

Arctic Marine Biodiversity Monitoring Plan Annual Report 2012

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



Acknowledgements

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- Directorate for Nature Management, Trondheim, Norway
- Environment Canada, Ottawa, Canada
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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)
- Gwich'in Council International (GCI)
- Inuit Circumpolar Council (ICC) – Greenland, Alaska and Canada
- Russian Indigenous Peoples of the North (RAIPON)
- Saami Council

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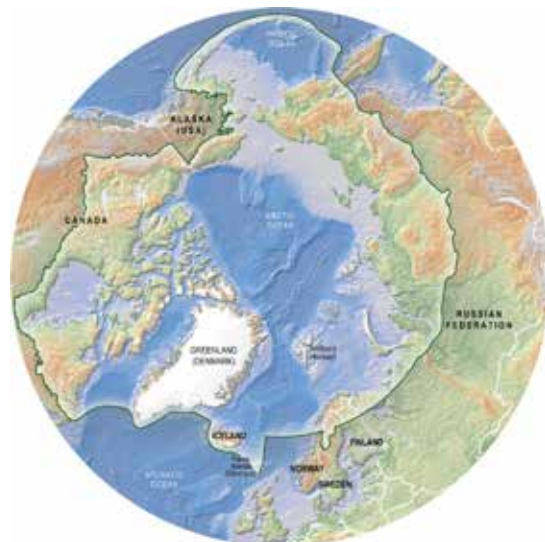
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What is the Arctic Marine Biodiversity Monitoring Plan (CBMP-Marine Plan)?

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. 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 to monitor at 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 better results from our existing collective monitoring efforts in Arctic marine ecosystems and it 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?

Implementation of the CBMP-Marine Plan began in late 2011, and this report describes the progress that has been made during the first year of implementation (2012). The governance structures were established: a Marine Steering Group that provides overall direction, and management; and five new Expert Networks (Sea-ice Biota, Plankton, Benthos, Marine Fish and Marine Mammals) that are concerned with determining marine biodiversity baselines, detecting changes and trends, and discerning the underlying reasons for such changes.

The participating countries, Permanent Participants and other Arctic Council working groups (Canada, Greenland, Iceland, Faroe Islands, Norway, Russia and US, Inuit Circumpolar Council, and Arctic Monitoring and Assessment Programme) have appointed members to the Steering Group and Expert Networks. All the groups have made progress against their work plans, a testament to the commitment and dedication of the scientists and countries involved, given the limited resources available to support their efforts.

The CBMP believes it has a significant contribution to make in building the next generation of polar scientists and towards this end cooperates with the Association of Polar Early Career Scientists (APECS). This cooperation has been mutually beneficial and has facilitated APECS' members attending a number of CBMP events and meetings.

This collective pan-Arctic effort is leading to the discovery, rescue and pan-Arctic 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 (Marine SG) 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 Marine SG ensures effective communication amongst and between the implementing nations; coordinates and provides direction to the Marine Expert Networks (Marine ENs); 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.



Canada led the Marine SG during this first year of implementation. The members were: Jill Watkins (Fisheries and Oceans Canada, and chair), Lisa Loseto-alternate (Fisheries and Oceans Canada); Aili Labansen (Greenland Institute of Natural Resources), Fernando Ugarte-alternate (Greenland Institute of Natural Resources); Gudmundur Gudmundsson (Icelandic Institute and Museum of Natural History); Jan Sørensen (Kaldbak Marine Biological Laboratory, Faroe Islands); Reidar Hindrum (Directorate for Nature Management, Norway), Dag Vongraven-alternate (Norwegian Polar Institute); Vadim Mokievsky (PP Shirshov Institute of Oceanology, Russia); Kathleen Crane (NOAA, US), Sue Moore-alternate (NOAA, US). The other members are Mike Gill (CBMP) and Jason Stow (Arctic Monitoring and Assessment Programme).

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 SG established	Completed, with all countries now represented.
	b. Marine Expert Networks established	Completed, with most countries now represented (still awaiting expert network members from Iceland and Faroe Islands).
	c. Adoption of the Terms of Reference	Completed.
	b. Marine SG and Expert Network leads confirmed	Marine Steering Group lead for 2013 to be shared by Canada and Greenland. Expert Network leads for 2013 confirmed for Sea-ice Biota (Norway), Plankton (Canada and US), Benthos (Norway), Fish (Canada and US), CBird (determined separately, Canada), and Marine Mammals (Greenland).
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.

