is used and identifying that the dataset was obtained through the JPSRM data archive. If multiple sources have been used, acknowledgement must be provided for each dataset used.
6. The JPSRM data management would include data Digital Object Identifier (DOI) standards supported by international coordination groups such as the Research Data Alliance (RDA).
7. Co-authorship of JPSRM publications that make extensive use of JPSRM data is warranted if their work has contributed to the study in question, or if the investigator has directly contributed to the publication in other ways. It is highly recommended that any data user contact the responsible PI and discuss whether the PI's data collection warrants co-authorship or an acknowledgement.
8. Research programs that contribute data to JPSRM use sophisticated, state-of-the-art instrumentation and comply with strict requirements for maintenance, exposure of instruments, calibration, quality assurance procedures and the like, in order to achieve the highest attainable standards of measurement, accuracy, representativeness, stability and repeatability. To ensure that this goal is reached, PIs who are leading experts for their instruments will take responsibility for individual instruments operated on the respective research program.
9. Users of JPSRM data will be encouraged to establish direct contact with the Scientific Point of Contact for each data set used; this contact will be included in the metadata for each data set. The JPSRM Scientific Point of Contact will discuss the planned use of the dataset and, if necessary, put the data user in contact with the data set PI as the data provider for the purpose of complete interpretation and analysis of data for publication purposes.
10. Users of JPSRM data are strongly encouraged to submit citations for any publications or products to the JPSRM shared archive. The JPSRM shared archive will develop a citation list of publications from the submitted citations. Whenever possible, the archive will use DOIs to link to a publication to its data source(s). The shared archive will make the citation list public via the archive website to provide a continuous record of applications and analyses of JPSRM data and JPSRM scientific achievements.

Appendix I: Mapping and Monitoring Working Group

Mapping and Monitoring Working Group (MM-WG) Terms of Reference (agreed upon at PSCG March 2022 meeting and ratified by COP May 2022):

a. The MM-WG will consist of multiple representatives from each Party with expertise, including scientific, Indigenous and Local Knowledge, as well as appropriate external experts, of ecosystem components of the JPSRM (e.g. fish, marine mammals, oceanography, ecosystem production, birds, lower trophic level species).
b. The MM-WG will meet on a timeline determined by the working group with draft plans available for review and discussion at the Fall 2022 PSCG.
c. The MM-WG may form smaller teams to meet separately with similar objectives and products to contribute to the overall draft plans.
d. The MM-WG will focus efforts on scientific, Indigenous and Local Knowledge activities concerned with
    i. Mapping requirements in the CAO, Atlantic, and Pacific gateways.
    ii. Monitoring requirements consistent with Article 4 of the Agreement.
    iii. Data collection (e.g. gear type) and data format standardization.
    iv. Prioritization of mapping and monitoring parameters as well as spatial and temporal sampling scales.

Appendix II: Data Sharing Plan Working Group

Working Group (DSP-WG) Terms of Reference (agreed upon at PSCG March 2022 meeting and ratified by COP May 2022):

a. The DSP-WG will consist of no more than two representatives from each Party including a technical expert, and no more than two representatives from any one external group, as appropriate.
b. The DSP-WG will meet on a timeline determined by the working group with a data management policy and sharing protocols plan available for review and discussion at the Fall 2022 PSCG.
c. The DSP-WG will meet in two phases to 1) identify the framework and specific policy components to be developed and 2) identify appropriate technical requirements.
    i. The DSP-WG will draft a hybrid framework that recognizes
    ii. a centralized data management system collected specifically for the JPSRM and
    iii. a distributed data management system for relevant accessible data collected in the JPSRM area.
d. The DSP-WG will consider other international data management policies and sharing protocols to benefit from state-of-the-art agreements already in use.

Appendix III: Key science meetings leading up to the Agreement

2011, June 15-17. Anchorage, U.S.A. First Meeting of Scientific Experts on Fish Stocks in Arctic Ocean. The first meeting of scientific experts addressed Terms of Reference to identify:

1. current information and data on fish stocks, their ecosystems, and patterns of migration,
2. ongoing and planned scientific activities,
3. current information gaps and options to address gaps,
4. priorities in regard to identified research requirements, and

5. opportunities for and impediments to closer cooperation.

2013, October 28-31. Tromsø, Norway. Second Scientific Meeting on Arctic Fish Stocks. Four major scientific research themes were identified in 2013 at the Meeting of Governments. The meeting of scientific experts completed Terms of Reference:

1. Establish baseline conditions and define information needs for to monitoring changes in baseline conditions, which might influence patterns of distribution and abundance of finfish in the Arctic Ocean. This is viewed as a high-priority requirement.
2. Evaluate the outcome of relevant recent scientific meetings, such as the ICES/PICES (North Pacific Marine Science Organization) workshop in St. Petersburg in May 2013, and discuss strategies to communicate outcomes regarding implications of climate change on management of living marine resources in the Arctic context.
3. Consider meetings and other fora for future scientific cooperation.

2015, April 14–16. Seattle, U.S.A. Third Meeting of Scientific Experts on Fish Stocks in the Central Arctic Ocean. Terms of Reference:

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.

2016, September 26–28. Tromsø, Norway. Fourth Meeting of Scientific Experts on Fish Stocks in the Central Arctic Ocean. Framework and Terms of Reference drafted for a joint scientific research and monitoring plan program that included two survey elements, 1) a mapping phase and 2) a monitoring phase. Scientific questions were identified that need to be addressed to fully assess the potential for sustainable commercial fishing in the High Seas CAO. Terms of Reference:

1. Complete the synthesis of knowledge.
2. Develop a Joint Scientific Research and Monitoring Plan to address the four questions.
3. Provide a Framework for the Implementation Plan.

2017, October 24-26. Ottawa, Canada. Fifth Meeting of Scientific Experts on Fish Stocks in the Central Arctic Ocean. This final meeting of the science experts reported on a number of completed Terms of Reference:

1. Identification of baseline data (i.e., a mapping program) in the high seas CAO to achieve the goals of documenting species distributions, relative abundances, and key ecosystem parameters,
2. Development of a strategy for monitoring indicators of fish stocks and ecosystem components,
3. Determination of preliminary cost estimates to implement a mapping program in the high seas portion of the CAO and in the Pacific Gateway region, and
4. Development of a draft data sharing policy as the foundation for a future data sharing protocol.

