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Arctic Marine Biodiversity Monitoring Plan Annual Report 2013

Annual Report on the Implementation of the Circumpolar Biodiversity Monitoring Program's Arctic Marine Biodiversity Monitoring Plan (CBMP-Marine Plan)



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- Russian Federation Ministry of Natural Resources, 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)
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- Inuit Circumpolar Council (ICC) – Greenland, Alaska and Canada
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What is the Arctic Marine Biodiversity Monitoring Plan (CBMP-Marine Plan)?

The Arctic Marine Biodiversity Monitoring Plan (CBMP-Marine Plan) is the first pan-Arctic, long-term, integrated biodiversity monitoring plan produced by CAFF's Circumpolar Biodiversity Monitoring Program (Gill et al. 2011). Approved by the Arctic Council in 2011, the objectives of the CBMP-Marine Plan are to integrate existing circumpolar monitoring datasets and models to improve the detection and understanding of changes in Arctic marine biodiversity, as well as to inform policy and management responses to these changes.

The Plan's development was co-led by Norway and the United States and was the result of extensive discussions and consultations during 2008-2011 involving experts from Arctic coastal nations (United States, Canada, Greenland, Iceland, Denmark, Norway and the Russian Federation), other Arctic Council working groups and Permanent Participants. The development of the Plan involved creating an inventory of current Arctic marine biodiversity monitoring efforts and datasets, producing a background paper and holding two international workshops. The Plan identified eight Arctic Marine Areas (AMAs) for the purposes of reporting and comparison, and selected Focal Ecosystem Components (FECs) to monitor various trophic levels using specific parameters, methodologies, indicators and sampling designs drawn from existing monitoring capacity and data.

The CBMP-Marine Plan represents broad agreement across Arctic nations on how to generate more extensive results from existing collective monitoring efforts in Arctic marine ecosystems and is designed to provide more comprehensive and timely circumpolar information for effective decision-making.

What is the status of the CBMP-Marine Plan's Implementation?

Since the implementation of the CBMP-Marine Plan in late 2011 the Marine Steering Group has provided overall direction and management, and five expert networks (Sea-ice Biota, Plankton, Benthos, Marine Fish and Marine Mammals) have worked on establishing marine biodiversity baselines, detecting changes and trends, and discerning the underlying reasons for change. This report describes progress made on carrying out the CBMP-Marine Plan during the second year of implementation (2013).

The CBMP-Marine Steering Group and Expert Networks are composed of national members from participating countries (Canada, Greenland, Iceland, Faroe Islands, Norway, Russia and US) along with Permanent Participants (e.g., Inuit Circumpolar Council) and other Arctic Council working groups (e.g., Arctic Monitoring and Assessment Programme).

The ongoing activities and work conducted within the Steering Group and Expert Networks rely primarily on national support and financing. The progress made on implementing the CBMP-Marine Plan and the resulting products that have been produced signify the commitment and determination of the involved members and countries.

The CBMP-Marine program is now established as a pan-Arctic network of scientists and other members from the different Arctic coastal nations with close connections to national monitoring efforts. National knowledge and experience have been integrated into the development of the CBMP-Marine Plan and continue to feed into the program. The established program is now providing guidelines, advice and input into ongoing and planned national monitoring efforts and processes, as well as actively supporting national marine monitoring initiatives.

Within the established network of members, the CBMP-Marine program is actively seeking greater collaboration, connection and alignment with other groups both within and outside the Arctic Council. Outside groups with interests that intersect with those of the CBMP-Marine program are being invited to annual meetings to facilitate open dialogue, and the CBMP-Marine program participates and actively contributes to outside meetings and workshops.

The CBMP-Marine program continues to promote and partake in the building of the next generation of polar scientists in collaboration with the Association of Polar Early Career Scientists (APECS). This cooperation has been mutually beneficial: an APECS member has provided Secretariat support to the program for the past two years, and APECS members have attended a number of CBMP events and meetings.

This collective pan-Arctic effort is leading to the discovery, rescue, aggregation and analysis of numerous datasets and has helped break down national and regional barriers in monitoring efforts.

Details of the progress of each group are provided below.

Updates from the CBMP-Marine Plan Implementation Teams

Marine Steering Group

Preamble

The Marine Steering Group members:

- ▶ Jill Watkins (Fisheries and Oceans Canada, Canada - co-chair 2013)
- ▶ Thomas Juul-Pedersen (Greenland Institute of Natural Resources, Greenland - co-chair 2013-14)
- ▶ Reidar Hindrum (Norwegian Environment Agency, Norway – co-chair 2014-15)
- ▶ Kathleen Crane (National Oceanic and Atmospheric Administration, U.S.)
- ▶ Sue Moore (National Oceanic and Atmospheric Administration, U.S. - alternate)
- ▶ Lisa Loseto (Fisheries and Oceans Canada, Canada – alternate)
- ▶ Fernando Ugarte (Greenland Institute of Natural Resources, Greenland – alternate)
- ▶ Gudmundur Gudmundsson (Icelandic Institute and Museum of Natural History, Iceland)
- ▶ Jan Sørensen (Kaldbak Marine Biological Laboratory, Faroe Islands)
- ▶ Dag Vongraven-alternate (Norwegian Polar Institute, Norway – alternate)
- ▶ Vadim Mokievsky (PP Shirshov Institute of Oceanology, Russia)
- ▶ Carolina Behe (Inuit Circumpolar Council, U.S.)
- ▶ Tom Christensen (CBMP co-chair, Denmark)
- ▶ John Payne (CBMP co-chair, U.S.)
- ▶ Jason Stow (Arctic Monitoring and Assessment Programme, Canada)
- ▶ Elizabeth McLanahan (Protection of the Arctic Marine Environment).

The Marine Steering Group (MSG) has the overarching role of setting the program's direction, facilitating, coordinating and tracking progress, and for addressing issues and barriers that may arise. More specifically, the MSG ensures effective communication amongst and between the implementing nations; coordinates and provides direction to the Marine Expert Networks (MENs); facilitates input from members' own national experts; facilitates and tracks the implementation of the CBMP-Marine Plan; and provides reports and information deriving from monitoring activities to the CAFF/CBMP Office.

Status of Work Plan

Milestone	Activities & Deliverables	Status
1. Plan published	a. Final plan endorsed by CAFF Board and published	Completed spring 2011.
	b. Executive Summary report published.	Not done. Decided to do brochure and video instead (both completed).
2. Governing structure activated	a. CBMP Marine Steering Group (MSG) established	Completed.
	b. Marine Expert Networks (MENs) established	Completed.
	c. Adoption of the Terms of Reference	Completed.
	d. MSG and MEN leads confirmed	Completed /Annually.
3. Establish coordinated monitoring in each Arctic Marine Area (AMA)	a. Arctic-based monitoring networks adopt parameters and sampling approaches	Good progress occurring in some areas. Coordination exists with AMAP at the researcher level. See below for details on progress by nation and expert network.
	b. Non-Arctic countries' Arctic monitoring networks added	US Distributed Biological Observatory (DBO) sites are also sampled by China, Korea, Japan, and Canada. To occur more generally post-2015. Several MENs working with Germany and Poland.

Milestone	Activities & Deliverables	Status
4. Data management structures established	a. Data nodes and hosts, web-entry and data standards established for each MEN	Started and ongoing.
	b. Nodes linked to portal and web portal analysis tools developed	Started and ongoing.
	c. Metadata added to Polar Data Catalogue	Started and ongoing.
5. Indicator development	a. Existing data sets identified, aggregated and analyzed to establish indicator baselines	Ongoing and completed in some cases (see below).
	b. Indicators updated with monitoring plan outputs (annually)	Ongoing.
6. Reporting and coordination	a. Annual performance reports and work plans	Completed.
	b. State of the Arctic Marine Biodiversity report (including AMA status reports) – every five years	Ongoing (planned for 2015/16).
	c. Scientific publications (ongoing)	Ongoing. Examples of publications include: <ul style="list-style-type: none"> • Arctic Report Cards • The Atlantic Gateway proposal of a standardized long term monitoring of benthos: The CBMP Marine Benthos Expert Network • List of Marine Fishes of the Arctic Region Annotated with Common Names and Zoogeographic Characterizations • A Circumpolar Monitoring Framework for Polar Bears: Ursus Monograph Series • Development of a Pan-Arctic Monitoring Plan for Polar Bears: Background paper • Arctic Marine Biodiversity Monitoring Plan: Background Paper
	d. General communications	Brochure, video, poster, annual reports, country-one page summaries, website updates produced; presentations made at conferences and other national and international venues (e.g., International Polar Year, ArcticNet, GEO BON).
	e. MSG meetings (telephone conf./ annual meeting)	Four teleconference calls in 2013. Annual meeting (face-to-face) held together with MENs in Akureyri, Iceland. Next meeting planned for Nuuk, Greenland (Sep/Oct 2014).
	f. MENs meetings (tel. conf./annual meeting)	Ongoing.
	g. Information at other events	Ongoing. Information and coordination of CBMP Marine activities is done continuously.
	h. Meeting with other CBMP steering groups	Participation of other CBMP Groups is planned for future annual meetings (CBMP Office coordinates).
	i. Making an information brochure	Completed.
	j. Information videos	Completed.
7. Program review & adjustments	a. Independent review of parameters, sampling approaches, data management approach, analysis, and reporting (every 5 years)	Planned for 2015.

