

CAFF Monitoring Series
March 2020

ARCTIC MARINE BIODIVERSITY MONITORING PLAN

2020 - 2021 Work Plan and Status Report



The Conservation of Arctic Flora and Fauna (CAFF) is a Working Group of the Arctic Council.

CAFF Designated Agencies:

- Norwegian Environment Agency, Trondheim, Norway
- Environment and Climate Change Canada, Ottawa, Canada
- Faroese Museum of Natural History, Tórshavn, Faroe Islands (Kingdom of Denmark)
- Finnish Ministry of the Environment, Helsinki, Finland
- Icelandic Institute of Natural History, Reykjavik, Iceland
- The Ministry of Nature and Environment, Greenland
- Russian Federation Ministry of Natural Resources and Environment, Moscow, Russia
- Swedish Environmental Protection Agency, Stockholm, Sweden
- United States Department of the Interior, Fish and Wildlife Service, Anchorage, Alaska

CAFF Permanent Participant Organizations:

- Aleut International Association (AIA)
- Arctic Athabaskan Council (AAC)
- Gwich'in Council International (GCI)
- Inuit Circumpolar Council (ICC) – Greenland, Russia, Alaska and Canada
- Russian Indigenous Peoples of the North (RAIPON)
- Saami Council

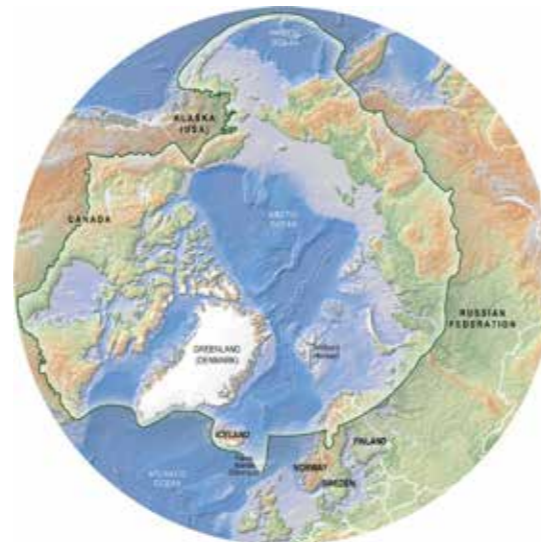
This publication should be cited as: CAFF (2020). Arctic Marine Biodiversity Monitoring Plan 2020 - 2021 Work Plan and Status Report. Conservation of Arctic Flora and Fauna International Secretariat: Akureyri, Iceland.

Coastal Expert Monitoring Group: Tahzay Jones, Stacey Fritz, Donald McLennan, Susse Wegeberg, Ingrid Handå Bysveen, Liudmilla Sergienko, Carolina Behe, Pitseolak Moss-Davies, Tom Christensen, and CAFF Secretariat

Cover photo: www.shutterstock.com

For more information please contact:

CAFF International Secretariat
 Borgir, Nordurlod
 600 Akureyri, Iceland
 Phone: +354 462-3350
 Fax: +354 462-3390
 Email: caff@caff.is
 Internet: www.caff.is



— CAFF Designated Area



Table of Content

1. Introduction..... 4

2. CBMP-Marine Organization..... 5

3. 2019 Report and Scoping Process 6

4 2020-2021 Work Plan 6

 4.1 Budget.....6

5. Expert Network Updates 10

 5.1 Sea Ice Biota Expert Network 10

 5.2 Plankton Expert Network 11

 5.3 Benthos Expert Network 12

 5.4 Fish Expert Network..... 14

 5.5 Circumpolar Seabird Expert Group (CBird)..... 15

 5.6 Marine Mammal Expert Group..... 16

ANNEX – 2019 Presentations and Publications by CBMP ENs Relevant to CBMP Goals 18

1. Introduction

The Arctic Marine Biodiversity Monitoring Plan (2011) is an agreement among Arctic States to compile, harmonize and compare results from existing Arctic marine biodiversity and ecosystem monitoring efforts across the Arctic region. This work is coordinated under the Circumpolar Biodiversity Monitoring Program (CBMP) of the Arctic Council's Conservation of Arctic Flora and Fauna (CAFF) Working Group. The CBMP is a network of scientists and traditional knowledge holders from governments, Indigenous organizations, academic institutions, and conservation groups that monitor the Arctic's living resources.

CBMP's Marine Expert Monitoring Group includes six Expert Networks focused on Sea ice biota, Plankton, Benthos, Marine fishes, Seabirds and Marine mammals. These networks have identified key elements of the Arctic marine ecosystem, called Focal Ecosystem Components (FECs). Changes in FECs status are considered indicative of changes in the overall marine environment. For the purposes of reporting and comparison, eight physically and bio-geochemically distinct Arctic Marine Areas (AMAs) are identified in the Plan.

In addition to the Plan, CBMP-Marine's key product to date is the State of the Arctic Marine Biodiversity Report (SAMBR) (CAFF 2017). SAMBR includes key findings and advice for monitoring. In 2019, CBMP-Marine conducted a scoping process to consider lessons learned during the development of the SAMBR and to plan next steps. This workplan is the first outcome of this scoping process and provides an overview of the activities planned for 2020-2021.

Traditional knowledge (TK) is an important source of information for understanding Arctic biodiversity and developing effective conservation strategies and facilitating their successful implementation. However, documenting TK and using these systems of knowledge appropriately along with scientific and management settings requires resources and strong intent. The Circumpolar Biodiversity Monitoring program calls for the increase efforts to better utilize different sources of information and support the involvement of TK holders and indigenous peoples from the inception of projects through analysis of information gained, and to build a strong and diverse network of experts within both science and traditional knowledge and local knowledge. Goal 1 of the CBMP Strategic Plan 2018-21 is that the CBMP should be relevant to the Arctic States, Permanent Participants, the scientific and Traditional knowledge and local knowledge communities, and other partners. The CBMP Strategic Plan 2018-21 also states that the CBMP should include TK when possible (Objective 1.3). The Marine group will work with intention to include traditional knowledge in their work through direct outreach to the permanent participants.