2020, February 11-13. Ispra, Italy. First meeting of the Provisional Scientific Coordinating Group. The first meeting of the PSCG reported on a number of completed Terms of Reference:

1. Development of Interim Rules of Procedure and a basis for future Rules of Procedure for the PSCG.
2. Identification of processes and mechanisms to incorporate indigenous and local knowledge, through the inclusion of representatives of Arctic communities, including Arctic indigenous peoples, in the work of the PSCG by specifically recommending direct participation in PSCG delegations, working groups, or sub-groups.
3. Update of current or upcoming scientific activities and platforms of opportunity list for scientific mapping work in the Central Arctic Ocean that could contribute relevant information and data to the Joint Program of Scientific Research and Monitoring and identification of the knowledge gaps addressed by each activity or platform.
4. Prioritization of mapping work based on identified gaps, and any updates to these gaps, and coordinate among Signatories opportunities for conducting scientific mapping work in accordance with the Joint Program of Scientific Research and Monitoring, including by using upcoming scheduled scientific activities and platforms of opportunity identified.
5. Updated the Inventory of Monitoring Programs in the High Seas Central Arctic Ocean and adjacent water.

Annex 4: China Mapping and Monitoring Discussion Paper

Draft Framework for the development of a Mapping and Monitoring program

A discussion paper to be circulated to Parties at the request of China

The COP has adopted the recommendation from PSCG on the establishment of a PSCG Mapping and Monitoring Working Group (MM-WG) to develop the mapping and monitoring plans for the JPSRM to achieve its aim, for approval by the PSCG, building on the draft plans from the 4th and 5th FiSCAO meetings and the 1st PSCG meeting and the questions and discussions from the 2nd PSCG meeting. and approved to hold the PSCG meeting in the fall 2022 to review and finalize the work of the Working Group. As this work has been laid behind our schedule, China would like to propose a preliminary framework for the development of Mapping and Monitoring program as the first step to facilitate the discussion in the PSCG meeting and expedite our work toward the development of a Mapping and Monitoring program.

1. Characteristics of a joint Mapping and Monitoring Program

A collaborative Mapping and Monitoring Program as part of the Joint Program of Research and Monitoring provided in Article 4 of the CAO Agreement shall have the following 4 attributes:

(i) Share the common objective as defined in Article 4.4 of the Agreement.

(ii) Fit in the same spatial-temporal PLANNING framework outlined by PSCG.

(iii) Apply the same STANDARDS or PROTOCOLS adopted by PSCG.

(iv) Follow the DATA-SHARING PROTOCOL agreed by PSCG.

The Mapping and Monitoring program to be developed can be benefited from:

(i) A jointly planned synoptic survey implemented by multi-ship operations with as many nations contributing as possible to obtain the best coverage and collaboration.

(ii) Surveys conducted by Parties with participation of any kind from one or more signatories in accordance with criteria for the Mapping and Monitoring Program.

(iii) Surveys conducted by Parties in accordance with criteria for the Mapping and Monitoring Program.

2. Mapping Program

2.1 Priority Sampling areas

- Ice-free areas of CAO extending to the adjacent eight LMEs relevant to the CAO ecosystem.
- Ice-covered areas of the CAO known to be important fish habitat.
- Atlantic Gateway extending to the ice-free area of CAO.
- Pacific Gateway extending to the ice-free area of CAO.

2.2 Prioritized data and indicators

(i) Fishery resources

Biodiversity of Arctic fishes (species of Arctic fishes); Distribution and abundance of important Arctic fishes; Biology of Arctic fishes

(ii) Physical environment

Temperature, Salinity, Current, etc.

(iii) Chemical environment

Nutrients, pH, DO, etc.

(iv) Biological environment

Primary Production, Planktons, Benthos, etc.

(v) Top predators

Marine mammals and seabirds

(vi) Relevant Meteorological factors

3. Monitoring Program

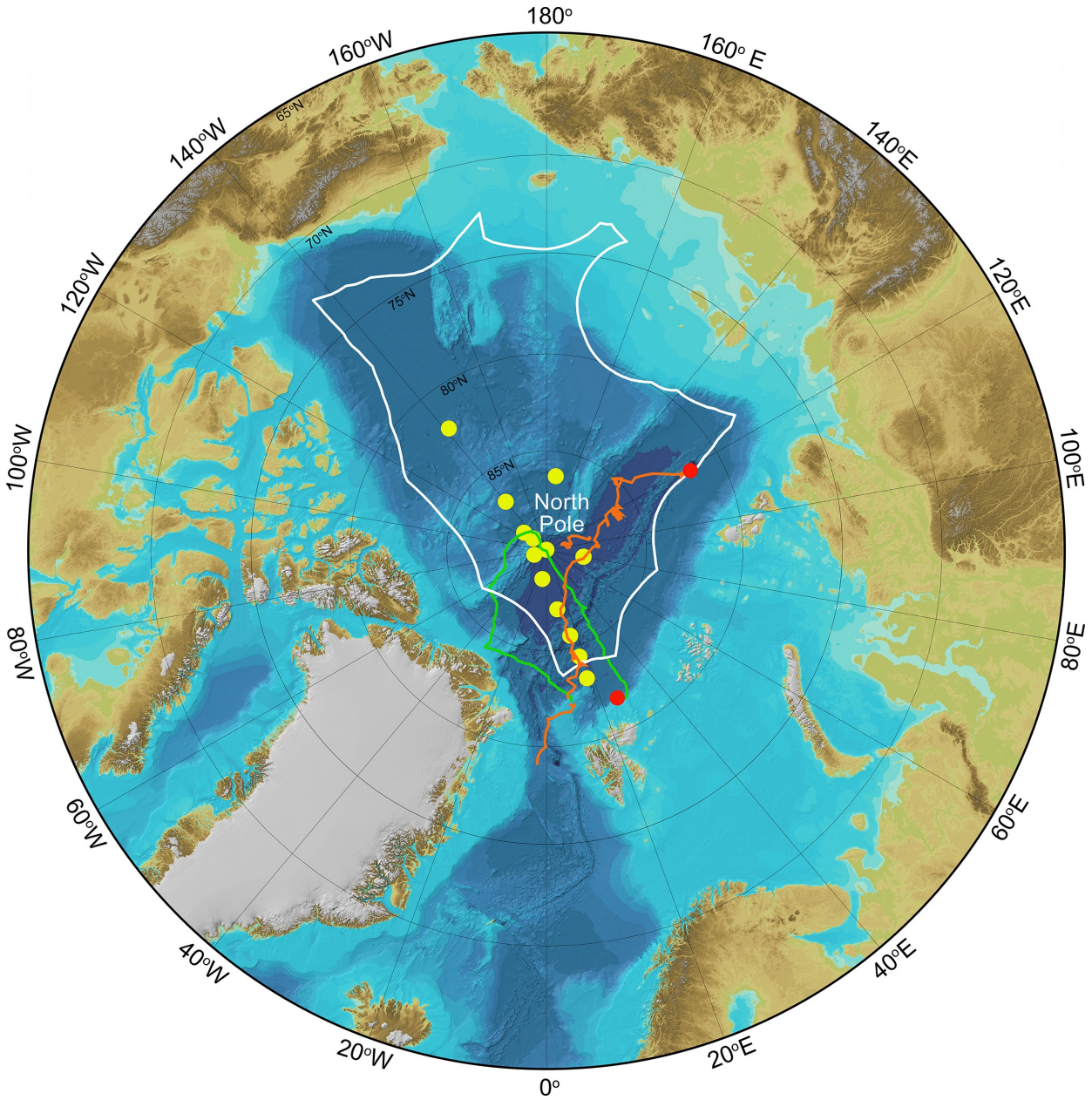
To be determined later based on the knowledge gained from the Mapping efforts.