Barriers and Challenges

The primary barriers and challenges facing the CBMP-Marine implementation teams can be summarized in two categories. While some teams face scientific challenges specific to their trophic level, funding and recognition at the national and international levels are the main two overarching issues facing all groups.

1. Establish and promote the relevance and importance of the CBMP-Marine Plan, nationally and internationally

Focussing resources on a few activities and products will accomplish this. Data gathering will concentrate on data that are already available and accessible. Links will be strengthened with international conventions and organizations, e.g., the Convention on Biological Diversity (CBD) Aichi Targets, the CBD Global Biodiversity Outlook, the Global Biodiversity Information Facility (GBIF), the Group on Earth Observations Biodiversity Observation Network (GEO BON), and the Ocean Biogeographic Information System (OBIS) of the Intergovernmental Oceanographic Commission (IOC), among others. Each country participating on the MSG is working on engaging national organizations and initiatives to gain better recognition, support and additional resources.

2. Funding

Funding will be sought from national and international organizations to cover MSG and MEN members' travel, time, and capacity for data gathering and aggregation. Funding is the shared responsibility of the CAFF Secretariat, the CBMP and the MSG and MENs. To date, the program has received support from national and international bodies. Further funding will be sought as appropriate through implementation of the CAFF/CBMP fundraising strategy, and additional capacity through collaboration with the Association of Polar Early Career Scientists (APECS). In order to improve fundraising efforts, the CBMP-Marine program is working together with the CBMP Office and CAFF Secretariat to better identify and present funding challenges related to achieving detailed targets and/or the completion of specific products.

Sea-Ice Biota Expert Network

Preamble

The Sea-ice Biota Expert Network members:

- ▶ Håkon Hop (Norwegian Polar Institute, Norway – Lead 2013-14)
- ▶ Bodil Bluhm (University of Alaska Fairbanks, U.S.)
- ▶ Michel Poulin (Canadian Museum of Nature, Canada)
- ▶ Thomas Juul-Pedersen (Greenland Institute of Natural Resources, Greenland)
- ▶ Igor Melnikov (Institute of Oceanology, Moscow, Russia)

No representatives from Iceland or the Faroe Islands have been appointed since no sea-ice biota research is being conducted by these countries. A post-doc (Malin Daase) was hired by the Norwegian Polar Institute for six months to assist Dr. Hop and the Expert Network, and was financed by the Directorate for Nature Management in Norway.

The Sea-ice Biota Expert Network (SIBEN) deals with ice algae, and sympagic meiofauna, and macrofauna. The ice-associated Polar cod (*Boreogadus saida*) and Arctic cod (*Arctogadus glacialis*) are dealt with by the fish EN. No organized monitoring of sea ice biota is ongoing anywhere in the Arctic, so the primary objective of the Sea-ice Biota Expert Network in this initial phase is to secure and accumulate historic data from literature and unpublished sources and obtain an overview of who is working where and with what in the Arctic. This exercise will help identify any locations where sea ice biota is sampled on a somewhat regular basis.

Status of Work Plan

Milestone	Activities & Deliverables	Status
1. Work plans developed	a. Develop and confirm with network members a work plan.	Completed.
2. Governing structure activated	a. Marine Expert Networks (MEN) established	Completed; chair and members appointed to the Sea Ice Biota Expert Network.
	b. Adoption of the Terms of Reference	Completed.
	c. Confirm Expert Network lead	Completed Håkon Hop confirmed as lead.
3. Establish coordinated monitoring in each AMA	a. Arctic-based monitoring networks adopt parameters and sampling approaches <ul style="list-style-type: none"> • Prioritize locations - difference between fast ice and drift ice; map of biological sampling locations (all) • Fill gaps in region, fill gaps in data access (Russian Arctic?); re-define CBMP sampling locations - discuss with physical ocean and sea ice physics (Hop) • Standardization of names (synonyms, taxonomic uncertainties) – ITIS, WORMS, Algaebase, EOL; • Redefine monitoring approaches based on new research and analysis of existing data 	No sea ice biota monitoring is going on anywhere in the Arctic. Accumulation of macrofauna data has progressed considerably. A comprehensive geo-referenced data compilation of abundances based on published and unpublished data is available. An overview of Norwegian unpublished data will be added. There is also an overview of available Russian data and Melnikov is prepared to make these data available for the EN. Hop submitted a related proposal requesting funding for travel and man power. Accumulation of historic and current meiofauna data has started (Bluhm). Poulin is working on verifying taxonomy of ice algae species.
	b. Non-arctic based monitoring networks adopt parameters and sampling approaches	Contact with German scientists is established and unpublished data will be made available for the EN. Polish scientists are also active in ice algae research, but have not been contacted with regard to this; however, collaborations exist between them and members of the EN on other projects.
4. Data management structures established	a. Data nodes and hosts, web-entry and data standards established for each MEN <ul style="list-style-type: none"> • Define sea-ice data nodes • Data nodes established and serving 80% of known data by when? • Data nodes completed serving 100% of data by when? 	At the moment, metadata and raw data are accumulated in a simple database (Excel sheets). Macro- and meiofauna data can be included in the Marine Database at the Norwegian Polar Institute (which contains zooplankton and phytoplankton data collected by the Institute) and be made accessible over the internet (password and login protected) at the ABDS. Alternatively, a simple, similar database only for sea-ice biota could be established at the Norwegian Polar Institute.
	b. Nodes linked to portal and web portal analysis tools developed <ul style="list-style-type: none"> • Gain access to relevant physical oceanographic and sea ice data 	Not completed.
	c. Metadata added to Polar Data Catalogue	Not completed.
5. Indicator development	a. Existing data sets identified, aggregated and analyzed to establish indicator baselines <ul style="list-style-type: none"> • Sea ice protist indicators: Chl a, Trends in community diversity, loss of indicator spp); verify species list for Arctic sea ice protists (and phytoplankton (Poulin); abundance and diversity assessment, sea ice protists (Poulin) • Sea ice meiofauna (community diversity); Pan-Arctic meiofauna assessment (Gradinger, Bluhm) • Sea ice macrofauna (loss of indicator spp, community structure); submit paper on Pan-Arctic macrofauna assessment incl. chl a (Hop, Gradinger) • Boreogadus/Arctogadus - presence/absence/habitat use 	Sea ice algae diversity and abundance is in progress (Poulin: including phytoplankton). Macrofauna abundance and species list in progress (Daase, Hop). Work on publication is delayed, as data still have to be added, but a Svalbard time series was published as part of the 2013 Arctic Report Card. Meiofauna diversity is in development (Bluhm) with some of the data in a submitted book chapter. Six indicators have been identified for the Russian-Norwegian Barents Sea Monitoring plan in collaboration with CBMP activities. Fish-related aspects are dealt with by the fish MEN.

Milestone	Activities & Deliverables	Status
	b. Indicators updated with monitoring plan outputs (annually)	Not completed.
	c. Develop cross-linked indicators <ul style="list-style-type: none"> Arctic cod, chl and diversity indices with plankton group, ice associated spp with plankton group, sympagic-pelagic-benthic coupling, ice fauna - marine predators (seabirds, seals) 	No progress.
	d. Future indicators to develop <ul style="list-style-type: none"> Confirmed absences, size classes of sea ice protists, changes in feeding ecology of key species, microbial components/genomics, modern tools, changes in seasonality, analysis of historical samples and data 	No progress except analysis of some historic data.
6. Reporting and coordination	a. Annual performance reports and work plans	Completed. Annual report delivered during CBMP MSG and MEN face-to-face meeting December 14-15, 2012 in Vancouver, BC.
	b. State of the Arctic Marine Biodiversity report (including AMA status reports) – every 5 years <ul style="list-style-type: none"> Synthesis Arctic publication with other expert networks using additional information from new indicators. Focus on effects of ecosystem changes on Arctic marine biota (e.g. changes in season duration; tipping points, etc.) 	Not until 2016.
	c. Scientific publications (ongoing) <ul style="list-style-type: none"> Summary of sea ice paper, including all trophic levels 	<p>Poulin M, Daugbjerg N, Gradinger R, Byash L, Ratkova T, von Quillfeldt C (2011) The pan Arctic biodiversity of marine pelagic and sea ice unicellular eukaryotes: a first attempt assessment. <i>Mar Biodiv</i> 41: 13-28</p> <p>Hop, H. and H. Gjøsæter. 2013. Polar cod (<i>Boreogadus saida</i>) and capelin (<i>Mallotus villosus</i>) as key species in marine food webs of the Arctic and the Barents Sea. <i>Marine Biology Research</i> 9: 878-894</p> <p>Bluhm BA, Gradinger R, Kwasniewski S, Poulin M, Sandulli R. Chapter 2.2.1 Arctic ice flora and fauna. In: Węśławski JM, Stempniewicz L, Masłowski W (eds) <i>The new face of the Arctic: The polar marine ecosystem in transformation</i>. Cambridge University Press, submitted Aug 2012</p> <p>Berge J, Varpe Ø, Molin MA, Wold A, Renaud PE, Daase M, Falk-Petersen S (2012) Retention of ice associated amphipods: possible consequences for an ice free Arctic Ocean. <i>Biology Letters</i> doi: 10.1098/rsbl.2012.0517</p>
	d. MEN meetings (annual meeting/ teleconferences)	Daase and Melnikov met in St. Petersburg, March 4-8, 2012.; Daase, Gradinger, Poulin participated in CBMP meeting at IPY Montreal April 24-25, 2012; Daase, Bluhm, Poulin met at CBMP meeting in Vancouver December 14-15, 2012.