Milestone	Activities & Deliverables	Status
	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 Expert Networks (ENs) working with Germany and Poland.
4. Data management structures established	a. Data nodes and hosts, web-entry and data standards established for each Marine Expert Network	Focus on developing interoperable datasets to aggregate and integrate, with controls on access where necessary. Further development of the Arctic Biodiversity Data Service (ABDS) and analysis and geographically based display tools.
	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	Good progress among expert networks and by countries (see below).
	b. Indicators updated with monitoring plan outputs (annually)	To start 2013 (for updates).
6. Reporting and coordination	a. Annual performance reports and work plans	Presented at Dec.14-15, 2012 joint meeting and completed by February 2013.
	b. State of the Arctic Marine Biodiversity report (including AMA status reports) – every 5 years	Originally planned for 2015, but need to revisit the date
	c. Scientific publications (ongoing)	Several in progress (see below for details under expert networks)
	d. General communications	Brochure, video, poster produced; presentations made at conferences and other national and international venues (e.g., International Polar Year, ArcticNet, GEO-BON)
	e. Meeting of the Marine SG (telephone conf./annual meeting)	Four teleconference calls in 2012 (February, May, August, and October). Annual meeting (face-to-face) held together with expert networks December 14-15 in Vancouver, BC.
	f. Meeting with the ENs (tel. conf./annual meeting)	Two face-to-face meetings: at IPY April 24-25, 2012 in Montreal, QC and annual meeting at ArcticNet December 14-15, 2012 in Vancouver, BC.
	g. Information at other events	See d. General communications above
	h. Meeting with other CBMP steering groups	FWEMG represented at annual meeting Dec. 14-15, 2012. Meeting with FW and TEMG leads at IPY April 2012 in Montreal, QC.
	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)	Not to occur until 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. Efforts will be made in 2013 to overcome these challenges.

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

This will be accomplished by focus resources on a few activities and products. 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 Marine Steering Group will engage national organizations and initiatives, to gain recognition, support and additional resources.

2. Funding

Funding will be sought from national and international organizations to cover Steering Group and Expert Network members' time and travel, and capacity for data gathering and aggregation. Funding is the shared responsibility of the CAFF Secretariat, the CBMP and the Marine Steering Group and Expert Networks. 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).



Sea ice algae. Photo: Armin Rose/Shutterstock.com

Sea-Ice Biota Expert Network

Preamble

The Sea-ice Biota Expert Network is led by Håkon Hop (Norwegian Polar Institute). The US representative Rolf Gradinger (University of Alaska Fairbanks) was replaced in October by Bodil Bluhm (University of Alaska Fairbanks). Thomas Juul-Pedersen (Greenland Institute of Natural Resources) was added as the Greenlandic representative. Russia is represented by Igor Melnikov (Institute of Oceanology, Moscow) and Canada by Michel Poulin (Canadian Museum of Nature). 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 she is financed by the Directorate for Nature Management in Norway.

The Sea-ice Biota Expert Network deals with ice algae, meiofauna, macrofauna, Polar cod (*Boreogadus saida*) and Arctic cod (*Arctogadus glacialis*). 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 to obtain an overview of who is working with what, and where 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 established	Network established
	b. Adoption of the Terms of Reference	Completed
	c. Confirm Expert Network lead	Confirmed - 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 & 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 list based on published and unpublished data is available. An overview of Norwegian unpublished data will be added to that list. There is also an overview of available Russian data and Melnikov is prepared to make these data available for the EN. ccumulation of 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 Marine Expert Network <ul style="list-style-type: none"> • Define sea-ice data nodes • Data nodes established and serving 80% of known data • Data nodes completed serving 100% of data 	At the moment, meta data 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). 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) • 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. Meiofauna diversity is in development (Bluhm). Six indicators have been identified for the Russian-Norwegian Barents Sea Monitoring plan in collaboration with CBMP activities.