4. Future work

To identify priority parameters of the six disciplines listed in Section 2.2. building on the FiSCAO 4th and 5th and PSCG 1 reports.

To develop relevant standards or protocols on survey and data processing/analysis.

Annex 5: European Union Science Presentation



Recent data on fish abundance

- Eurasian Basin
- Lomonosov Ridge
- Atlantic gateway

Fully ice-covered

2016 Oden expedition (yellow)

- Snoeijs-Leijonmalm, P et al. (2021) A deep scattering layer under the North Pole pack ice. Progress in Oceanography 194:102560 (collaboration with IMR, Bergen, Norway)

2019-2020 Polarstern MOSAiC expedition (orange)

- Snoeijs-Leijonmalm, P et al. (2021) Ecosystem mapping in the Central Arctic Ocean (CAO) during the MOSAiC expedition. Publications Office of the European Union, 2021
- Snoeijs-Leijonmalm, P et al. (2022) Unexpected fish and squid in the central Arctic deep scattering layer. Science Advances 8:eabj7536

2021 SAS-Oden expedition (green)

- Snoeijs-Leijonmalm, P et al. (2022) Ecosystem mapping in the Central Arctic Ocean (CAO) during the SAS-Oden expedition. Publications Office of the European Union, 2022

April 2023: EFICA project ends (EU-Report, scientific papers)

Financed by European Commission
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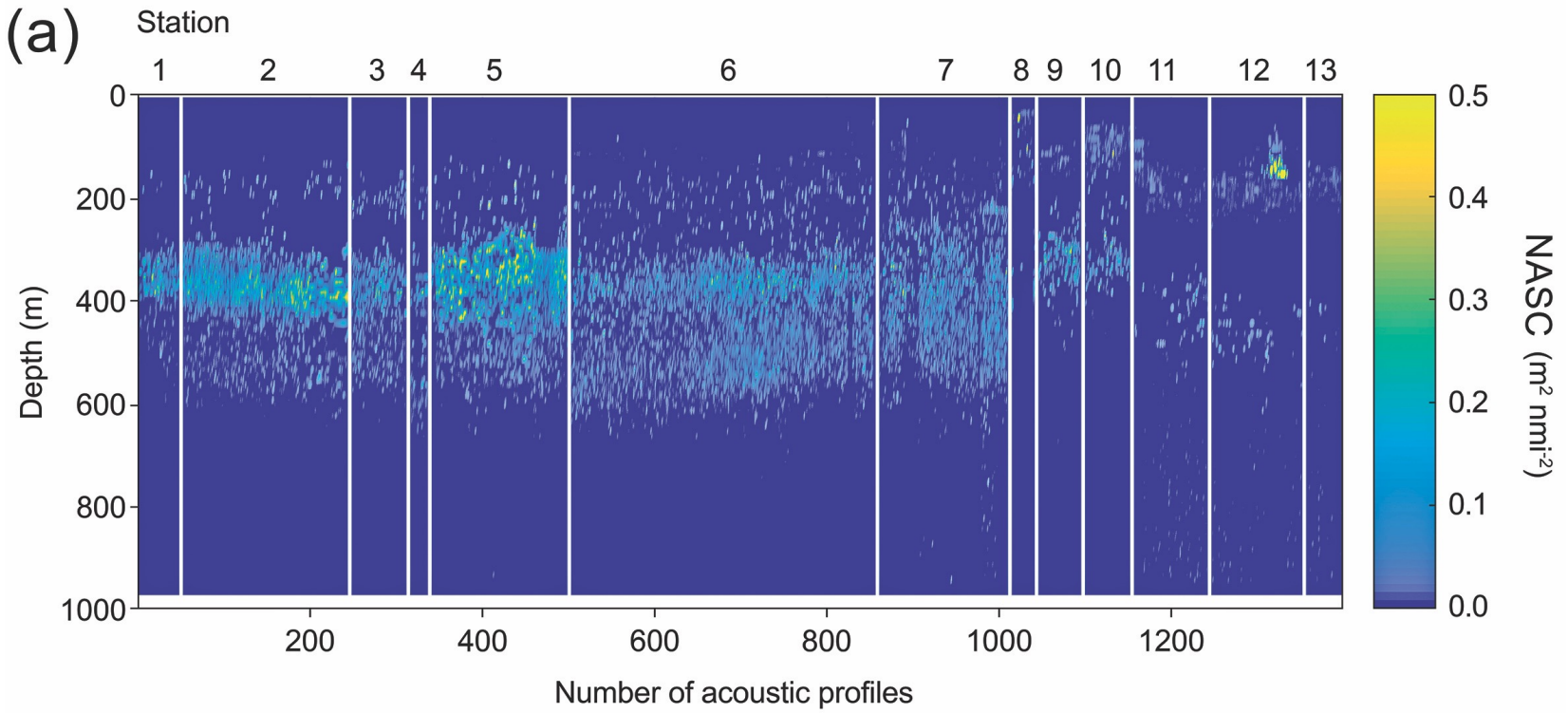
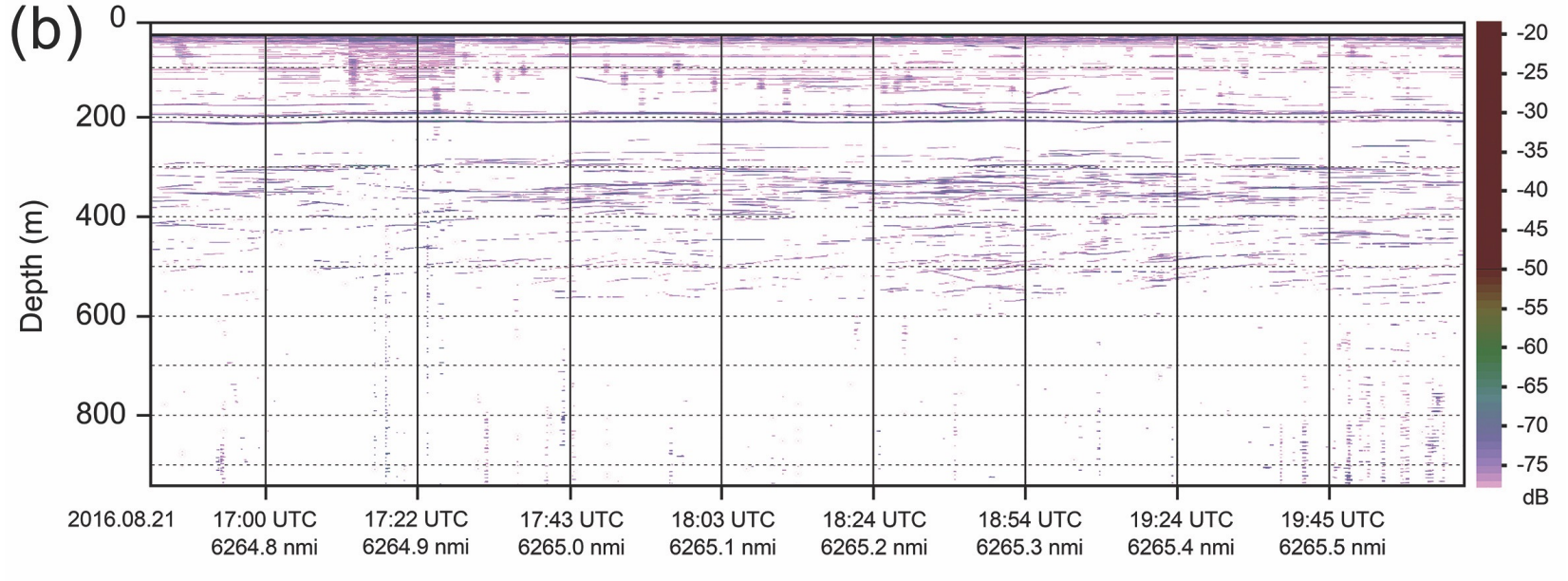