Barriers and Challenges

There is a lack of financial resources in Russia to enable participation at meetings. Shortages of time, money and people constrain progress. Accumulating data is a time consuming activity, and no funding is available to hire students.

Some of the historic and unpublished data are not digitized and time is required to accumulate them. It is difficult to obtain the background data (physical data, chl a) that are necessary for interpreting biological data. Many taxonomic uncertainties and unknowns exist, in particular for ice algae and meiofauna.

Plankton Expert Network

Preamble

The Plankton Expert Network members:

- ▶ Russ Hopcroft (University of Alaska, Fairbanks, U.S. – co-lead 2013-14)
- ▶ Connie Lovejoy (Université Laval, Canada – co-lead 2013-14)
- ▶ Kristin Arendt (Greenland Institute of Natural Resources, Greenland)
- ▶ Hogni Debes (University of the Faroe Islands, Faroe Islands)
- ▶ Cecilie von Quillfeldt (Norwegian Polar Institute, Norway)
- ▶ Ksenia Kosobokova (PP Shirshov Institute of Oceanology, Russia).
- ▶ Gudmundur Gudmundsson (Icelandic Institute of Natural History, Iceland)

The overall objective of the Marine Plankton Expert Network (PEN) is to coordinate implementation of the plankton monitoring component of the Arctic Marine Biodiversity Monitoring Plan. The PEN will:

- ▶ ensure effective communication between plankton experts within the network as well as on a national level;
- ▶ collect, aggregate, analyse and report on relevant data in accordance with the priority parameters, indicators and sampling schemes of the plan, and adjust and further develop the plan, to deliver data and reports in accordance with the CBMP data management plan to the CBMP Office; and
- ▶ deliver this information and analysis to inform future Arctic Council assessments and CBMP indicators

Following the meeting in Akureyri a list of expected specific products and 2014 leads was noted (Leads: Russ Hopcroft and Connie Lovejoy):

- ▶ Publications and maps
- ▶ Teaching slides
- ▶ Phytoplankton database
- ▶

Status of Work Plan

Milestone	Activities & Deliverables	Status
1. Work Plans developed (2012)	a. Develop and confirm with network members a work plan.	Implementation remains highly dependent on funding.
2. Governing structure activated	a. Marine Expert Networks established	Completed; chair and members appointed to the Plankton Expert Network.
	b. Adoption of the Terms of Reference	Completed.
	c. Confirm Expert Network lead	Completed Hopcroft and Lovejoy confirmed as co-lead. Leads and members remain highly overcommitted hampering overall progress.
3. Establish coordinated monitoring in each AMA	a. Arctic-based monitoring networks adopt parameters and sampling approaches <ul style="list-style-type: none"> • Explore stable funding for monitoring programs • Coalesce site locations for monitoring 	Variable success, efforts remain fragmented.
	b. Non-arctic based monitoring networks adopt parameters and sampling approaches	Not tackled – Distributed Biological Observatory (DBO) offers possible model.

Milestone	Activities & Deliverables	Status
4. Data management structures established	a. Data nodes and hosts, web-entry and data standards established for each Marine Expert Network <ul style="list-style-type: none"> • ID data for nodes by plankton category • Data nodes fully established 	Many data nodes and tools for them are funding driven – Hopcroft has consolidated some zooplankton datasets. Ongoing sequence based information is entered in NCBI and the NCBI SRA, all entries are compliant with latitude, longitude, depth information.
	b. Nodes linked to portal and web portal analysis tools developed <ul style="list-style-type: none"> • Assemble relevant physical data including satellite data 	Not tackled although tools are developed by related efforts. Suggest satellite data be used as pointers to other sites.
	c. Metadata added to Polar Data Catalogue	Canadian Plankton Metadata added.
5. Indicator development	a. Existing data sets identified, aggregated and analyzed to establish indicator baselines (including aggregating datasets from non-Arctic countries; exploit CoML publications) <ul style="list-style-type: none"> • Phyto and other protist plankton; validation of species lists and compilation of Genbank records, pyrodata, etc. (CvQ and CL); explore development of phyto-protist change index • Archaea and Bacteria; compilation of Genbank records, pyrodata, etc. (CL); explore development of bacteria-archaea change index • Multicellular microzooplankton; begin development of reference data base for genetic id (CL); analyse pyro-bycatch using reference base • Zooplankton; validation of spp lists and georeferenced occurrences (TBD); create maps of current and past distributions 	Datasets continue to be consolidated. Parallel efforts underway for Pacific Arctic by other funding agencies/industry (Several students working in this) Archaea/Bacteria - some progress Phyto/Protozooplankton – draft list from Census of Marine Life (CoML), Arctic Biodiversity Assessment (ABA). New circumpolar microbial sequence data was generated, In addition other countries continue to carry collect data, Very ad hoc but overall we are starting to get a picture of different Arctic regions.
	b. Indicators updated with monitoring plan outputs (annually) <ul style="list-style-type: none"> • Baselines established 	No formal progress. Unpublished primary data is being collated for both zooplankton (Hopcroft), microbes (Lovejoy), Phytoplankton (von Quillfeldt, Lovejoy, based on Poulin).
	c. Develop cross-linked indicators <ul style="list-style-type: none"> • Seabirds and marine mammals to identify productivity hotspots; id long-term trends in plankton compared to animal distribution/health • Benthos-Benthic-Pelagic coupling; sedimentation, benthic respiration, nutrient regeneration or loss in shallow seas • Sea-ice biota, occasional grazers, nutrient drawdown; modeling and nutrient budgets, biomass, lipids, stable isotopes; develop new understanding of species-specific impacts. • Fish, populations, lipid content (diatoms have PUFAS); georeferencing, time trends with phyto to zoo to fish models 	No progress yet.
	d. Future indicators to develop	The microbial heterotrophic eukaryotes are a promising indicator of ice extent and nutrient – light limitation this work is in progress.
6. Reporting and coordination	a. Annual performance reports and work plans	This document.
	b. State of the Arctic Marine Biodiversity report (including AMA status reports) – every 5 years	Noted.
	c. Scientific publications (ongoing) <ul style="list-style-type: none"> • Co-author food webs diversity papers using new models of how spp affect ecosystem function. 	ABA assessment published. Ongoing.

Milestone	Activities & Deliverables	Status
	d. Meeting with the Marine ENs (annual meeting/ teleconferences)	Meeting among some members occurred in Oct 2013 in conjunction with the joint SG-ENs meeting in Vancouver. Funding constrains ability to meet as a group.
7. Communications	Video on Arctic plankton communities and their diversity for the general public. Teaching Slides	No progress (requires funding). CL is collecting slides as students finish.

Barriers and Challenges

Lack of funding hampers administrative/coordination progress, as does the fragmented nature of activities that could be aggregated under a monitoring umbrella. Long-term funding commitment to a stable monitoring network remains the ultimate challenge for nearly all countries.

Benthos Expert Network

Preamble

The Benthos Expert Network members:

- ▶ Lis Lindal Jørgensen (Institute of Marine Research, Norway – co-lead 2013-14)
- ▶ Philippe Archambault (Université du Québec à Rimouski, Canada – co-lead 2013).
- ▶ Katrin Iken (University of Alaska, Fairbanks, U.S.)
- ▶ Martin Blicher (Greenland Institute of Natural Resources, Greenland)
- ▶ Gudmundur Gudmundsson (Icelandic Institute of Natural History, Iceland – co-lead 2014)
- ▶ Jan Sørensen (Kaldbak Marine Biological Laboratory, Faroe Islands)
- ▶ Nina Denisenko (Zoological Institute, St. Petersburg, Russia)
- ▶ Stanislav Denisenko (Zoological Institute, St. Petersburg, Russia)

The overall objective of the Benthos Expert Network (BEN) is to coordinate the implementation of the benthos monitoring component of the Arctic Marine Biodiversity Monitoring Plan. The BEN will:

- ▶ ensure effective communication between benthos experts within the network as well as on a national level;
- ▶ collect, aggregate, analyse and report on relevant data in accordance with the priority parameters, indicators and sampling schemes of the plan, and adjust and further develop the plan, to deliver data and reports in accordance with the CBMP data management plan to the CBMP Office; and
- ▶ deliver this information and analysis to inform future Arctic Council assessments and CBMP indicators.