Photo: www.shutterstock.com

2. CBMP-Marine Organization

CBMP-Marine consists of a Marine Steering Group (MSG) and the six Expert Networks (EN).

The Marine Steering Group (MSG):

- ▶ Coordinates implementation of the CBMP-Marine Plan;
- ▶ Ensures effective communication among and between the implementing states;
- ▶ Coordinates and provides direction to the Marine ENs;
- ▶ Facilitates input from national experts;
- ▶ Meet annually to review program implementation;
- ▶ Tracks implementation of the CBMP Marine Plan in response to advice from SAMBR; and
- ▶ Provides reports and information derived from monitoring activities to CAFF.

Chairs rotate on the MSG every two years. The MSG is currently led by Canada and Greenland. It is composed of one representative and an alternate from each Arctic coastal state as well as representatives from interested Permanent Participants (PPs) and others as appropriate:

- ▶ **United States:** John Bengtson, National Oceanic and Atmospheric Administration; Catherine Coon, Bureau of Ocean Energy Management (alternate)
- ▶ **Norway:** Eirik Drabløs Pettersen, Norwegian Environment Agency; Dag Vongraven, Norwegian Polar Institute (alternate)
- ▶ **Russia:** Vadim Mokievsky; P.P. Shirshov, Institute of Oceanology Russian Academy of Sciences.
- ▶ **Kingdom of Denmark:** Thomas Juul-Pedersen, Greenland Institute of Natural Resources; Fernando Ugarte, Greenland Institute of Natural Resources (alternate); Jan Sørensen, Kaldback Marine Biological Laboratory (alternate)
- ▶ **Canada:** Glenn Benoy, Fisheries and Oceans Canada; Alain Dupuis, Fisheries and Oceans Canada (alternate)
- ▶ **Iceland:** Steinunn Hilma Ólafsdóttir, Marine and Freshwater Research Institute
- ▶ **AMAP:** Jason Stow, Fisheries and Oceans Canada
- ▶ **PAME:** Elizabeth McLanahan, National Oceanic and Atmospheric Administration
- ▶ **CBMP Co-chairs:** Tom Christensen, Aarhus University, Kingdom of Denmark; Catherine Coon, Bureau of Ocean Energy Management, U.S.
- ▶ **CAFF Secretariat:** Kári Fannar Larusson

Further information can be found here: www.caff.is/marine/marine-steering-group

The six ENs:

- ▶ Adopt and implement the CBMP Marine Plan;
- ▶ Identify priority knowledge gaps;
- ▶ Identify existing datasets for aggregation;
- ▶ Meet annually to review program implementation;
- ▶ Produce regular reports and publications; and
- ▶ Review and adjust the monitoring approach.

Further information can be found here: www.caff.is/marine/marine-expert-networks

3. 2019 Report and Scoping Process

A priority outcome of the CBMP-Marine Annual Meeting in 2018 (Rovaniemi, Finland) was the agreement to conduct a Scoping Workshop in 2019 to develop a work plan. As the first CBMP group to complete its State of the Arctic report, CBMP-Marine needed to develop a path of action that built upon the results and lessons learned from the SAMBR and aligned with the CBMP Strategic Plan 2018-2021.

In 2019, the CBMP-Marine Steering Group focused its efforts on organizing and convening the Scoping Workshop held November 5-7 in Nuuk, Greenland. Workshop objectives were to:

1. Identify any new information needs of existing and potential users of CBMP-Marine monitoring data from both within and outside the Arctic Council;
2. Discuss ways of improving alignment with other CBMP monitoring groups (particularly Coastal);
3. Identify areas for collaboration with other partners, including other Arctic Council Working Groups (AMAP, PAME) and other CAFF efforts;
4. Consider effective means for compiling and delivering information;
5. Discuss better integration among the Expert Networks;
6. Consider ways to increase the sustainability of CBMP-Marine; and
7. Review conceptual models in the Arctic Marine Plan and consider revisions needed based on new information, SAMBR key findings and advice, and national efforts to implement SAMBR recommendations. This includes identifying emerging or changing ecosystem drivers and stressors that should be considered for monitoring and assessment.

Thirty-six participants attended the workshop from Canada, Finland, Greenland/Denmark, Iceland, Norway, Saami Council, Sweden, and the U.S. This included representatives from the CBMP-Marine Steering Group, CAFF Board, CAFF Secretariat, all six ENs, and guest presenters on external projects, including other Arctic Council working groups. Although participation was somewhat limited by the remote location, there was very positive feedback from the Government of Greenland regarding the opportunity to meet with CAFF representatives and engage in the workshop itself.

Activities in this workplan are the result of the scoping process in Nuuk. A more detailed workshop report will be forthcoming in early 2020.

In addition to the workshop, the CBMP-Marine Steering Group developed brief reports on national activities ("1-pagers") related to Arctic biodiversity monitoring and implementation of SAMBR recommendations. These were completed for Canada, Greenland, Norway, Iceland, and the U.S.

4. 2020-2021 Work Plan

Table 1 outlines the CBMP-Marine MSG work plan for 2020-2021, including tasks linkages to the CBMP Strategic Plan 2018-2021 recommended actions.

4.1 Budget

Estimated costs for continued implementation of the CBMP-Marine Plan are presented in the Marine Monitoring Plan (CAFF 2011) and previous annual reports (CAFF 2018; 2017). For further details see Appendix A, Implementation Schedule and Budget in the monitoring plan (CAFF 2011). Based on this information, the 2020 budget for implementing the activities related to the annual meeting is estimated to be \$5000 USD per representative per meeting (travel and in kind), and an additional \$5000 USD for hosting the annual meeting.

A CBMP coordinator on contract to the U.S. Fish and Wildlife Service is currently supporting CBMP-Marine until June 2020. Budget for this function beyond 2020 need to be secured. The CAFF Secretariat provides additional support for coordination, product development, data management, reporting and communication activities.

An ongoing challenge is securing consistent travel support for national and PP representatives, both in the MSG and ENs. Inconsistent funding for EN work results in inconsistent deliverables. This varies across countries, ENs and projects.