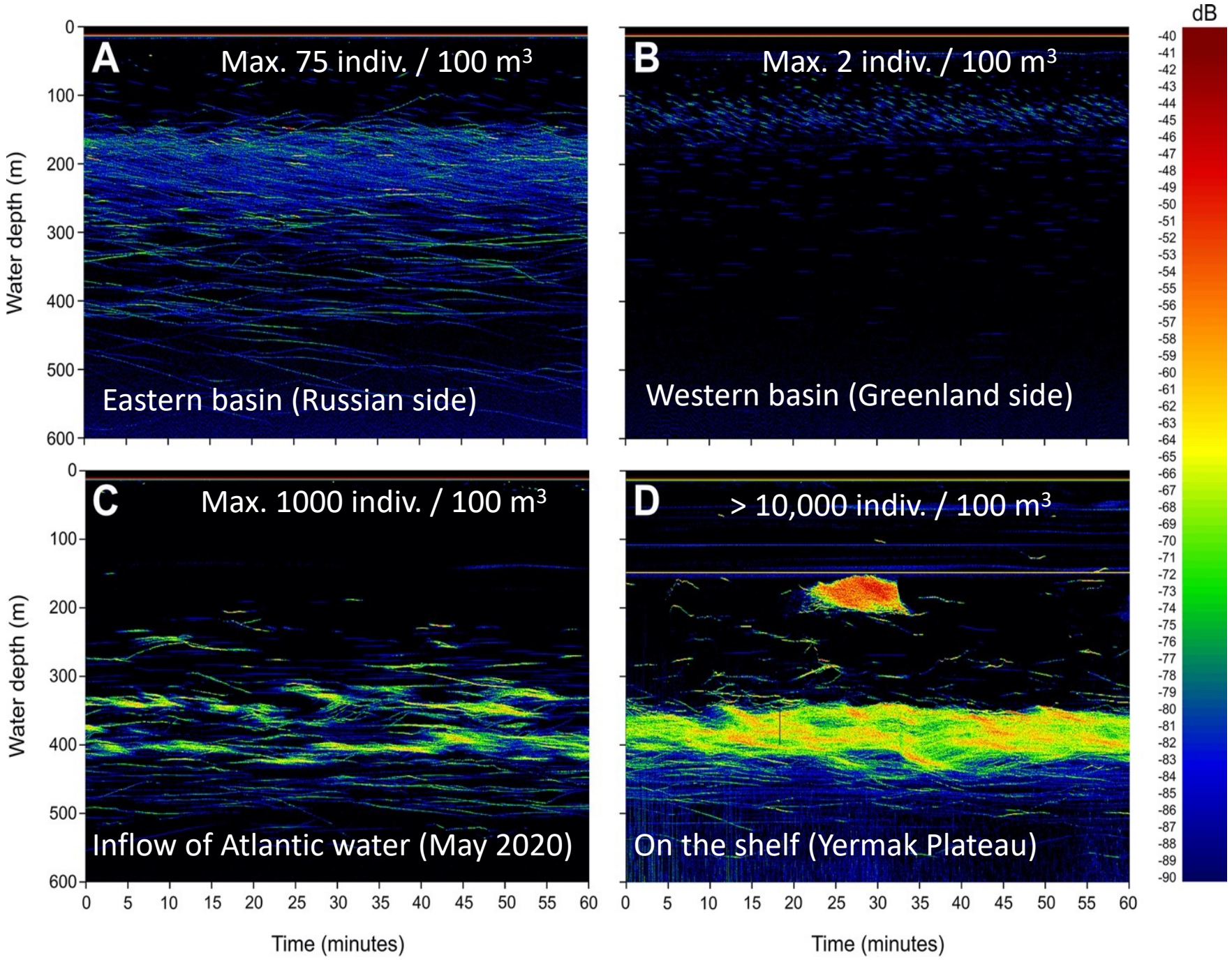
2016 Oden expedition

(a) Deep scattering layer at 300 – 600 m depth

(b) North Pole station single tracks of fish

CAO (North Pole area)
Max. 50 kg / km^2

Barents Sea (average)
Max. 1,386 kg / km^2
(only of *Boreogadus*)