Status of Work Plan

Milestone	Activities & Deliverables	Status
1. Work plans developed	a. Develop and confirm with network members a work plan.	Completed; first work plan developed in September 2011 at Vancouver inaugural meeting.
2. Governing structure activated	a. Marine Expert Networks established	Completed; chair and members appointed to the Benthos Expert Network.
	b. Adoption of the Terms of Reference	Completed.
	c. Confirm Expert Network lead	Completed Philippe Archambault confirmed as lead.

Milestone	Activities & Deliverables	Status
3. Establish coordinated monitoring in each AMA	a. Arctic-based monitoring networks adopt parameters and sampling approaches	<p>Most efforts are individual projects, tied to individual methods:</p> <ul style="list-style-type: none"> • Increasing effort to make sampling comparable (e.g., gear comparisons). • New projects aware of this and aim to use established and accessible methods. • Difficult to achieve on pan-Arctic scale. • Attempt was made in 2013 to initiate an Atlantic (Norway, Island, Faroe, Greenland, Canada) long term monitoring plan of benthos by using the already existing scientific fish assessment fleet in each nation. The Barents Sea model was presented and the other nations fish assessments fleet was evaluated. • Electronic topographic map will be posted at the CAFF secretary homepage with possibilities to enter metadata from trawl surveys identifying benthos • Initial version of protocol on benthic recording on fish assessment surveys (Barents Sea, ICES, NOAA) • PowerPoint presentation will be developed presentation together with the CAFF Secretariat in order to bring forward information on the Atlantic Long Term Monitoring of Benthos
4. Data management structures established	<p>a. Data nodes and hosts, web-entry and data standards established for each Marine Expert Network</p> <ul style="list-style-type: none"> • Data nodes identified • Data nodes established 	<p>Use of existing Arctic Benthos Network Database housed at University of Rimouski. Already populated with data (Arctic Ocean Diversity [ArCOD] effort) and many investigators are familiar with database. Contact letter developed, Data Sharing Agreement exists (restricted access, co-authorship for data use). Benthic Expert Members contacted researchers in their countries for data submission (several pending). An US data node (AOOS/K. Iken) and Canadian data node (P. Archambault) will be established together with the CAFF Secretariat.</p>
	b. Nodes linked to portal and web portal analysis tools developed	
	c. Metadata added to Polar Data Catalogue	

Milestone	Activities & Deliverables	Status
5. Indicator development	<p>a. Existing datasets identified, aggregated and analyzed to establish indicator baselines (including aggregating datasets from non-Arctic countries; exploit CoML publications)</p> <ul style="list-style-type: none"> • Species richness measure (presence/absence based); create template according to P. Archambault's database and convert data, taxonomic check • Lis/Karen contact Russian and other colleagues. Gudmundur contact Faroe Island colleagues. Phil contact D. Ellis (Canadian Arctic), D. Piepenburg, Doris Schiedek (Århus Univ.); invite letters out to data contributors; data accumulation and standardization; data analysis for initial indicators; manuscript based on presence/absence indicators; submission to co-authors • Abundance (biomass, density); standardize data • Assessment of using abundance (biomass, density) as pan-Arctic indicators; manuscript based on indicators (abundance data) submission to co-authors; submission to Journal/CBMP report 	<p>Benthic Expert Members contacted researchers and data set aggregation in progress (needed for indicator development). Fisheries and Oceans Canada (Kenchington) developed a monitoring program in Baffin Bay - Kenchington, E., Siferd, T., and Lirette, C. 2012. Arctic Marine Biodiversity: Indicators for Monitoring Coral and Sponge Megafauna in the Eastern Arctic.</p>
	<p>b. Indicators updated with monitoring plan outputs (annually)</p>	<p>Synthesis of existing knowledge in the Arctic Report Card: Benthos chapter.</p>
	<p>c. Develop cross-linked indicators</p> <ul style="list-style-type: none"> • Relate benthic indicators to: topography, substrate/bottom, and habitat type • Relate benthic indicators to pelagic and ice-associated productions • Relate benthic indicators to higher trophic levels (fish, mammals, birds) • Relate benthic indicators to EBSA 	<p>Develop cross-linked indicators: ongoing on regional scales (e.g., several projects/publications in progress that relate benthic communities to hydrography, pelagic production, fish predators) Kenchington, E., et al. 2011. Identification of Mega- and Macrobenthic Ecologically and Biologically Significant Areas (EBSAs) in the Hudson Bay Complex, the Western and Eastern Canadian Arctic. DFO Can. Sci. Advis. Sec. Res. Doc. 2011/071. vi + 52 p.</p>
	<p>d. Future indicators to develop</p>	
6. Reporting and coordination	<p>a. Annual performance reports and work plans</p>	<p>Completed.</p>
	<p>b. State of the Arctic Marine Biodiversity report (including AMA status reports) – every 5 years</p> <ul style="list-style-type: none"> • Synthesis 	
	<p>c. Scientific publications (ongoing)</p> <ul style="list-style-type: none"> • Standardize data by Archambault. Submission to Journal/CBMP report. 	<p>Publications ongoing.</p>
	<p>d. Meeting with the Marine ENs (annual meeting/teleconferences)</p>	<p>BEN members participated in the joint annual meeting of the Steering Group and Expert Networks, Vancouver, December 2012.</p>

Barriers and Challenges

The three main categories of barriers and challenges relate to financial, collaboration, and time (effort) limitations.

Funding is required to ensure meeting attendance for the Expert Network members. Funding is also required for a database manager to compile, QA/QC data, and perform taxonomic checks.

Regarding collaboration, some collaborators are hesitant to share data for various reasons, and there is a need for commitment to long-term monitoring (by countries).

Expert Network members are very busy, making a large time commitment on a “volunteer” basis. This may be difficult to sustain over time.

Marine Fish Expert Network

Preamble

The Marine Fish Expert Network members:

- ▶ Catherine Mecklenburg (Point Stephens Research, U.S. – co-lead 2013-14)
- ▶ Kevin Hedges (Fisheries and Oceans, Canada – co-lead 2013)
- ▶ Edda Johannesen (Institute of Marine Research, Norway – co-lead late 2013-14)
- ▶ Carolina Behe (Inuit Circumpolar Council, U.S.)
- ▶ Helle Siegstad (Greenland Institute of Natural Resources, Greenland).
- ▶ Jakup Reinert (Faroe Marine Research Institute, Faroe Islands)
- ▶ Vadim Mokievsky (PP Shirshov Institute of Oceanology, Russia)

The Marine Fish Expert Network (MFEN) objectives are to:

- ▶ ensure effective communication between fish experts within the network as well as on a national level.
- ▶ collect, aggregate, analyze, and report on relevant data in accordance with the priority parameters, indicators and sampling schemes of the CBMP marine plan, and adjust and further develop the plan, to deliver data and reports in accordance with the CBMP data management plan to the CBMP Office.
- ▶ deliver this information and analysis to inform future Arctic Council assessments and CBMP indicators.

Each representative is responsible for:

- ▶ facilitating implementation of the monitoring program within each nation, and ensuring that the data are managed in concert with the CBMP data management approach.
- ▶ communicating with other marine fish experts within their country.
- ▶ contributing to the aggregation, analysis and reporting of relevant datasets.

Status of Work Plan

Milestone	Activities & Deliverables	Status
1. Work Plans developed	a. Develop and confirm with network members a work plan.	A draft work plan was available in late 2011. A revised work plan was developed at the third meeting of the Marine Fish EN on December 13, 2012.
2. Governing structure activated	a. Marine Expert Networks established	The network has been established but Russian and Icelandic members have not yet been identified; the Greenlandic member is inactive.
	b. Adoption of the Terms of Reference	Completed in October 2011.
	c. Confirm Expert Network lead	Jim Reist was confirmed as lead in September 2011. In January 2012, Reist withdrew from the MFEN and was replaced by Kevin Hedges. In June 2012, Catherine Mecklenburg and Kevin Hedges were confirmed as co-leads of the MFEN for the rest of 2012, and again for 2013. In October 2013, Edda Johannesen and Catherine Mecklenburg were confirmed as co-leads for late 2013-2014.
3. Establish coordinated monitoring in each AMA	a. Arctic-based monitoring networks adopt parameters and sampling approaches	Ongoing until 2015. <ul style="list-style-type: none"> • Dependent on overarching work by CBMP secretariat (identifying groups) • Community based monitoring (possibly) • Identify existing monitoring networks (e.g., Arctic Net) • What is being collected, can it be standardized for inclusion in maps and indicators? Do not need to use the same standardization for both science and traditional knowledge (different purposes). • Identify gaps.