Table 1. CBMP MSG work plan for 2020-2021

#	Tasks	Overview	Start-end date	Status	Actions, Outputs, and Notes	CBMP strategic plan 2018-2021
Research and Technical Products						
1	Update Arctic Marine Biodiversity Monitoring Plan	At the 2019 Scoping workshop, the EN's suggested minor updates to conceptual models and other sections of monitoring plan. The SG will facilitate this update by compiling and communicating updates provided by ENs.	2019-2020	Planned/Ongoing	<ul style="list-style-type: none"> Review and finalize at 2020 Annual Meeting Communicate changes through the CAFF web page Distribution according to communication plan 	2.1; 3.1
2	Establish coordinated CBMP monitoring in each Arctic Marine Area	Arctic-based monitoring networks adopt parameters and sampling approaches		Ongoing	<ul style="list-style-type: none"> MSG will communicate the recommended approaches and protocols in their countries MSG will help facilitate relevant plans in EN's as possible. Progress made in some ENs (e.g., benthos) 	1.1; 2.4; 2.5
3	Update SAMBR summary snapshots and related explanations	Short update with summary figures, case examples highlighted	2021	Begin 2020	<ul style="list-style-type: none"> Build off, but not replicate, SAMBR First update will be made at fall annual meeting in 2020 and available at CAFF biennial in 2021. This pilot update will inform level of effort, and results – to determine appropriate frequency of such updates going forward Distribution according to communication plan 	1.4; 1.5; 2.2
4	Scope and refine approach to thematic issue briefs	Series of issue briefs developed to share new information or observations more quickly than a synthesis report	2020-	Ongoing (periodic)	<ul style="list-style-type: none"> A concept on how to continue a more focused reporting approach on biodiversity or ecosystem themes and/or emerging issues will be prepared at the 2020 annual meeting A memo on the outcomes will be submitted to the CAFF Board describing a proposed process for determining/ prioritizing what these will address and how to disseminate 	2.2
5	Special journal issue on CBMP-Marine monitoring and research, possibly including co-authored articles with CBMP groups and AMAP	Special journal issue (journal TBD) to document science underlying other outputs (e.g., SAMBR update, issue briefs)	2020-2023	Begin 2020	<ul style="list-style-type: none"> EN(s)-led research articles on specific drivers or locations of interest (e.g. polynyas) in relation to changing biodiversity Explore the option of including and co-developing articles on areas of overlap with other CBMP groups, Arctic Council programs, including AMAP and PAME, and potentially external activities (e.g., Central Arctic Ocean Fisheries Agreement) In early 2020, begin to develop list of possible articles and identify potential journals The MSG will support CAFF Board in a potential process with AMAP to outline specific monitoring, research and reporting gaps and needs related to the CBMP-Marine FEC's and climate change 	1.1; 1.2; 1.4; 2.1; 2.2; 3.3

#	Tasks	Overview	Start-end date	Status	Actions, Outputs, and Notes	CBMP strategic plan 2018-2021
6	Data management structures	Continued development of a system for data storage and sharing from CBMP Marine for inclusion within ABDS; entry of data from ENs, interoperability with relevant data frameworks, e.g., GBIF and OBIS web analysis tools; metadata added	2013-	Ongoing	<ul style="list-style-type: none"> MSG, CAFF Secretariat to encourage and support development and management of data from ENs. Encourage addition of information to ABDS through updates to SAMBR and research articles 	2.6
External Communication and Outreach						
7	Communication and outreach to public, policy makers, scientists	Following the CAFF Communication Strategy work to reach target audiences as appropriate (e.g., through development of case studies, special journal issues, more rapid communications)	2017-	Ongoing	<ul style="list-style-type: none"> Some elements underway: SAMBR summary translation into Inuktitut (Canada) and Greenlandic Coordinate on timing, product outputs with other CBMP groups and maximize uses of CAFF Biennial, Congress, etc. MSG will give input to the continued process of integrating CBMP products; e.g. a shorter integrated report inspired by the CAFF 2010 indicator report, in 2021 and/ or 2023, that builds on SAMBR updates and a special issue focused on all four CBMP monitoring groups Develop targeted distribution lists for products Report draft to be circulated to participants for review 	1.1; 1.2; 1.3; 1.4; 2.1; 2.2; 2.6; 3.3;
8	Report from scoping workshop in Nuuk	Documentation of discussions and decisions	2019-2020	Ongoing	<ul style="list-style-type: none"> Report draft to be circulated to participants for review 	
CBMP-Marine Leadership and Management						
9	CBMP-Marine organization	Encourage involvement by all participating countries/PPs	2011-	Ongoing	<ul style="list-style-type: none"> CAFF Secretariat to repeat invitation to join the MSG and ENs to those countries/PPs not currently represented in these groups 	3.5; 4.1
10	Annual face-to-face meeting of MSG and ENs	Fall 2020 and 2021: Location tbd	Annually	Planned for 2020, 2021	<ul style="list-style-type: none"> Meeting will be timed to coordinate delivery of products for submittal to CAFF Board in time for CAFF Biennial in 2021 (anticipate updated Monitoring Plan, collection of case studies, updates to SAMBR summary outputs) Location is currently being explored for Fall 2020 meeting 	1.4; 2.1; 2.3; 3.1; 3.2; 3.5; 4.2
11	Reports to CAFF Board	Annual work plan and status report; CAFF Board memo; national implementation reports (one-pagers)	Ongoing	Ongoing	<ul style="list-style-type: none"> Annual work plan and status report to CAFF Board Posting of the national one-pagers (according to communications plan) 	1.4; 2.2; 2.6; 4.2
12	Enhance coordination with other CBMP groups (Coastal, Freshwater, Terrestrial)	Identify lessons learned, overlapping communications strategies and needs	2018 -	Ongoing	<ul style="list-style-type: none"> Co-leads participate in CBMP Co-lead/Co-chair calls and physical meetings, and attend each others' meetings where feasible Identify shared needs for communications where feasible Consider potential for integrated assessments across CBMP groups 	1.1; 3.1:3.3