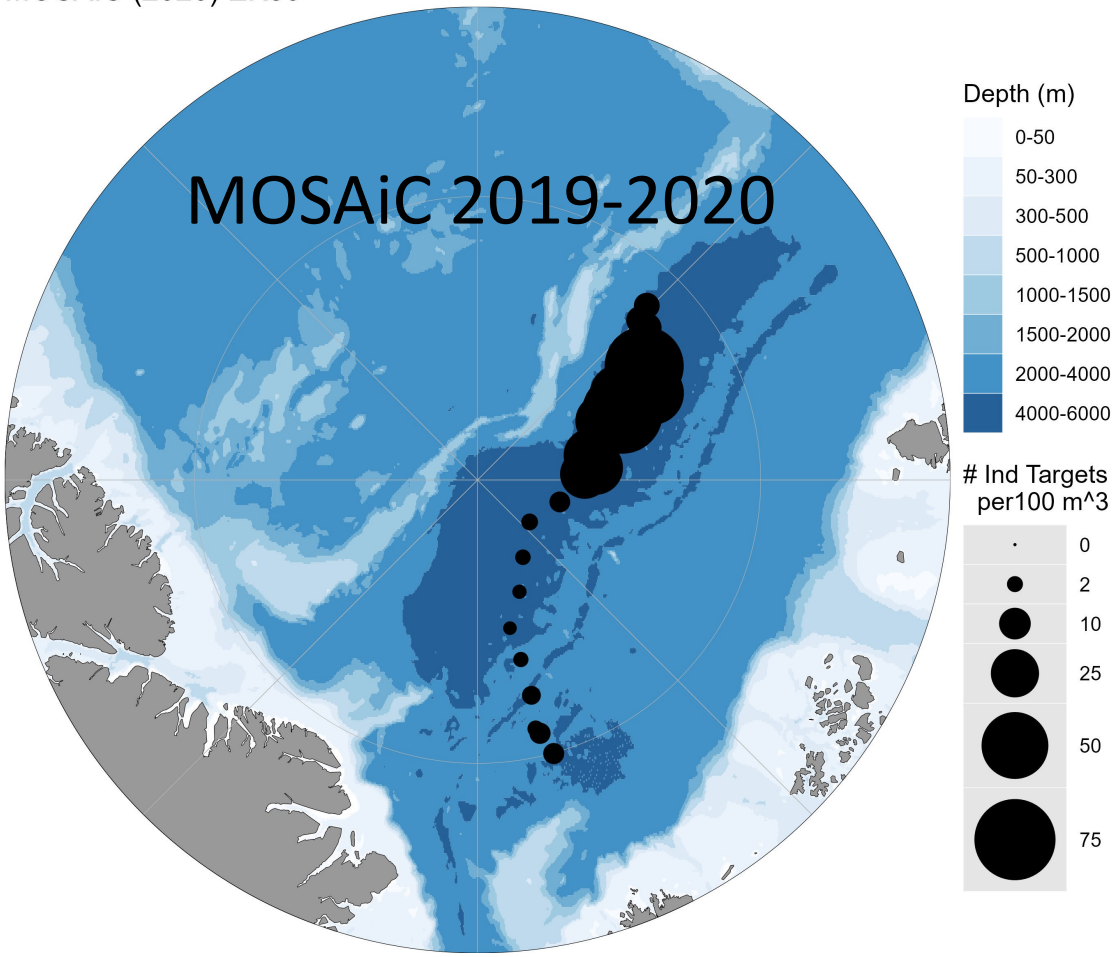


2019-2020 MOSAiC expedition

Shelf = high fish density
CAO = almost no fish

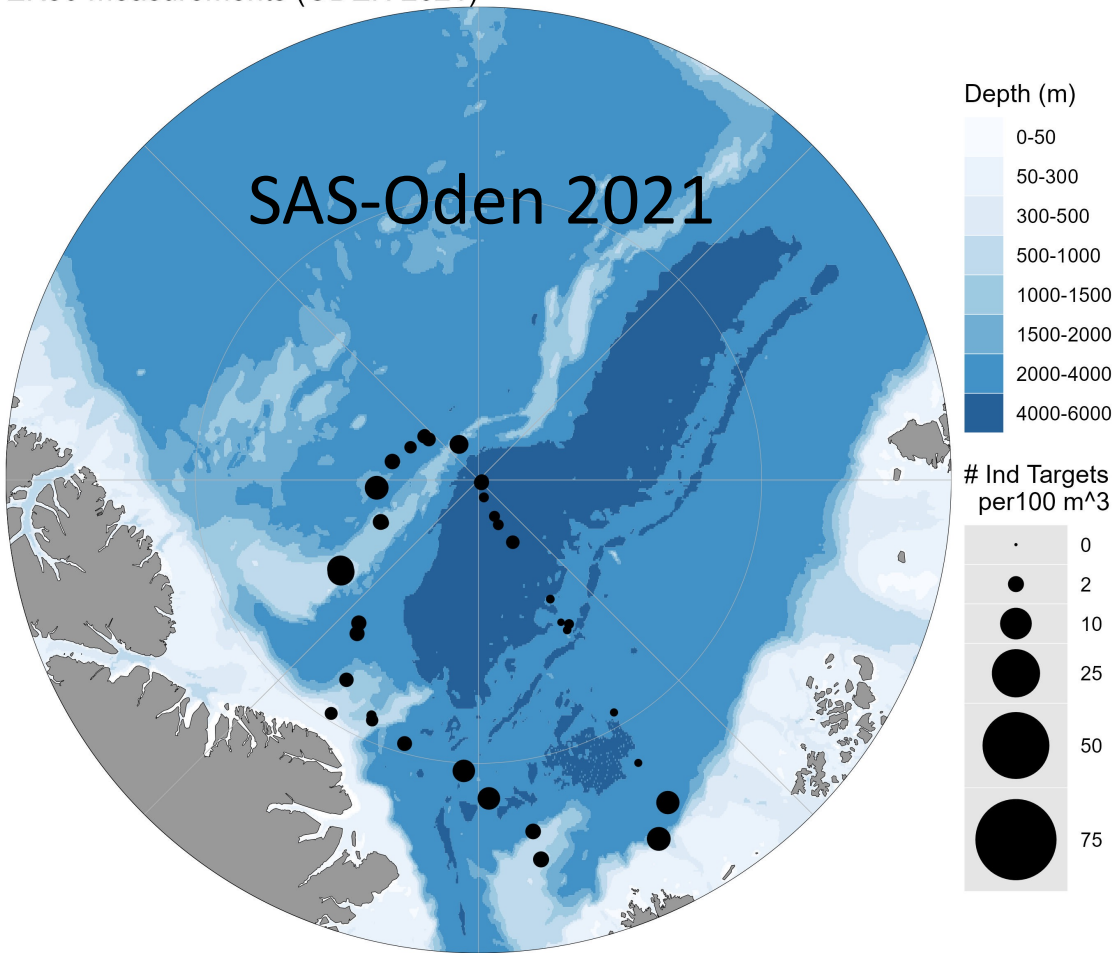
2021 SAS-Oden expedition

MOSAIC (2020) EK80

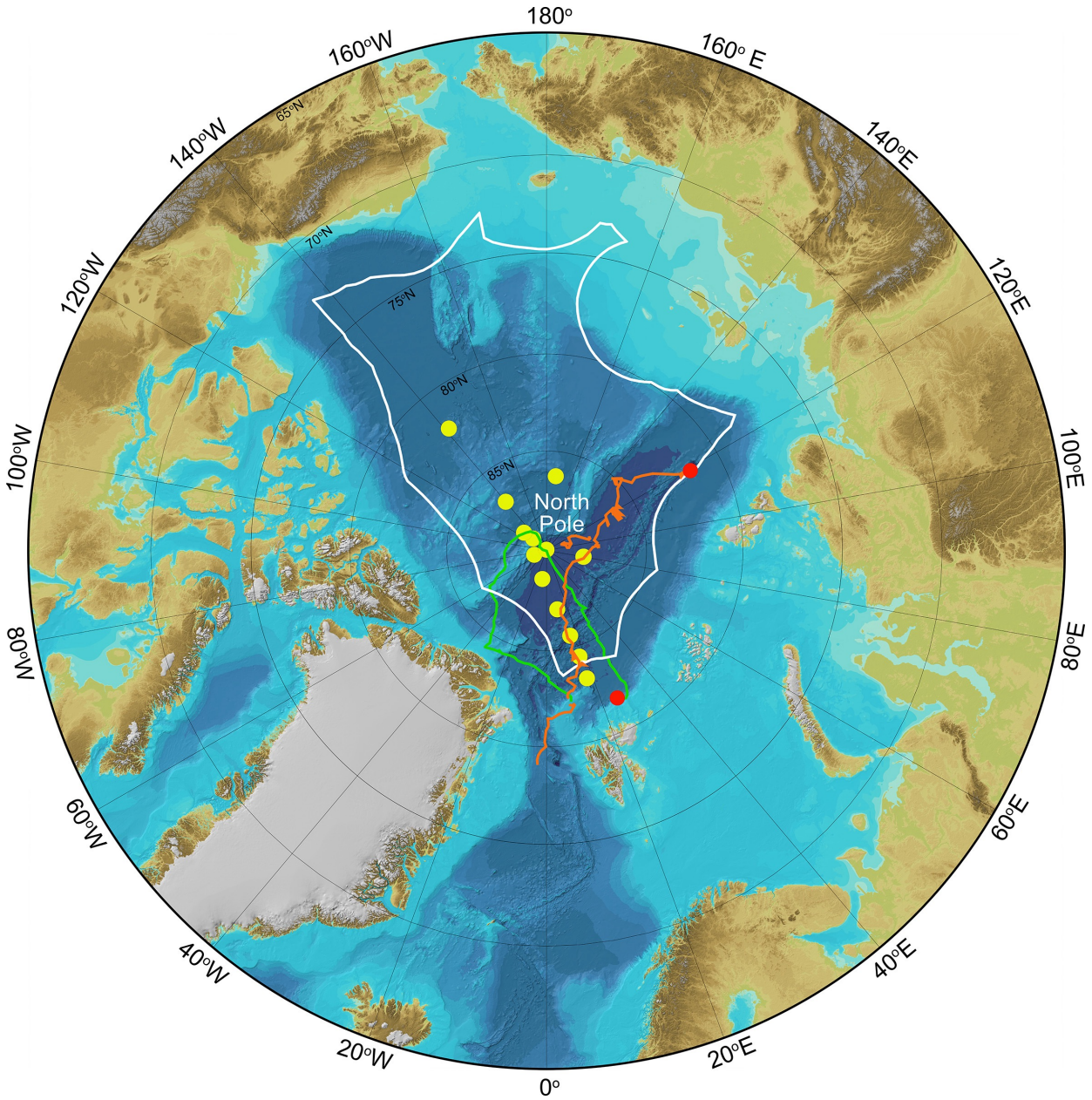


Max. 75 indiv. / 100 m^3

EK80 measurements (ODEN 2021)



Max. 1-5 indiv. / 100 m^3



Conclusions

There is a deep scattering layer everywhere