Milestone	Activities & Deliverables	Status
	b. Non-arctic based monitoring networks adopt parameters and sampling approaches	Planned for after 2015.
4. Data management structures established	a. Data nodes and hosts, web-entry and data standards established for each Marine Expert Network <ul style="list-style-type: none"> • Data nodes identified • Data nodes established 	Data nodes were identified and discussed at the Marine Fish Expert Network (MFEN) meeting in December 2012. Data nodes have not been established. <ul style="list-style-type: none"> • Shared site established
	b. Nodes linked to portal and web portal analysis tools developed	2013-2014.
	c. Develop cross-linked indicators <ul style="list-style-type: none"> • Link to sea-ice network: habitat for key fish and documented shifts in ice types/fishes; Arctic/Polar Cod abundance estimates from hydroacoustic surveys, ice-related surveys, or other data • Linkage to CBird: fish composition in bird diets; Kongsfjorden, Hudson Bay, Prince Leopold Is, other areas? • Linkage to Plankton network: ichthyoplankton data - available? • Linkage to Marine Mammal network: fish in diets - both spp composition and relative abundances over space/time 	Ongoing until 2015.
5. Indicator development	a. Existing data sets identified, aggregated and analyzed to establish indicator baselines (including aggregating datasets from non-Arctic countries; exploit CoML publications) <ul style="list-style-type: none"> • Circumpolar; Spp composition; ratios of spp compositions; fish guide; geographic baselines/distributions • Regional; condition; diet changes 	Species composition and distribution data are being collected and baseline indicators will be determined in 2013. <ul style="list-style-type: none"> • Spp. distribution maps developed for the first 100 spp. (out of approx. 245) by July 2014. • Polygons or points • Mechanism for data contribution/input from organizations (data sharing agreements, etc.) • Gather published traditional knowledge on marine fishes and determine which baselines are possible
	b. Indicators updated with monitoring plan outputs (annually)	Ongoing once established.
	c. Develop cross-linked indicators <ul style="list-style-type: none"> • Link to sea-ice network: habitat for key fish and documented shifts in ice types/fishes; Arctic/Polar Cod abundance estimates from hydroacoustic surveys, ice-related surveys, or other data • Linkage to CBird: fish composition in bird diets; Kongsfjorden, Hudson Bay, Prince Leopold Is, other areas? • Linkage to Plankton network: ichthyoplankton data - available? • Linkage to Marine Mammal network: fish in diets - both spp composition and relative abundances over space/time 	Beginning in 2014. <ul style="list-style-type: none"> • Using Google Earth application? • Depends on data storage and formats among groups
	d. Future indicators to develop <ul style="list-style-type: none"> • Arctic/Polar Cod: Age, size, condition; acoustic biomass estimates (Barents); population baselines (geographic, temporal?) • Indices of ecosystem/community level changes using fish data; genomic techniques, Genetic techniques, trophic parameters, others? 	Planned for after 2015.

Milestone	Activities & Deliverables	Status
6. Reporting and coordination	a. Annual performance reports and work plans	Work plan partly updated and annual report submitted in Dec 2013.
	b. State of the Arctic Marine Biodiversity report (including AMA status reports) – every 5 years	Planned for 2015.
	c. Scientific publications (ongoing)	Published in 2013: <ul style="list-style-type: none"> Annotated list of Arctic marine fishes (scientific names, common names in several languages, zoogeography)
	d. Meeting with the Marine ENs (annual meeting/ teleconferences)	Third meeting held on December 13, 2012 in Vancouver, British Columbia, Canada. Fourth meeting on October 29-30, 2013 in Akureyri, Iceland.

Barriers and Challenges

Only the Inuit Circumpolar Council, Norway, Canada, and USA are active participants in the MFEN. A permanent fish expert for Russia has not been assigned. The Iceland, Greenland, and Faroese members are inactive or have no time or funding to participate.

The MFEN does not have the capacity by itself to perform the work outlined in the Work Plan, and is assisted by a community of international collaborators. Both the MFEN and the collaborators have mostly been donating their time to the CBMP. Funding needs to be obtained for MFEN participation and for other collaborators who may need honoraria, travel funds, or other financial aid for help with the MFEN products.

There are challenges impeding having a traditional knowledge (TK) holder as a network member.

- ▶ Funding is lacking for the TK holder to do the following:
 - Develop maps by collecting TK and gleaning existing literature
 - Distribute maps to indigenous groups
 - Produce and distribute CD/digital versions for schools (indigenous language and use)
 - Translate materials
 - Establish community monitoring and reporting of abnormalities

Technical and Scientific challenges include:

- ▶ Obtaining comparable datasets on fish species presence from all around the Arctic to establish distributions with the same level of assurance in each region
- ▶ Lack of historical data for some regions due to lack of sampling or reporting
- ▶ Obtaining datasets that include abiotic and biotic variables (e.g., temperature, depth, associated benthos) to determine associations with fish presence
- ▶ Accounting for gear selectivity during surveys
 - Incomplete sample coverage
 - Many species not sampled or inadequately sampled

Seabird Expert Network

The Seabird Expert Network members:

- ▶ Grant Gilchrist (Wildlife Research Division, Canada – Lead)
- ▶ Greg Robertson (Canadian Wildlife Service, Canada)
- ▶ Kenton D. Wohl (U.S. Fish and Wildlife Service, U.S.)
- ▶ David Irons (U.S. Fish and Wildlife Service, U.S.)
- ▶ Flemming Ravn Merkel (Aarhus University, Denmark)
- ▶ Trausti Baldursson (Icelandic Institute of Natural History, Iceland)
- ▶ Bergur Olsen (Faroese Fisheries Laboratory, Faroe Islands)
- ▶ Jim Reid (Joint Nature Conservation Committee, United Kingdom)
- ▶ Maarten Loonen (University of Groningen, The Netherlands)
- ▶ Henrik Osterblom (Baltic Nest Institute, Sweden)
- ▶ Martina Kadin (Baltic Nest Institute, Sweden)

- ▶ Jonas Sundberg (Baltic Nest Institute, Sweden)
- ▶ Mia Rönkä (University of Turku, Finland)
- ▶ Yuri Artukhin (Kamchatka Branch of Pacific Institute of Geography, Russia)
- ▶ Maria Gavrilov (Arctic & Antarctic Research Institute, Russia)

The Seabird Expert Network role is being fulfilled by the CBird expert group under CAFF (<http://caff.is/seabirds-cbird>) which was established in 1993. CBird has worked on several Arctic seabird issues and has written a Framework for a Circumpolar Arctic Seabird Monitoring Network (Petersen et al. 2008, CAFF Technical Report No. 15). The framework report laid out the vision and rationale for monitoring seabirds, but did not specify an actual monitoring plan. CBird is now completing such a monitoring plan (lead author: David Irons, david.irons@fws.gov).

CBird also developed a Circumpolar Seabird Data Portal under the Seabird Information Network (SIN) and each country is encouraged to establish a national colony registry that can feed into this. SIN is online and currently has much of the colony locations in the Arctic. CBird is working on making a Seabird Population Trend Index and a Seabird Productivity Index part of the Circumpolar Seabird Data Portal. SIN was the first mapping system to be incorporated under the Arctic Biodiversity Data Service (ABDS), i.e. the data management vision of the Circumpolar Biodiversity Monitoring Program (CBMP).

CBird has adopted the reporting recommendations of the CBMP – Arctic Marine Biodiversity Monitoring Plan with some slight changes.

Marine Mammal Expert Network

Preamble

The Marine Mammal Expert Network members:

- ▶ Fernando Ugarte (Greenland Institute of Natural Resources, Greenland - lead)
- ▶ Rosa Meehan (ArcticTurn Consulting, U.S. – lead 2014-15)
- ▶ Peter Thomas (US Marine Mammal Commission, U.S.)
- ▶ Carolina Behe (Inuit Circumpolar Council, U.S.)
- ▶ Steve Ferguson (Fisheries and Oceans Canada, Canada)
- ▶ Kristin Laidre (Greenland Institute of Natural Resources, Greenland)
- ▶ Dag Vongraven (Norwegian Polar Institute, Norway)
- ▶ Stanislav Belikov (All-Russia Research Institute for Nature Protection, Russia)
- ▶ Bjarni Michelsen (Museum of Natural History, Faroe Islands)

The Marine Mammal Expert Network (MMEN) currently deals with the seven species of Arctic marine mammals with circumpolar or nearly circumpolar distribution: bowhead whale, narwhal, beluga, polar bear, walrus, ringed seal and bearded seal. A multitude of stressors affect Arctic marine mammals, including climate change, harvesting, increased shipping and emerging industrial activities, such as hydrocarbon and mineral exploration and production. Despite the existing and anticipated pressures that marine mammals face in the Arctic, current monitoring efforts are limited and largely uncoordinated. To meet these challenges, the MMEN has the task of coordinating monitoring and conducting analyses of marine mammals on a pan-Arctic scale.

The objectives of the Marine Mammal Expert Network are to:

- ▶ Identify past abundance estimates for Arctic marine mammals.
- ▶ Identify the most suitable database format for integration with the Arctic Biodiversity Data Service (ABDS) www.abds.is.
- ▶ Identify how user knowledge (both scientific and traditional knowledge) can be incorporated into the database.
- ▶ Identify time series that can be used to monitor trends.
- ▶ Produce a CAFF publication of circum-Arctic abundance estimates
- ▶

Status of Work Plan

The MMEN has established a five-year work plan.

The first task of the group is to establish a database of known abundance estimates for different populations of

marine mammals in the Arctic. This includes finding as many past abundance estimates as possible in order to establish historic baselines and trends, and a reference point for future monitoring. The database will be updated annually and regular analysis conducted. Data will be made available on the ABDS. The ABDS has been undergoing development since 2012 to meet the requirements of the Expert Networks and will continue to develop alongside implementation to facilitate data distribution, access and usage.