#	Tasks	Overview	Start-end date	Status	Actions, Outputs, and Notes	CBMP strategic plan 2018-2021
13	Further engagement of Observers and experts	Increase engagement, fill vacancies in Expert Networks, and ensure Networks benefit from wide-ranging expertise	2017-	Planned/Ongoing	<ul style="list-style-type: none"> Seek input from CAFF Board ENs to consider further involvement from Observers and experts, MSG will work with CAFF Secretariat Update Terms of Reference for CBMP MSG (and ENs) 	2.3,2.4,2.5
14	Links to other groups	Establishing/strengthening collaboration with relevant organizations, e.g. Arctic Council Working Groups, including AMAP and PAME, ICES Working Group on Integrated Ecosystem Assessment for the Central Arctic Ocean, scientific coordinating group supporting the Central Arctic Ocean Fisheries Agreement and contributing information to support the Convention on Biological Diversity (CBD)	Ongoing	Started	<ul style="list-style-type: none"> MSG members discussions with CAFF Board representatives and by the CAFF Board; identify priority opportunities for engagement and criteria for considering such opportunities (e.g., willingness to share data, opportunities to enhance coordinated monitoring, etc.) Others steps mentioned under previous activities 	1.1, 1.4
15	Fundraising	Continue to actively seek funding and other support/capacity for implementation	Ongoing	Ongoing	<ul style="list-style-type: none"> Application by CAFF to relevant sources MSG representatives work with their representatives on the CAFF Board to ensure capacity and resources for their work 	4.3
16	Track and report to CAFF on SAMBR implementation	SAMBR information is used and recommendations/gaps are addressed.	2017-	Planned/Ongoing	<ul style="list-style-type: none"> CAFF Board representatives to discuss internally and at Board meetings with goal to provide direction to CBMP-Marine Annual one pagers include description of SAMBR implementation within countries 	2.1; 4.2

5. Expert Network Updates

This section provides updates on recent and upcoming activities and needs for each of the six ENs.

5.1 Sea Ice Biota Expert Network

List of members

- ▶ **Canada:** Michel Poulin
- ▶ **Greenland:** Thomas Juul-Pedersen
- ▶ **Russia:** Igor Melnikov
- ▶ **Norway:** Bodil Bluhm (lead), Cecilie von Quillfeldt
- ▶ **USA:** currently no member

Top five needs, estimated cost and contributions (in-kind and otherwise)

Top need	Estimated cost	Contributions to date
Researcher time for work on pan-Arctic occurrence of sympagic amphipods	Ca. 2 months	Researchers time
Securing travel funds for meetings	~\$5000 USD per participant per meeting	Norway: requested from the Norwegian Environment Agency
Other sources not currently identified		
Develop plan for integration and synthesis of data past SAMBR	Ca. 6 months of post-doc time	None identified yet

2019 Activities

- ▶ Participated in CBMP-Marine Scoping Workshop in Nuuk
- ▶ Continued work on items listed below
- ▶ Field work related to the Nansen Legacy project <https://arvenetternansen.com/>

Activities to be continued/completed in 2020-2021

Activity	Status/Target for Completion
Finalize peer-reviewed article on pan-Arctic ice algal biodiversity shifts over past 4 decades for special issue of Frontiers in Marine Science (Hop et al., most in EN), to be submitted Jan 2020	Review and revisions in 2020; completion depends on researcher time and review process
Finish paper on pan-Arctic pelagic occurrence of sympagic amphipods (Kunisch, Bluhm, Hop et al.) – accepted with Journal of Plankton Research	Published early 2020
Finish peer-reviewed article on pan-Arctic sympagic occurrence of amphipods (Hop, Bluhm et al.)	2021 (submission in 2020)
Contribute to Nansen Legacy sea ice sample processing and reporting (Bluhm, Gradinger et al.)	2021-2023
Contribute to paper on ribbon-shaped Arctic diatom taxa with morphological and genomic data (linked to TaxMArc project) (Edvardsen, Poulin, v. Quillfeldt et al.)	2020-2021
Contributions to documents on occurrence of harmful algae in the Canadian Arctic (Poulin et al.)	2019/2020
Phytoplankton identification guide and new records; linked to involvement in the TaxMArc Norwegian project (Diversity, taxonomy and distribution of marine protists in a changing Arctic) (Edvardsen, von Quillfeldt, Poulin et al.)	2021
Contribute to CBMP's plans on developing fact sheets, report cards etc.	2020 onwards

5.2 Plankton Expert Network

List of members

- ▶ **Canada:** Connie Lovejoy (co-lead), Michel Poulin
- ▶ **Faroe Islands:** Ian Salter
- ▶ **Greenland:** Mie Winding
- ▶ **Iceland:** Astthor Gislason, Guðmundur Guðmundsson
- ▶ **Norway:** Cecilie von Quillfeldt
- ▶ **Russia:** Ksenia Kosobokova
- ▶ **US:** Russ Hopcroft (co-lead)

Top five needs, estimated cost, and contributions (in-kind and otherwise)

Top need	Estimated cost	Contributions to date
Securing support for a co-ordinator, data compilation, data management	\$20 000 to \$30 000 USD per year	None in 2019
Securing travel funds for meetings	~\$5000 USD per person per meeting	Iceland, US, and Norway contributed for EN member travel to Nuuk; information needed regarding 2020 meeting for funding applications

2019 Activities

- ▶ Participated in CBMP-Marine Scoping Workshop in Nuuk
- ▶ Continued work on items listed below
- ▶ Published/submitted peer-reviewed publications in 2019 relevant to Arctic plankton biodiversity and trends (see annex for details)

Activities to be continued/completed in 2020-2021

Activity	Status/Target for Completion
Continue search for funding and partnership development	Ongoing
Compile new datasets on marine microbial eukaryotic biodiversity to increase understanding of polar planktonic systems for scientists and policy makers	2020
Prepare publication comparing zooplankton time-series across Network	2020
Zooplankton mapping exercise based on literature and new data	Ongoing; version 1 to be submitted 2020
Phytoplankton identification guide and new records; linked to involvement in the TaxMArc Norwegian project (Diversity, taxonomy and distribution of marine protists in a changing Arctic)	2021
Write up data sets for Bacteria and Archaea	2021
Thematic focus on temperature, salinity and phytoplankton species	2021