Fish density is extremely low

Most fish are small (10-15 cm)
very few larger predatory fish (40-60 cm)

There is just enough fish to feed the few seals
- and the few polar bears - in the CAO

The Arctic shelf seas are highly productive,
the CAO is not

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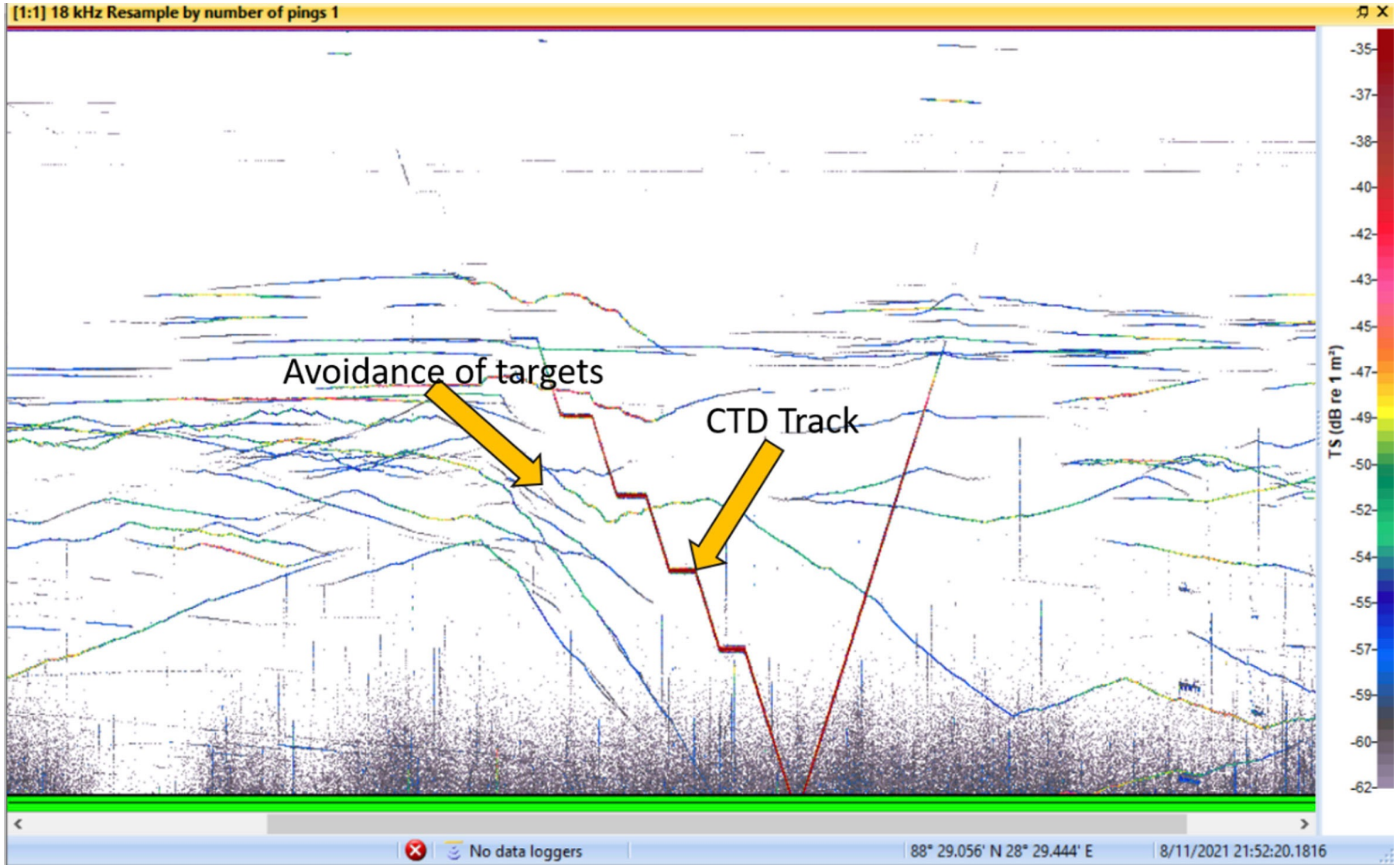
Problem: difficult to catch fish with vertical sampling gear