Following the work plan, a comprehensive table with the most recent available abundance estimates for most populations was created in 2012 and 2013. Work in 2014 will focus on developing systems for the online updating of the database, incorporating past abundance estimates in this table and making an inventory of existing harvest databases. In 2014-2015, the MMEN will establish a harvest database and, during 2015-2016, the focus will shift to incorporating data on body condition and health.

Milestone	Activities & Deliverables	Status
1. Work Plans developed	a. Develop and confirm with network members a work plan.	Developed in Vancouver, September 2011 and modified in Vancouver, December 2012 and Akureyri November 2013: <ul style="list-style-type: none"> • Work in 2012 linked to Arctic Biodiversity Assessment and focus on baseline data on abundance • 2013 -2014 incorporation of past abundance estimates to the database • 2014 – 2015 harvest data • 2015 –body condition and health
2. Governing structure activated	a. Marine Expert Networks established	Completed; chair and members appointed to the Marine Mammal Expert Network.
	b. Adoption of the Terms of Reference	Completed.
	c. Confirm Expert Network lead	Completed Rosa Meehan confirmed as leader 2014 and 2015.
3. Establish coordinated monitoring in each AMA	a. Arctic-based monitoring networks adopt parameters and sampling approaches	Work in 2012 -14 focused on abundance estimates. Next parameters include harvest, body condition and health.
	b. Non-arctic based monitoring networks adopt parameters and sampling approaches	Not relevant so far because abundance estimates are only carried out by Arctic countries.
4. Data management structures established	a. Data nodes and hosts, web-entry and data standards established for each Marine Expert Network <ul style="list-style-type: none"> • Data nodes identified and establish framework for database on historical abundance estimates • Data nodes established 	Data node for abundance estimates established in 2013. It is being tested and developed in 2014, as data is being entered.
	b. Nodes linked to portal and web portal analysis tools developed; access relevant stressor data	Not yet.
	c. Metadata added to Polar Data Catalogue	Not yet.
5. Indicator development	a. Existing data sets identified, aggregated and analyzed to establish indicator baselines (including aggregating datasets from non-Arctic countries; exploit CoML publications) <ul style="list-style-type: none"> • Abundance; ringed Seal, walrus, beluga, bowhead, narwhal, bearded seal, polar bear • Harvest“ • Body condition and health databases • Movement/distribution, diet, genetics, contaminants 	Table on abundance for the ABA finalised. Data will be entered into the on-line system in 2014. Past abundance estimates need to be incorporated. It was decided that after abundance, work will focus on harvest, and then on body condition and health.
	b. Indicators updated with monitoring plan outputs (annually)	Not yet.

Milestone	Activities & Deliverables	Status
	c. Develop cross-linked indicators <ul style="list-style-type: none"> • Sea-ice; benthos-walrus-bearded seals; plankton-bowheads; fish-marine mammals; sea-ice biota-all; human activity-all; contaminants-AMAP; ID data sources on overlapping spatial and temporal scales; encourage comparative studies in two regions or more 	Draft paper about abundance of marine mammals and trends on sea ice habitat, to be submitted in 2014.
	d. Future indicators to develop	Past abundance estimates/trends in abundance (next step 2014). Harvest (2014-15) Body condition and health (2015) Possibilities for distant future: Movements and distribution changes (telemetry, sightings, acoustic monitoring) Non strictly arctic species.
6. Reporting and coordination	a. Annual performance reports and work plans	Here.
	b. State of the Arctic Marine Biodiversity report (including AMA status reports) – every 5 years <ul style="list-style-type: none"> • Analysis of trends in abundance for 2015 assessment 	Delayed (for all Expert Networks) to 2016.
	c. Scientific publications (ongoing) <ul style="list-style-type: none"> • Analysis of trends in abundance for 2015 assessment 	Laidre et al. in prep. Circumpolar abundance of marine mammals and trend on sea ice in the 21st century.
	d. Meeting with the MENs (annual meeting/ teleconferences)	Face-to-face meeting in Vancouver on December 2012, five members (Laidre, Meehan, Ferguson, Vongraven & Ugarte) and one guest present (Lisa Loseto, Canada). E-mail exchange in 2012. Face-to-Face meeting in Akureyri on November 2013, 4 members present (Meehan, Thomas, Ferguson & Ugarte) + 2 via Skype (Vongraven & Laidre).

Barriers and Challenges

A serious challenge has been finding adequate capacity to perform the work, and most has been done without adequate funding and with limited effort, most of it in-kind. The MMEN needs funding for experts (both scientists and community-based experts) in Russia, US, Canada, Greenland and Norway to conduct research domestically as well as to provide support for annual meetings.

The incorporation of traditional knowledge needs to be enhanced. This is a task that is being addressed within the MMEN and representatives from the Permanent Participants to the Arctic Council, as well as CBMP efforts to establish a Community Based Monitoring registry, currently in its early stages. Incorporating TK is a complex process that will require dedication from all parties, more direct involvement of TK holders through a participatory approach, and adequate funding.

Russian experts have not yet been able to participate actively in the MMEN.

A technical challenge that is being addressed relates to the final design of the database.

Financial Report

Status of Funding for 2013, and Outlook for 2014

2013 Budget:

Estimated costs for implementation of the Circumpolar Biodiversity Monitoring Program's Arctic Marine Biodiversity Monitoring Plan (CBMP-Marine Plan) are presented in the table below (for further details please

see Appendix A. Implementation Schedule and Budget. In: Arctic Marine Biodiversity Monitoring Plan, CAFF Monitoring Series Report No.3, April 2011, ISBN 1. 978-9979-9778-7-2).

Milestone	Activities & Deliverables	Total Cost (USD)	Cost Details	Responsibility
1. Governing and operational structure activated	a. 2011 Inaugural meeting of CBMP-MSG and Marine Expert Networks	180K (30k per country)	Meeting costs (travel support for CBMP-MSG leads and alternates and MEN national representatives and venue costs)	Arctic coastal nations for travel support. CBMP for venue costs.
	b. CBMP-MSG – program coordination	2012 onwards: 36K per year (6K per country)	Conference calls, annual meeting costs (travel, venue), coordination.	Arctic coastal nations
	c. Marine Expert Networks	2012 onwards: 150K per year (25K per country).	Conference calls, annual meeting costs (travel, venue), coordination, analysis, and reporting for 5 new expert networks.	Arctic coastal nations
2. Data management structures established	a. Data nodes and hosts, web-entry interfaces, and data standards established	2011: 60K 2012: 60K 2013 onwards: 10K (data node maintenance)	Web-entry interface and web-based databases and nodes and data entry manuals established	CAFF CBMP Office
	b. Data nodes linked to web portal and analytical tools developed	2011: 30K 2012: 60K 2013 onwards: 20K (web portal maintenance)	Data Portal linked to data nodes via XML, and canned analysis tools developed	CAFF CBMP Office
	c. Metadata added to Polar Data Catalogue	2010: 0K	Metadata entry by University of Laval free of charge	CAFF CBMP Office
3. Indicator development	a. Existing data sets identified, aggregated and analyzed to establish indicator baselines	2012: 105K (15K per expert network) 2013: 105K (15K per expert network) 2017/18: 210K every 5 years to support five year assessment.	Costs for expert network analysis support.	MEN's (CAFF CBMP Office to provide funds)
	b. National dataset compilations, QA/QC and formatting	Varies by nation.	Each nation will need to assign staff to focus on dataset compilation, QA/QC, interaction with CAFF/CBMP Data team and formatting. Costs will vary depending on state of national datasets.	Arctic coastal nations
	c. Dataset compilations archived	Minimal cost. CAFF Data manager staff time.	All datasets compiled and used to be archived at CAFF Secretariat.	CAFF Secretariat
4. Reporting	a. Annual indicator updates	15K per year starting in 2012	Website indicator updates and other media	CAFF CBMP Office
	b. Annual performance reports and work plans	0K per year starting in 2012	Performance report/work-plan layout and digital publication	CBMP-MSG
	c. State of the Arctic Marine Biodiversity Report	2015: first initial assessment report. 50K every five years (2015, 2020, 2025, etc.) Note: costs spread over several years to prepare for assessment report.	CBMP-MSG and Marine Expert Network annual meetings coordinated to aggregate & analyze data, and develop report; publishing and communications costs	CBMP-MSG, MEN's and CAFF CBMP Office

Milestone	Activities & Deliverables	Total Cost (USD)	Cost Details	Responsibility
5. Program review and adjustment	a. Review of parameters and sampling approaches.	0K – costs of MEN's reflected above.		MEN
	b. Independent review of data management approach, analysis, and reporting using performance measures	30K every ten years starting in 2016	Contract independent review of Monitoring Program	CBMP Office
TOTALS	Total Cost (USD)		Responsibility	
	2011: 270K (180K Arctic coastal nations; 90K CAFF CBMP) 2012: 436K (186K Arctic coastal nations; 250K CAFF CBMP) 2013: 341K (186K Arctic coastal nations; 155K CAFF CBMP) 2014: 231K (186K Arctic coastal nations; 45K CAFF CBMP) 2015: 281K (186K Arctic coastal nations; 95K CAFF CBMP) 2016: 261K (186K Arctic coastal nations; 75K CAFF CBMP) 2017: 336K (186K Arctic coastal nations; 150K CAFF CBMP) 2018: 336K (186K Arctic coastal nations; 150K CAFF CBMP) 2019: 231K (186K Arctic coastal nations; 45K CAFF CBMP) 2020: 281K (186K Arctic coastal nations; 95K CAFF CBMP)		Arctic Coastal Nations: 2011: 180K (30K per country) 2012 onwards: 186K per year (31K per country per year) CAFF CBMP: 2011: 108K 2012: 250K 2013: 155K 2014: 45K 2015: 95K 2016: 75K 2017: 150K 2018: 150K 2019: 45K 2020: 95K	

a. Conservation of Arctic Flora and Fauna (including CBMP office)