Photo: www.shutterstock.com

5.3 Benthos Expert Network

List of permanent members

- ▶ **Canada:** Virginie Roy (Lead), Philippe Archambault
- ▶ **Faroe Islands:** Jan Sørensen
- ▶ **Germany:** Dieter Piepenburg and Jan M. Holstein (observer country)
- ▶ **Greenland:** Martin Bilcher
- ▶ **Iceland:** Steinunn Olafsdottir
- ▶ **Norway:** Lis Lindal Jørgensen
- ▶ **Poland:** Monika Kędra (co-lead) (observer country)
- ▶ **Russia:** Nina Denisenko, Stanislav Denisenko
- ▶ **US:** Katrin Iken

Top five needs, estimated cost and contributions (in-kind and otherwise)

Top need	Estimated cost	Contributions to date
Top Priority: Securing travel funds for meetings	~\$5000 USD per participant per meeting	Travel funds needed for participants from: Canada, Greenland, Russia, US. Suggestion: Based on the low 2019 expert member attendance annual CBMP-Marine meeting, we request that CAFF-CBMP Board pay for one expert member from each of the 6 sub-groups every year (= funding for 6 participants at least). <ul style="list-style-type: none"> • Norway: Institute of Marine Research, paid by the Norwegian Environment Agency • Iceland: Steinunn H. Ólafsdóttir, paid by the Icelandic Institute of Natural History. • Observers: Germany: Piepenburg (paid by Alfred Wegener Institute Bremerhaven)
Project Priority: Financial support for time spent to work on collecting macrobenthic (grab) national data and creating maps.	Cost tbd for Zoological Institute Russian Academy of Science (ZIRAS) scientist for compiling Russian grab-sample metadata.	Can be located in any member country. Work with data assembled in the PANAVIO database on macrofauna.

Top activities in the previous year (2019)

- ▶ Collected metadata on grab-macrofauna data available in the different member countries to assess spatial coverage and data availability of a pan-arctic assessment. Data collated in PANABIO database at the Alfred Wegener Institute for Polar and Marine Research.
- ▶ Workshop in November 2018, Reykjavik Iceland, on Long Term Monitoring of Benthos from fish-assessment surveys: data work.. The by-catch of benthic invertebrate species from annual fisheries trawl surveys were biological trait-coded for further analysis and comparison over the pan-arctic area. Further work on this is expected in 2019 and 2020.
- ▶ Benthic expert members gave 11 presentations conferences on topics pertaining to Arctic benthic biodiversity (see annex for details)
- ▶ Published/submitted 12 peer-reviewed publications in 2019 relevant to Arctic benthic biodiversity and trends (see annex for details)
- ▶ Field work on benthic biodiversity was completed in the following countries:
 - **Canada**
 - None reported
 - **Faroe Islands**
 - None reported
 - **Germany**
 - None reported

- **Greenland**
 - 3-week offshore survey in Baffin Bay: Trawl bycatch, beam trawl, towed video sled
 - 2-week offshore survey in Davis strait: Trawl bycatch, towed video sled
 - 10-day inshore survey in Disko Bay, W Greenland: Towed video sled, drop camera, multibeam acoustics
 - 6-day offshore survey on continental slope, W Greenland: Towed video sled
- **Iceland**
 - While benthic data have been collected during the annual groundfish surveys since 2015, logistical reasons prevented these surveys in 2019.
- **Norway**
 - 2 month "Ecosystem survey" in the Barents Sea including long term monitoring of the benthos (in cooperation with PINRO)
- **Poland**
 - None reported
- **Russia**
 - Benthic offshore survey within the framework of the "TRANSARCTICA-2019" program: 90 days survey in the Chukchi, East Siberian, Laptev, Kara and Pechora Seas. Benthic samples collected using van-Veen grab.
- **USA**
 - August 2-23, 2019: DBO-NCIS (Northern Chukchi Integrated Study) on USCGC Healy
 - July 11-23, 2019: DBO cruise on CCGS Sir Wilfrid Laurier
 - August 1-October 3, 2019: Arctic Intergrated Ecosystem Survey cruise on R/V Ocean Starr

Activities to be continued/completed in 2020-2022

Main activity	To be continued/completed in the year
Continue to develop epifauna assessment for the vulnerability to trawling effects.	Sub-group of the benthic expert network used available fisheries trawl survey bycatch data to create maps on biomass hotspots, species richness distribution and is now in the process to associate functional traits with the epifauna species to determine regions that may be particularly vulnerable to trawling. Anticipated product is a peer-reviewed publication. 2-year plan
Gather available information on macrofauna collections on pan-Arctic scale (latitude, longitude, depth, date, sample status) to develop an overview of Arctic grab-surveys	A sub-group was developed that contributed metadata on Arctic grab macrofauna to the PANABIO database at the Alfred Wegener Institute (Germany). Once the group had an opportunity to review the metadata for coverage and available biological data (biomass, abundance, species identification), we will decide if a product (peer-reviewed publication) can be produced. Biomass from epifauna could be added to this and distribution patterns of the two benthic elements compared. 2-year plan
Gather metadata information on bottom imagery.	In addition to trawl and grab samples, bottom imagery is a tool frequently used for benthic studies. We plan to gather metadata on available imagery data to assess pan-arctic coverage. 5-year plan
Continue consideration for future focus on ecological hotspots. Could be a cross cutting issue for CBMP marine. Focus could include mapping hotspots on a pan-Arctic scale. Identify driving forces behind these, identify stressors and map these, evaluate cumulative effects.	Continued. Russian benthic experts used grab samples to estimate macrofauna changes on the species level and determined a hotspot region - the Pechora Sea - located in the Barents Sea and influenced by both Atlantic and Arctic waters. However, with increasing data available from epi- and macrofauna (see above), we may eventually get to a point where such evaluations of ecological hotspots or EBSAs (Ecologically or Biologically Significant Marine Areas) become possible at a larger scale.