The fish are so very few and they see the gear coming down

We tried many different types of

Nets
Lines
Traps



The JPSRM is very important even if we found so little fish in the deep basins

- Study the shallower areas (especially Chukchi plateau area)
- Fish is expected to move northward with climate change in all slope areas / gateways
- Pelagic fish are crucial in the ecosystem and should be monitored

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Recommendations on methodology

- Standard sampling protocols based on experience from the CAO
- Synoptic ecosystem surveys (lessons learnt from SAS, more structured than SAS)
- eDNA (metagenomic and amplicon methods are currently being developed by EFICA)
- Acoustics on all ships and drift stations in the High Seas / gateways areas
- Acoustic, eDNA sampling buoys, gliders (real time data – relatively cheap)
- Trawling if open water (areas with open water increase rapidly)

Etc., etc.

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Annex 6: Updated JPSRM Questions based on Discussions at the Third PSCG Meeting

1. What are the distributions of species with a potential for future commercial harvests in the Central Arctic Ocean?
    a. What fish species are currently present in the high seas?
    b. Do fishable concentrations of commercial species exist in the high seas?
    c. What are their distributions and abundance patterns?
    d. What are their local life-history strategies, habitat associations, and demographic patterns?
    e. Do these strategies, associations, or patterns differ among regions of the Arctic?
2. What other information is needed to provide advice necessary for future sustainable harvests of commercial fish stocks and maintenance of dependent ecosystem components?
    a. What are the trophic linkages among fishes and between fishes and other taxonomic groups (i.e. quantify food webs, including identifying keystone forage species)?
    b. How do fish species abundances and distributions vary in response to climate variability (e.g. time scale of change, extreme events, declining sea ice, and biogeochemical changes)?
    c. Can the species be harvested sustainably with respect to both target fish stocks and dependent parts of the ecosystem? If not, what are the prospects for the development of fisheries in the future?
3. What are the likely key ecological linkages between potentially harvestable fish stocks of the central Arctic Ocean and the adjacent shelf ecosystems which includes support for Indigenous communities and local communities?
    a. What are the connections between fish in the High Seas and those in the adjacent regions?
    b. What are the mechanisms that establish and maintain these linkages?
    c. How might fisheries in the High Seas and that in the adjacent and congruent portions of the shelf ecosystems interact, including fish stocks, fishable invertebrates (crabs, shrimp, mollusks), marine mammals, birds, and fisheries-dependent communities (which include those communities that are dependent on subsistence harvests of fish, invertebrates, and mammals)?
4. Over the next 10-30 years, what changes in fish populations, dependent species and the supporting ecosystems may occur in the central Arctic Ocean and the adjacent shelf ecosystems?
    a. Which marine species will likely increase and decrease in population size and/or productivity in the central Arctic Ocean in the next 10-30 years?
    b. What changes in production and key linkages are expected in the coming 10-30 years?
    c. What northward population expansions are expected in the next 10-30 years?
    d. What are the anticipated impacts of change in ocean acidification in the next 10-30 years?
    e. How will existing and increased human activity and pressures in the region likely affect fish populations and ecosystems, which includes support for Indigenous communities and local communities, in the next 10-30 years?
    f. How could increased fishing activity affect bycatch species, seabirds, migratory and wide-ranging marine mammals, and Indigenous communities and local communities that depend upon these species to sustain their ways of living?
5. What Indigenous Knowledge and local knowledge is available, and how can it be taken into account, to inform ecological baselines?

Annex 7: China Data Sharing Protocol Discussion Paper

Draft Framework for the Development of a Data Sharing Protocol

A discussion paper to be circulated to Parties at the request of China

Summary: The COP have approved the PSCG to establish a working group to develop data sharing protocols, and agreed to hold the PSCG meeting in the fall 2022 to review and finalize the work of the Working Group. However, our work has been laid far behind the schedule to date. To facilitate the discussion in the coming PSCG meeting, China has urgently prepared this paper in case there will be no documents to be discussed as the basis of our work.

This paper draws on some international data management polices and practices, and provided a draft framework and some basic elements for the development of a Data Sharing Protocol for the consideration of Parties. It is recommended that the PSCG to adopt the framework for the development of a data sharing protocol on the basis of this paper as the first step, and request the DSP-WG to further draft a Data Sharing Protocol in accordance with the CAO Agreement for approval by the PSCG, then request the DSP-WG to develop standard specifications on the formats of the different types of data to be generated by the JPSRM for the centralized data management system, and encourage Parties to use the same format to collect data in their national research programs for the distributed data management system where appropriate.

1. Background

The CAO agreement obligated the Parties to establish a Joint Program of Scientific Research and Monitoring (JPSRM) and a data sharing protocol as part of it within two years of the entry into force of the Agreement. The JPSRM shall aim to improve understanding of the ecosystems of the Agreement Area and, in particular, of determining whether fish stocks might exist in the Agreement Area now or in the future that could be harvested on a sustainable basis, and the possible impacts of such fisheries on the ecosystems of the Agreement Area, and takes into account the work of relevant scientific and technical organizations, bodies and programs, as well as indigenous and local knowledge.