The CAFF Secretariat and the CBMP are working to implement the CBMP-Marine Plan with specific responsibilities in the areas of communication and data management support. In this regard, the CBMP technical team now consists of the CBMP Chairs and their support teams, a data manager, program officer and communications in the CAFF Secretariat who provide daily support for the implementation of the CBMP-Marine Plan including management, fundraising and communications. For 2014, CAFF and the CBMP were able to secure funding and in-kind support from a number of sources to facilitate communications and data management support. The CAFF Secretariat will continue its work to secure funding to facilitate the implementation of the CBMP-Marine Plan

This funding supported the development of a number of communications products in 2014 for the CBMP-Marine Plan: the production of four one-page country reports, an annual plan, products from the Marine Expert Networks, inclusion in two progress reports for SAOs, Arctic Report Cards support, website and some social media support. As well, the funding also supported ongoing development of the Arctic Biodiversity Data Service with an interoperable, distributed system being developed to allow for access and integration of existing marine datasets.

For 2014 CAFF will continue to support the data manager, communications officer and program officer positions, and will continue their support for the CBMP-Marine Plan. This will involve ongoing connections between the Marine Steering Group co-chairs and the CAFF Board as well as facilitating connections between the Marine Steering Group co-chairs and the Freshwater and Terrestrial Steering Group Chairs. As well, ongoing communications support and product development (e.g., for Arctic Council Ministerial, Arctic Report Cards, etc.) will be provided. Data management will continue to provide direct assistance for database development as well as ongoing development of the Arctic Biodiversity Data Service, including the development of data nodes and interoperable links.

b. Canada

Canada co-chaired the CBMP-Marine Steering Group with Greenland during 2013, and scientists from government and academia participated on all Expert Networks.

Fisheries and Oceans Canada provided US \$77K in 2012-2013 and US \$44K in 2013-2014 (April-March) to support a number of activities. In-kind contributions were also made by participating members and organizations in Canada: Fisheries and Oceans Canada, Environment Canada, Aboriginal Affairs and Northern Development, Canadian

Museum of Nature, Université Laval, Université du Québec à Rimouski, University of Victoria, Fisheries Joint Management Committee, Nunavut Wildlife Management Board, Nunavik Marine Region Wildlife Board, and Inuit Tapiriit Kanatami.

By working with the Association of Polar Early Career Scientists (APECS), Fisheries and Oceans Canada (DFO) was able to provide secretariat support for both the CBMP-Marine Steering Group and Canadian National Network. Cooperative (undergraduate) students hired by DFO for their work terms provided additional short-term support. DFO, the Canadian Museum of Nature, and Université Laval provided travel support to several scientists who participated in the annual joint meeting in Akureyri, Iceland in October 2013.

DFO partnered with the Inuit Tapiriit Kanatami to rescue traditional ecological knowledge (TEK) that was collected during the 1970s during the Inuit Land Use and Occupancy Project. Marine ecosystem and other data relevant to Arctic marine biodiversity from the Inuvialuit Settlement Region were photographed and digitized from maps held in Library and Archives Canada. The Inuvialuit Settlement Region Joint Secretariat is now continuing this project.

Funding was provided to rescue legacy data on Canada's Arctic marine fish and marine mammals. Old marine mammal surveys in Lancaster Sound were also digitized. These data are contributing to the products being developed by the Marine Fish and Marine Mammal Expert Networks. Work was undertaken to establish baselines on the taxonomic makeup and ecological distribution of microbes in the Arctic Ocean. These included laboratory analyses of archived microbe specimens and are contributing to the Plankton Expert Network.

Canada developed a domestic website, hosted by DFO that provides information about the CBMP-Marine Plan, highlighting Canada's specific involvement: <http://www.dfo-mpo.gc.ca/science/oceanography-oceanographie/cbmp-psbc/index-eng.html>. The website will be updated periodically as implementation progresses. Canada also completed a two-sided pamphlet for information and promotion purposes.

The Canadian National Network met three times during 2013, including a face-to-face meeting on the margins of the ArcticNet Annual Science Meeting in December 2013 in Halifax. Good progress is being made on the Canadian monitoring plan, and partnerships are being explored with the Canadian High Arctic Research Station, as well as with other organizations and projects.

c. Greenland/Denmark

In 2013, Denmark took on co-chairmanship of CBMP together with US. Part of national funding granted to the co-chairing work included US \$20K to strengthen and coordinating the CBMP-Marine program's efforts within Greenland/Denmark, and attending relevant international meetings. In addition, the Greenland Institute of Natural Resources (GINR) provided US\$10K in travel funds for experts to participate in Expert Network meetings. In addition, there were many in-kind hours of work contributed by experts on the Steering Group and Expert Networks, particularly from GINR and Marine programs of the Greenland Ecosystem Monitoring Program (funded mainly by Danish Ministry of Environment and the Ministry of Energy).

An external application has been submitted to the Danish Ministry of Environment for hosting and national participation to the annual CBMP-Marine SG/EN meeting in Nuuk, Greenland and for national participation to the annual meeting in 2015 planned for Norway.

Greenland/Denmark has committed to conserve Arctic biodiversity via the 'Denmark, Greenland and the Faroe Islands: Kingdom of Denmark Strategy for the Arctic 2011-2020'.

The Greenland Institute of Natural Resources (GINR) is the centre for biological research and monitoring in Greenland. GINR is working closely together with the Danish Centre for Environment and Energy, Aarhus University (DCE). Its primary objective is to provide the Government of Greenland with scientific advice for the sustainable use of the living resources, as well as the safeguarding of the country's environment and biological diversity. As such, GINR represents Greenland in the CBMP Marine programme.

GINR has monitoring programs, funded primarily by the Government of Greenland, for stocks of fish, crustaceans, mammals and birds that are important for the Greenland society. The data on seabirds and marine mammals are available to the CBMP Marine through the CAFF CBird group and the Marine Mammal Expert's Network, respectively. Data from the fisheries monitoring surveys are still to be incorporated in the CBMP Marine.

The Greenland Climate Research Centre (GCRC) at GINR runs two marine ecosystem monitoring programs, one in a high Arctic system and one in a low Arctic system. These programs are part of the Greenland Ecosystem Monitoring Program, which is mainly funded by the Danish Ministry of Environment and the Ministry of Energy. Data from these two monitoring programs is being incorporated into the CBMP Marine through the Sea-ice Biota, Plankton and Benthos Marine Expert Networks.

d. Iceland

Funding was provided by the Ministry of the Environment for the Marine Steering Group member to attend one face-to-face meeting during 2013 and about two weeks of work. Funding has also been secured to attend one meeting in 2014 and for the allocation of related effort (labour time). A request has been made to fund four months of labour from specialists at relevant research institutions in Iceland. The feasibility and cost estimates of establishing an annual monitoring program of benthic invertebrates in Icelandic waters were discussed with representatives of the Marine Research Institute. Discussion will continue in 2014.

e. Norway

The Ministry of Climate and Environment (MoCE)¹ supported Norwegian participation on the Marine Steering Group and Expert Networks by funding the travel costs. Norway is also supporting a half-time post-doc to review and access relevant sea-ice biota data from all countries. These funds were allocated to the Norwegian Environment Agency (NEA) by application.

The available 2013 budget was US \$51K to cover travel costs for the Norwegian participants, plus US \$67,5K for the Sea-ice Biota Expert Network data review. Additionally the Norwegian Institute for Marine Research (IMR), the Norwegian Polar Institute (NPI) and NEA contributed in-kind work equivalent to US \$90K.

The Norwegian data that are available for the CBMP Marine originate from various government funded monitoring programs mainly run by the institutes participating in the ENs, but also to a certain extent from other Norwegian institutes and universities.

For 2014, NEA has applied to the MoCE for US \$90K to support Norwegian participation on the Steering Group and Expert Networks, including funding of special projects on sea-ice biota data review, retrieving Russian sea-ice biota data from the Arctic Basin (from Dr. Igor Melnikov), benthos monitoring in the North Atlantic, and processing of Norwegian plankton data. Additionally the IMR has applied to the Norwegian Ministry of Foreign Affairs for a support to the three-year project Arctic Fish Distribution Atlas and Identification Guide starting in 2014/15 (US \$200K annually).

f. USA

The National Oceanic and Atmospheric Administration (NOAA) supported U.S. participation on the Marine Steering Group and Expert Networks by funding travel costs of the expert scientists and one member of the Inuit Circumpolar Council to the CBMP-Marine program meetings.