5.4 Fish Expert Network

List of members

- ▶ **Canada:** Kevin Hedges (lead)
- ▶ **Iceland:** Hreiðar Þór Valtýsson
- ▶ **Norway:** Edda Johannesen
- ▶ **Russia:** Vadim Mokievsky (not active)

Top five needs, estimated cost and the contributions (in-kind and otherwise)

Top need	Estimated cost	Contributions to date
Active participation by all Arctic countries on the CBMP-Marine Fish Expert Network (FEN)	Varies by country	Canada, Iceland and Norway will likely continue to work together in the MFEN. Active participation by the US, the Kingdom of Denmark and Russia would greatly enhance our opportunities for data integration, analysis and monitoring.
Meeting travel	~\$5000 USD per participant per meeting	MFEN members have individually obtained funding to participate in meetings.

Top activities in the previous year (2019)

- ▶ Participated in the ICES/PICES/PAME Working Group on Integrated Ecosystem Assessment of the Central Arctic Ocean (WGICA).
- ▶ Participated in the first Preparatory Meeting of the Signatories to the Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean.
- ▶ Conducted baseline biodiversity surveys of marine fishes and invertebrates in Eclipse Sound, Pond Inlet, Frobisher Bay and at Southampton Island, Canada. Data input to managed database.
- ▶ Continued trawling surveys in Canada, Iceland and Norway. Data input to managed databases within each country.

Main activities to be continued/completed in year ahead (2020)

Main activity	To be continued/completed in the year
Participation in the Working Group on Integrated Ecosystem Assessment for the Central Arctic Ocean (WGICA) and look for opportunities to link and leverage activities between groups.	Ongoing: 2017-2022
Participate in the first meeting of the Provisional Scientific Coordinating Group of the Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean and look for opportunities to link and leverage activities between groups.	2020
Develop annual report cards for marine fish FECs	2019-2021
Continue to collect marine fish biodiversity data in national waters and ensure data are stored in managed databases.	Ongoing

5.5 Circumpolar Seabird Expert Group (CBird)

List of members:

- ▶ **Finland:** Mia Rönkä (lead)
- ▶ **Canada:** Grant Gilchrist, April Hedd, Mark Mallory
- ▶ **Denmark:** Flemming Ravn Merkel, Anders Mosbech
- ▶ **Faroe Islands:** Jóhannis Danielsen
- ▶ **Iceland:** Erpur Hansen
- ▶ **Norway:** Hallvard Strøm, Tycho Anker-Nilssen
- ▶ **Russia:** Maria Gavrilov, Yuri Artukhin
- ▶ **Sweden:** David Schönberg Alm
- ▶ **US:** Kathy Kuletz, Robert Kaler

Observer countries:

- ▶ **France:** David Grémillet
- ▶ **Japan:** Akinori Takahashi
- ▶ **Netherlands:** Maarten Loonen
- ▶ **UK:** Tim Dunn, Norman Ratcliffe

Top need	Estimated cost	Contributions to date
On-line data portal for seabird population trend and breeding success data		Pioneer version close to finalization in collaboration with CAFF Secretariat
Travel funding for annual CBird meetings and CBMP meetings	~\$5000 USD per person per meeting	

Top activities in the previous year (2019):

- ▶ Reporting on seabird population trends and breeding success by colony and reporting on the implementation of the Circumpolar Seabird Monitoring Plan: developed an on-line data portal for seabird colony data in collaboration with CAFF Secretariat
- ▶ Designed a template for country updates for implementation of CBird work and produced the reports
- ▶ Designed a template for dissemination and outreach for scientific publications
- ▶ Implemented species-specific conservation strategies and action plans
- ▶ Compiled an updated workplan
- ▶ Arctic Biodiversity Assessment (ABA)
 - Migratory Birds Initiative (AMBI) (Implementing the Circumpolar Flyaway Workplan): collaboration
 - Circumpolar Biodiversity Monitoring Program (CBMP): collaboration
- ▶ Discussed options for collaboration with AEW and OSPAR
- ▶ Held an annual meeting in Akureyri, Iceland, March 2019
- ▶ Planned the annual meeting 2020
- ▶ Participated in conferences and other meetings, in particular the CBMP-Marine Scoping Workshop in Nuuk, Greenland, and the CAFF Board meeting in Stockholm, Sweden
- ▶ Advanced nine projects in accordance with workplan, please see below.

Main activities to be continued/completed in year ahead (2020) (up to 10 activities)

Main activity	To be continued/completed in the year
International Ivory Gull survey	Ongoing: 2019-2022
North Atlantic Murre Harvest model	Ongoing: 2017–2020 (workshop in Reykjavik Apr 2020, paper accepted)
Shipping Risk to Seabirds in Circumpolar Regions	Ongoing: 2018-2023
Seabird – polar bear interaction: review and evaluation	Ongoing
Circumpolar Black-legged Kittiwake Conservation Strategy and Action Plan	Ongoing (to be submitted for CAFF Board approval at Board meeting Feb 2020)
Participation in the Working Group on Integrated Ecosystem Assessment for the Central Arctic Ocean (WGICA)	Ongoing: 2017-2020
Circumpolar Review of Arctic Tern Population Trends	Ongoing
Bycatch of seabirds in Lumpfish fisheries	Ongoing (paper published autumn 2019)
Status, trends and drivers of Leach's and European Storm-Petrel populations	Ongoing: 2018-2020
Annual meeting 14.–17.10.2020 in Hobart, Tasmania, and a symposium at the World Seabird Conference after the meeting	October 2020

5.6 Marine Mammal Expert Group**List of members**

- ▶ Norway: Kit M. Kovacs (lead), Dag Vongraven
- ▶ Canada: Steve Ferguson, Garry Stenson
- ▶ Kingdom of Denmark/Greenland: Fernando Ugarte, Kristin Laidre, Rikke Guldborg Hansen
- ▶ North Atlantic Marine Mammal Commission: Genevieve Desportes
- ▶ Russia: Stanislav Belikov
- ▶ US: Peter Boveng, Peter Thomas

Top needs, estimated cost and contributions

Funding application has been submitted in Norway for the updates to population abundance and trends and work on white whale (Beluga) morphometry. Additional funding needs are listed here.