The 2nd PSCG Meeting in March 2022 recommended to establish a PSCG Data Sharing Protocol Working Group (DSP-WG) to develop an agreement on a data management policy and sharing protocols as part of the JPSRM, for consideration by the PSCG and approval by the Parties, building on the draft plan from the 5th FiSCAO meeting and informed by the discussions from the 2nd PSCG meeting. The DSP-WG will meet in two phases to identify the framework and specific policy components to be developed and, then identify appropriate technical requirements. The DSP-WG will draft a hybrid framework that recognizes *a centralized data management system* collected specifically for the JPSRM and *a distributed data management system* for relevant accessible data collected in the JPSRM area. The DSP-WG will consider other international data management policies and sharing protocols to benefit from state-of-the-art agreements already in use[1]. The Parties approved the establishment of the proposed working group as a productive means of advancing the PSCG work on the development of data sharing protocols, and

[1] Provisional Scientific Coordinating Group proposal to the Conference of Parties to the Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean.

approved the holding of a PSCG meeting in the fall 2022 to review and finalise the work of the Working Group[2].

2. International data management policies and Sharing Protocols

2.1. CCAMLR's centralized data management and sharing system

All the scientific data collected in the centralized data management and sharing system of CCAMLR are originated from the contributions of members, either submitted by members on a mandatory basis in accordance with relevant legally binding provisions stipulated in CCAMLR Conservation Measures, or provided by members on a voluntary basis to aid the scientific work of CCAMLR. The "mandatory data" need to be submitted in accordance with the format specified in the relevant Conservation Measures, while the "voluntary data" are usually provided with a format discussed and adopted by the relevant Working Group of the SC-CAMLR.

The scientific data are stored in the centralized data management system operated by the Secretariat in CCAMLR Headquarter. The Secretariat is responsible for archiving and maintaining the data, while the ownership of the respective data still resides in the hands of the data originator. The data can be shared and used for the purpose of CCAMLR business through a series of Data Request, Permission-seeking, Permission-granting and Data-release procedures according to the *RULES FOR ACCESS AND USE OF CCAMLR DATA*; publication of the results originated from the data thus granted is also possible with additional consultation with and permission of the data owners in advance.

2.2 MOSAiC Data Policy

The Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC) is a collaborative, international project to address pressing scientific questions in the central Arctic. MOSAiC Data Policy regulates data management, access and release as well as authorship and acknowledgment. Signing the Data Policy is a pre-requisite for participation in MOSAiC field operations and being a member of the MOSAiC consortium.

The MOSAiC Central Storage (MCS) aboard Polarstern is the basis for gathering data during the year of operation, offering near-real-time access and early processing of the data to the users underway. The land MCS provided by AWI is the central and reliable storage and working database of MOSAiC data within the AWI storage platforms. Only MOSAiC consortium members with authentication/authorization will have access to the data prior to public release. PANGAEA is the primary long-term archive for the MOSAiC data set and all primary data, with the exception of the subsequently mentioned cases, must be submitted to the PANGAEA data base for long-term archival.

2.3 DBO Data Policy

The Distributed Biological Observatory (DBO) is an Arctic change detection array established along a latitudinal gradient that currently extends from the northern Bering Sea to the boundary between the Beaufort and Chukchi Seas near Cape Barrow, Alaska. DBO sampling focuses on cross-sections of areas with high productivity, biodiversity and rates of biological change.

[2] Summary Report of the Meeting of the COP to the CAO Agreement Virtual, May 31 and June 14, 2022.

The data centers that make up the "DBO Distributed Archive" will coordinate their data management activities, including the development of consistent metadata generation, management, and interoperability. When data submitted directly to the DBO AOOS workspace or national archive is deemed ready for long-term storage and distribution, final versions of these data and metadata will be updated or linked to the DBO EOL archive.

3. Framework for the development of Data Management andSharing Protocol

To facilitate the discussion among members to expedite the implementation of CAO Agreement and the work plan approved by the COP, a draft Framework for the Data Sharing Protocol was developed drowning on the practices on international data management and sharing, particularly those experiences in the data management associated with joint marine surveys in the Arctic and Antarctic region:

3.1 Data Management

i. Establish a hybrid framework of "centralized + distributed data management system". The data generated from the JPSRM is managed in centralized data management system, while the data generated by national scientific programs and other sources are managed in distributed data management system.

ii. To promote efficient collaboration on centralized data management, Parties are encouraged to establish a Data Center to facilitate data collection, archiving, maintenance and sharing. The main responsibilities of the Data Center may include:

    a) Establish and maintain a centralized data management and sharing system;

    b) Carry out the data collection and prepare the annual data collection report;

    c) Carry out the data quality checking, and provide feedback to the data provider;

    d) Collect and managing metadata submitted by Parties;

    e) Ensure the data safety and security, and make regular backup of the data;

    f) Provide data to Parties that request data sharing in accordance with section 3.2 of this Agreement

iii. Centralized managed data

    a) The centrally managed data includes three levels: raw data, quality control data and data product. Raw data refers to machine recorded data without any processing, mainly used for data permanent preservation and data traceability; Quality control data refers to the data that can be directly used for fish population and ecosystem evaluation after quality accusation and standardization; Data products refers to the data generated from fish survey mapping and ecosystem evaluation.

    b) To improve the data availability, the metadata and the data documentation must be submitted along with the data.

    c) The raw data generated by the Joint Program for Scientific Research and Monitoring are recommended to be submitted within 3 months after the finish of the survey, whilehe quality control data be submitted within 1 year after the expedition.

d) The quality control data adopts a unified data format and measurement unit, the metadata adopts the ISO 19115 standards or other standards approved by PSCG or its succeeding body.

e) In order to protect the data intellectual property rights, the data generated by the Joint Program for Scientific Research and Monitoring suggests to be identified by DOI and to specify how the data is referenced. Parties must reference the data when using the data generated by the Joint Program for Scientific Research and Monitoring.

iv. Distributed-managed data

a) Data generated by the national scientific program of Parties and other cooperative organizations adopt distributed management.

b) Parties are encouraged to share the data generated by the national scientific program, and the relevant historical data. And the relevant metadata is transferred to the data center.

3.2 Data sharing

To implement the objectives and requirements of the Agreement, the Parties is entitled to use and analysis the data deposited in the centralized management system. In addition, the access to and use of the data managed in a centralized system for the purposes like publication shall be subject to the consent of the data provider.

Access to and use of the data deposited in the distributed management system should be requested from the relevant Parties and organizations. Parties and relevant organizations are encouraged to share those data.

4. Recommendations:

It is recommended that the PSCG to

1) adopt the framework for the development of a data sharing protocol on the basis of this paper as the first step;

2) request the DSP-WG to further draft a Data Sharing Protocol in accordance with the CAO Agreement for approval by the PSCG;

3) request the DSP-WG to develop standard specifications on the formats of the different types of data to be generated by the JPSRM for the centralized data management system, and encourage Parties to use the same format to collect data in their national research programs for the distributed data management system where appropriate.