The U.S.A. has pursued four activities that contribute to the CBMP Marine Plan. They include developing a framework of observations and modeling to support forecasting of sea ice extent, identifying study sites in the Beaufort and Chukchi Seas and the contiguous Arctic Ocean where climate feedbacks are active, completing deployment of a Distributed Biological Observatory (DBO) in the U.S. and neighbouring Arctic Ocean to create long-term data sets on biological, physical and chemical variability and ecosystem response and developing integrated ecosystem processes research in the Beaufort, Chukchi and East Siberian Seas as well as parts of the East Siberian and Pacific Arctic Ocean.

NOAA contributed US \$1.5M in 2013 to the analysis and synthesis of RUSALCA (Pacific Arctic Region) data, which contribute to the monitoring of sentinel stations reported by the U.S.. These stations are called the Distributed Biological Observatory. An additional US\$ 180K was dedicated to data management for the Pacific Arctic sector data at the Alaska Ocean Observing System (AOOS). Salary for the Expert Network participants was provided in-

1. The Norwegian Ministry of the Environment changed name into the Ministry of Climate and Environment after the parliament election in 2013

kind by the University of Alaska, Fairbanks, the Point Stevens Institute, and the Marine Mammal Commission.

NOAA also supported, together with the Department of the Interior and the National Science Foundation, funds to carry out the observations gathered along the Distributed Biological Observatory (the CBMP sentinel stations in U.S. waters). In addition efforts from both Canada and Russia contributed greatly to the observation programs in 2013.

NOAA contributed to an effort to consolidate zooplankton data and the results are housed at the AOOS website in preparation for transfer to the ABDS. In 2013, U.S. agencies funded sea ice biota sampling campaigns off of Barrow, Alaska, U.S.A. In addition, NOAA contributed funds to carry out fish species composition and distribution data. These data are being entered into the Pacific Arctic Data Node (RUSALCA) on the AOOS website for future CBMP-Marine program use. NOAA contributed a total of US \$7K to the U.S. representatives to the Marine Mammal Expert Network to cover costs focused on tracking marine mammal information located in NOAA, the Fish Wildlife Service archives, in the Alaska State Fish and Game and native communities. The Fish and Wildlife Service continued its support of the U.S. Seabird activities.

In 2014, NOAA anticipates spending US \$587K for continued RUSALCA analysis, US \$180K for data management at the AOOS, US \$75K for the travel costs of the ENs to attend meetings and \$27K to pay for salary support of the participants. In addition an additional \$545K will be allocated to carry out the RUSALCA 2014 operations.

g. Others (as applicable)

The Nordic Council of Ministers Aquatic Ecosystems Group (NCM AEG) also supports the CBMP Marine implementation with US \$70K. In particular, this project supports work conducted by the Nordic countries. The CAFF Secretariat in Iceland is the project leader and the Norwegian Environment Agency is the project administrative body for this funding.

The Expert Network members are working with colleagues who, in some cases, are from non-Arctic Council countries. These scientists have valuable data holdings and expertise that make useful contributions to the work of the Expert Networks. While they are not members of the Expert Networks, they are connected to the CBMP-Marine Plan via wider scientific networks.

Looking Ahead

Going forward, the CBMP-Marine program will build on the successes achieved since implementation of the CBMP-Marine Plan started. Work will continue on refining and testing indicators of change in marine biodiversity; building accessible and interoperable databases; rescuing legacy datasets; exploring ways to include traditional knowledge; and producing baselines. The CBMP-Marine program will continue to strengthen connections with and contributions to national and other international efforts, e.g., the annual NOAA Arctic Report Cards.

In the coming year the CBMP-Marine program will work to overcome the most important challenges and barriers faced by the Steering Group and Expert Networks, i.e., funding, and recognition and support at the national and international levels.

In particular, the CBMP-Marine program will establish and promote the relevance and importance of the CBMP-Marine Plan, nationally and internationally, by focusing resources on a few activities and products, and strengthening links with international conventions and organizations. These include the Convention on Biological Diversity (CBD) Aichi Targets and Global Biodiversity Outlook, and GEO BON, as well as national institutions, to gain recognition, support and additional resources.

Funding will be sought from national and international organizations to cover Steering Group and Expert Network members' time and travel, and to provide capacity for data gathering and aggregation. This will be accomplished by implementing the CAFF/CBMP fundraising strategy. Further funding will be sought to continue collaboration with external organizations, while effort to increase capacity will continue in association with the Association of Polar Early Career Scientists.

Overcoming these barriers will help the CBMP-Marine program achieve our vision of informing decision and policy makers by providing them with information based on more effective marine biodiversity monitoring in the Arctic, more rapid and effective detection of important trends in Arctic marine ecosystems, and a better understanding of the mechanisms driving these trends. This information will be organized in multiple formats to facilitate more rapid and effective decision and policy making for conservation, mitigation and adaptation purposes.

Work Plan and Budget for 2014:

Milestone	Activities & Deliverables	Status	Timeline	Responsible	Cost (\$)/ Source
Plan published	Final plan endorsed by CAFF Board and published	Completed	2011	CBMP Office	
Governing structure activated	CBMP-Marine SG established	Completed	2011	Marine SG	
	Marine Expert Networks established	Completed	2011	Marine SG/Expert Networks	
	Adoption of the ToRs	Completed	2011	CBMP Office/CAFF Board	
	New Marine SG and EN leads confirmed	Completed	2014	Marine SG/Expert Networks	
	Support involvement by all participating countries	Ongoing	2013	Arctic coastal states/ Marine SG/Expert Networks	
Establish coordinated monitoring in each AMA	Arctic-based monitoring networks adopt parameters and sampling approaches	Ongoing	2014	Expert Networks	Covered/ Nationally (Arctic Council coastal states)
	Non-Arctic countries' Arctic monitoring networks added	Planned	2015	CBMP Office/Marine SG	
	Explore options for including traditional knowledge in the monitoring effort	ongoing	2014	Marine SG, Expert Networks	To be determined
Data management structures established	Data nodes and hosts, web-entry and data standards established for each Marine Expert Network	Ongoing	2014	CAFF Sec./ CBMP Office/Marine SG/ Expert Networks	60K/CBMP Office
	Nodes linked to portal and web portal analysis tools developed	Ongoing	2014	CAFF Sec./ CBMP Office/Marine SG/ Expert Networks	30K/CBMP Office
	Metadata added to Polar Data Catalogue	Ongoing	Continuously	CAFF Sec.	Covered/ CAFF Sec.
	Create database with form for entering data	Ongoing	2013	CAFF Sec.	Covered
Indicator development	Existing data sets identified, aggregated and analyzed to establish indicator baselines	Ongoing	2014	Marine SG/Expert Networks	Covered/ CAFF Sec./ Unspecified/ Nationally
	Indicators updated with monitoring plan outputs (annually)	Ongoing	Annually	Expert Networks	Covered/ Nationally

Milestone	Activities & Deliverables	Status	Timeline	Responsible	Cost (\$)/ Source
Reporting and coordination	Annual performance reports and work plans	Completed/Ongoing	Annually	Co-Chairs/Marine SG	Covered/Nationally
	Products for Arctic Council CAFF Board, SAOs and Ministers	Completed/Ongoing	Continuously	Marine SG, Expert Networks	Covered
	State of the Arctic Marine Biodiversity report (inc. AMA status reports) – every 5 years	Ongoing	2015/16	CAFF Sec./ CBMP Office/Marine SG/ Expert Networks	
	Scientific publications	Ongoing	Continuously	Expert Networks	Covered/Nationally
	General communications	Ongoing	Continuously	CAFF Sec./ CBMP Office/Marine SG/ Expert Networks	Covered
	Meeting of the Marine SG (telephone conf.)	Completed/Ongoing	Quarterly	Co-Chairs/Marine SG	6K/Nationally
	Meeting with the ENs (tel. conf.)	Completed/Ongoing	Continuously	Co-Chairs/Marine SG	30K/Nationally
	Annual face-to-face meeting of SG and ENs	Completed/Ongoing	Annually	Co-Chairs/Marine SG	
	Meeting with other CBMP steering groups	Planned	Continuously	CBMP Office/Co-Chairs/Marine SG	Covered
Fundraising and promotion	One-pagers developed for each country to use to promote the CBMP-Marine Plan and raise funds/support.	Completed/Ongoing	Annually	National Leads/CAFF Sec./Marine SG	Covered
	Actively seek funding and other support/capacity for Expert Networks and Permanent Participants	Ongoing	Continuously	CAFF Sec./ CBMP Office/Marine SG/ Expert Networks	
	Information at other events	Completed/Ongoing	Continuously	CAFF Sec./ CBMP Office/Marine SG/ Expert Networks	4K/Nationally
	Making an information brochure	Completed	2013	CAFF Sec.	0,5K/CAFF/ CBMP
	Information videos	Completed	2013	CAFF Sec.	4K/CAFF/ CBMP
Program review & adjustments	Independent review of parameters, sampling approaches, data mgmt approach, analysis, and reporting (every 5 years)	Planned	2015		

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