Top need	Estimated cost	Contributions to date
Complete "hot-spots" analysis	\$56,000 USD remaining funds needed	(Estimated cost represents remaining cost to finalize analysis and complete report writing)
Mapping projects listed in table below – partial staffing	\$34,000 USD	

Top activities in the previous year (2019)

- ▶ Ongoing updates to population status and trends
- ▶ Ongoing ice-seals subgroup is underway, with special effort to bring ringed and bearded seal data into the scientific literature and management real (nationally and internationally) -see example articles in Annex
- ▶ Continued work on ringed seal ecotypes project; additional analytical effort was required to incorporate new people and areas into the work (analyses completed in 2019 – report writing extending into 2020)
- ▶ "Listen Connect and Conserve" project has resulted in an interactive map of Passive Acoustic Monitoring sites, including metadata on who owns the instruments, deployment period, recording settings, etc. Launched at World Marine Mammal Congress on 7 December 2019 with positive reception, discussion of possible collaborations and possible additional data.

Main activities to be continued/completed in years ahead (2020-2021 and up to 2025)

Main activity	To be continued/completed in the year
Updates to status and trends	Ongoing
Ringed seal ecotype analyses/paper	Ongoing – to be completed in 2020
Delivery of Listen, Connect and Conserve map link to CAFF for posting/linking	To be shared with CAFF January 2020
Marine mammal "hot-spots" analysis throughout circumpolar Arctic (majority of science teams that have tracked marine mammals in Arctic have provided data; analysis underway in 2019)	To be completed 2020
Polar bear community identification of baselines	2019-2021
Evaluate white whale (Beluga) morphometry and ecologies across the circumpolar Arctic	2019-2021
Develop circumpolar map showing regional stocks and illustrating abundance and trends	2019-2021
Develop circumpolar species diversity map for marine mammals	2019-2021
Establish health database including unusual mortality and disease events, e.g., Pacific disease/mortality events (2), Harp seal mortality event, Hudson Bay skin issues, Bald hooded seals in Canadian population(s)	2020 and beyond
Other possible projects on 5-year timeline: <ul style="list-style-type: none"> • Focal parameters to monitor health in marine mammals • Assess available harvest statistics for seals, whales, and polar bears (Harvest records remain a priority, though compilation of statistics has proven to be "politically" difficult) • Time trends in dietary analyses (responses to changing food webs) • Evaluation of marine mammal habitat changes (IPCC results from a biotic perspective – impacts forecasts) 	2020-2025

ANNEX – 2019 Presentations and Publications by CBMP ENs Relevant to CBMP Goals

Selection of presentations and publications related to activities of CBMP-Marine by the members of the CBMP-Marine Expert Networks in 2019.

Plankton Expert Network

Publications (selection)

Ershova EA, Descoteaux R, Wangensteen OS, Iken K, Hopcroft RR, Smoot C, Grebmeier JM, Bluhm BA. 2019. Diversity and distribution of meroplanktonic larvae in the Pacific Arctic and connectivity with adult benthic invertebrate communities. *Frontiers in Marine Science* <https://doi.org/10.3389/fmars.2019.00490>

Kobari, T., A. Sastri, L. Yebra, H. Liu, & R. R. Hopcroft. 2019. Evaluation of trade-offs in traditional methodologies for measuring metazooplankton growth rates: assumptions, advantages and disadvantages for field applications. *Prog. Oceanogr.* 178: <https://doi.org/10.1016/j.pocean.2019.102137>

Benthos Expert Network

Presentations (selection)

Blicher ME (2019) An open access benthos portal as a tool for marine spatial planning in Greenland. Ministry for Fisheries and Hunting, November 1, Nuuk, Greenland.

Yesson C, Sparrow-Scinocca B, Kemp K, Fuhrmann M, Hammeken Arboe N, Long S, Blicher ME (2019) Coral dominated Vulnerable Marine Ecosystem (VME) observations in the Davis Strait, West Greenland. Deep Sea Coral Symposium, July 29-Aug 2, Cartagena, Colombia.

Long S, Sparrow-Scinocca B, Kemp K, Fuhrmann M, Hammeken Arboe N, Blicher ME & Yesson C (2019) Vulnerable marine ecosystem (VME) observations in the Davis Strait, west Greenland. ICES Annual Science Conference, 9-12 September, 2019, Gothenburg, Sweden.

Golikov AV, Blicher ME, Zakharov DV, Xavier JC, Ceia FR, Sabirov RM (2019) Stable isotopes in cephalopod molluscs (Cephalopoda) of the Arctic. *The Molluscs: Biology, Ecology and Evolution of Malacofaunas*. Abstracts of all-Russian scientific conference with international participation. Borok, 14–18 October 2019, Papanin Institute for Biology of Inland Waters Russian Academy of Sciences. – Yaroslavl: Filigran', 2019. – p. 22.

Signe Christensen-Dalsgaard, Tycho Anker-Nilssen, Rory Crawford, Alexander Bond, Guðjón Már Sigurðsson, Gildas Glemarec, Erpur Snær Hansen, Martina Kadin, Lotte Kindt-Larsen, Mark Mallory, Flemming Ravn Merkel, Aevor Petersen, Jennifer Provencher & Kim Magnus Bærum 2019: What's the catch with lumpsuckers? A North Atlantic study of seabird bycatch in lumpsucker gillnet fisheries. *Biological Conservation* 240 (2019) 108278, <https://doi.org/10.1016/j.biocon.2019.108278>

Sutton L, Iken K, Bluhm B, Mueter F. 2019. A comparison in functional diversity of two Alaskan shelf systems. Alaska Marine Science Symposium, Anchorage, AK. 28-31 January 2019 (oral presentation)

Grebmeier J, Cooper L, Goethel C, Kedra M, Iken K. 2019. Pelagic-benthic coupling in the Chukchi Sea ecosystem: a key part of the Arctic Marine Biodiversity Observing Network (AMBON). Alaska Marine Science Symposium, Anchorage, AK. 28-31 January 2019 (oral presentation)

Ravelo A, Bluhm B, Iken K, Foster N. 2019. 1000 meters under the Beaufort Sea: Exploring Arctic epibenthic assemblages along a depth gradient. Alaska Marine Science Symposium, Anchorage, AK. 28-31 January 2019 (poster presentation)

Denisenko N, Blicher M. 2019. Biodiversity of bryozoan fauna and its variation along environmental gradients in Greenland waters. 19th conference of the International bryozoology association. Liberec, Chekh Republic. June, 2019.

Stratanenko E, Denisenko S. 2019. Growth of *Stegophiura nodosa* (Lütken, 1854) in the Pechora Sea. In: *The 18th Russian-Norwegian Symposium Murmansk, 5–7 June 2019 "INFLUENCE OF ECOSYSTEM CHANGES ON HARVESTABLE RESOURCES AT HIGH LATITUDES"*

Jørgensen LL, Huse G, Bakke G, Hoel AH. 2019. Protection of vulnerable benthos communities in the northern Barents Sea. Implementation of the EAM in the Arctic: Integrating information at different scales in the framework of EA implementation (organizer), 25-27 June 2020 Bergen Norway

Jørgensen LL. 2019. EcosystemBased Management in the Arctic. PAME 2, meeting 10-13 September, Reykjavik Iceland.

Publications (selection)

Golikov V, Blicher ME, Jørgensen LL, Walkusz W, Zakharov DV, Zimina OL and Sabirov RM (2019). Reproductive biology and ecology of the boreoatlantic armhook squid *Gonatus fabricii* (Cephalopoda: Gonatidae). *Journal of Molluscan Studies*, <https://doi.org/10.1093/mollus/eyz023>

Bock C, Wermter FC, Schalkhauser B, Blicher ME, Pörtner H, Lannig G, Sejr MK (2019) In vivo 31P-MRS of muscle bioenergetics in marine invertebrates: Future oceans limits scallops' performance. *Magnetic Resonance Imaging* 61:239–246, DOI: 10.1016/j.mri.2019.06.003

Ershova EA, Descoteaux R, Wangensteen OS, Iken K, Hopcroft RR, Smoot C, Grebmeier JM, Bluhm BA. 2019. Diversity and distribution of meroplanktonic larvae in the Pacific Arctic and connectivity with adult benthic invertebrate communities. *Frontiers in Marine Science* <https://doi.org/10.3389/fmars.2019.00490>

Zhulay I, Iken K, Renaud P, Bluhm BA. 2019. Epifaunal communities across marine landscapes of the deep Chukchi Borderland (Pacific Arctic). *Deep-Sea Research I* <https://doi.org/10.1016/j.dsr.2019.06.011>

Divine LM, Mueter FJ, Kruse GH, Bluhm BA, Jewett SC, Iken K. (2019) New estimates of weight-at-size, maturity-at-size, fecundity, mortality and biomass of snow crab, *Chionoecetes opilio*, in the Arctic Ocean off Alaska. *Fisheries Research* 218: 246-258.

Canonico G, Buttigieg PL, Montes E, Stepien CA, Wright D, Benson A, Helmuth B, Costello MJ, Muller-Karger FE, Sousa Pinto I, Saeedi H, Newton JA, Appeltans W, Bednaršek N, Bodrossy L, Best BD, Brandt A, Goodwin K, Iken K, Marques A, Miloslavich P, Ostrowski M, Turner W, Achterberg EP, Barry T, Defeo O, Bigatti G, Henry L-A, Ramiro Sanchez B, Durán Muñoz P, Mar Sacau Cuadrado M, Morato T, Roberts M, Garralda Garcia-Alegre A, Murton BJ. (2019) Global observational needs and resources for marine biodiversity. *Frontiers in Marine Science* <https://doi.org/10.3389/fmars.2019.00367>

Iken K, Mueter FJ, Grebmeier J, Cooper L, Danielson SL, Bluhm B (2019) Developing an observational design for epibenthos and fish assemblages in the Chukchi Sea. *Deep-Sea Research II* 162: 180-190. <https://doi.org/10.1016/j.dsr2.2018.11.005>

Denisenko SG, Denisenko NV, Chaban EM, Gagaev SYu, Petryashov VV, Zhuravleva NE, Sukhotin AA. 2019. The current status of the macrozoobenthos around the Atlantic walrus haul-outs in the Pechora Sea (SE Barents Sea). *Polar Biology* (2019) 42: 1703–1717. <https://doi.org/10.1007/s00300-018-02455-3>

Denisenko NV, Denisenko SG, Lehtonen KK. 2019. Distribution of macrozoobenthos in an Arctic estuary (Pechora Bay, SE Barents Sea) during the spring flood period. *Polar Biology* (2019) 42: 1667–1684. <https://doi.org/10.1007/s00300-018-02452-6>

Sukhotin A, Denisenko S, Galaktionov K. 2019. Pechora Sea ecosystems: current state and future challenges. *Polar Biology* (2019) 42:1631–1645. <https://doi.org/10.1007/s00300-019-02553-w>

Jørgensen LL, Primicerio R, Ingvaldsen RB, Fossheim M, Strelkova N, Thangstad TH, ... & Zakharov D. 2019. Impact of multiple stressors on sea bed fauna in a warming Arctic. *Marine Ecology Progress Series* 608: 1-12.

Goldsmith J, McKindsey C, Archambault P, Howland KL. 2019. Ecological risk assessment of predicted marine invasions in the Canadian Arctic. *PloS One*:14(2): e0211815.

Marine Mammal Expert Network

Publications (selection)

Hamilton, C.D., Lydersen, C., Fedak, M.A., Freitas, C., Hindell, M.A. and Kovacs, K.M. 2019. Behavioural ontogeny of bearded seals *Erignathus barbatus* through the first year of life. *Marine Ecology Progress Series* 627: 179-194.

Hamilton, C.D., Kovacs, K.M. and Lydersen, C. 2019. Sympatric use of a glacial fjord by two Arctic endemic seals *Marine Ecology Progress Series* 615: 205-220.

Kovacs, K.M., Krafft, B. and Lydersen, C. 2020. Bearded seal (*Erignathus barbatus*) pup growth - body size, behavioral plasticity and survival in a changing climate. *Marine Mammal Science* – in press – January 2020.

For further information and additional copies
contact:

CAFF INTERNATIONAL SECRETARIAT
Borgir
Nordurslod
600 Akureyri
ICELAND

Telephone: +354 462 3350
Fax: +354 462 3390
E-mail: caff@caff.is
Internet: <http://www.caff.is>

Prentstofan: Stell