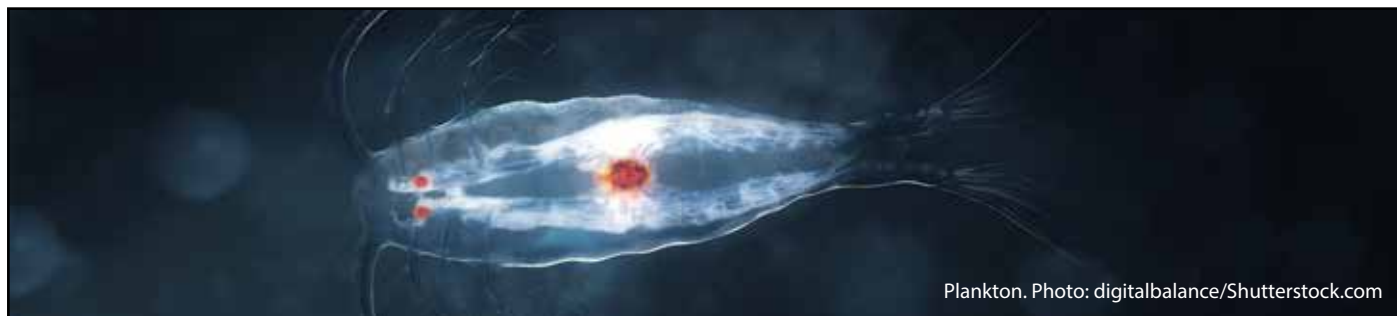
Milestone	Activities & Deliverables	Status
	b. Indicators updated with monitoring plan outputs (annually)	Not completed
	c. Develop cross-linked indicators Arctic cod, chl and diversity indices with plankton group, ice associated spp with plankton group, sympagic-pelagic-benthic coupling, ice fauna - 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
6. Reporting and coordination	a. Annual performance reports and work plans	Completed. Annual report delivered during CBMP-Marine SG and EN 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> (in press.)</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></p>
	d. Meeting with the Marine ENs (annual meeting/ teleconferences)	Daase and Melnikov met in St. Petersburg, March 4-8, 2012. Sea Ice Biota Expert Meeting (CAFF) 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 with the work. 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

the biological data. Many taxonomic uncertainties and unknowns exist, in particular for ice algae and meiofauna.



Plankton. Photo: digitalbalance/Shutterstock.com

Plankton Expert Network

Preamble

The Plankton Expert Network was led in its first year by Russ Hopcroft (University of Alaska, Fairbanks, US), with members from five other circumpolar countries (Connie Lovejoy, Université Laval, Canada), Hogni Debes (Faroe Islands), Kristin Arendt (Greenland Institute of Natural Resources), Cecilie von Quillfeldt (Norwegian Polar Institute), and Ksenia Kosobokova (PP Shirshov Institute of Oceanology, Russia).

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. More specifically, 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

Status of Work Plan

Milestone	Activities & Deliverables	Status
1. Work Plans developed	a. Develop and confirm with network members a work plan.	Work plan was developed but implementation highly dependent on funding
2. Governing structure activated	a. Marine Expert Networks established	Members added for Russia and Faroe Islands; unofficial member from Iceland
	b. Adoption of the Terms of Reference	Completed
	c. Confirm Expert Network lead <ul style="list-style-type: none"> • Confirm Russ Hopcroft as 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 completed – 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 	Data nodes and tools for them are funding driven – limited progress beyond some consolidation of datasets
	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 completed although tools being developed by related efforts
	c. Metadata added to Polar Data Catalogue	Not completed
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), refinement underway Meta-zooplankton species list legacy of CoML, maps underway to various degrees of sophistication Genetic library growing
	b. Indicators updated with monitoring plan outputs (annually) <ul style="list-style-type: none"> • Baselines established 	No progress yet
	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	No progress yet
6. Reporting and coordination	a. Annual performance reports and work plans	
	b. State of the Arctic Marine Biodiversity report (including AMA status reports) – every 5 years	
	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. 	
	d. Meeting with the Marine ENs (annual meeting/teleconferences)	Meeting among some members occurred in December 2012 in conjunction with the joint SG-ENs meeting in Vancouver. Funding constrains ability to meet as a group.
7. Communications	Video on plankton diversity for general public	No progress (requires funding)

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.



Benthic samples. Photo: Bodil Bluhm/NOAA

Benthos Expert Network

Preamble

For 2012, the Benthos Expert Network was chaired by Philippe Archambault (Université du Québec à Rimouski, Canada) and Katrin Iken (University of Alaska, Fairbanks, US). The other members were: Jan Sørensen (Kaldbak Marine Biological Laboratory, Faroe Islands), Martin Blicher (Greenland Institute of Natural Resources), Gudmundur Gudmundsson (Icelandic Institute and Museum of Natural History), Lis Lindal Jørgensen (Institute of Marine Research, Norway), Nina Denisenko (Zoological Institute, RAS, St. Petersburg, Russia) and Stanislav Denisenko (Zoological Institute, RAS, 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. More specifically, the BEN is to:

- ▶ 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 <ul style="list-style-type: none"> • Philippe Archambault confirmed as lead 	Completed
3. Establish coordinated monitoring in each AMA	a. Arctic-based monitoring networks adopt parameters and sampling approaches	Most efforts are individual projects, tied to individual methods. 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.
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 	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)

Milestone	Activities & Deliverables	Status
	b. Nodes linked to portal and web portal analysis tools developed	
	c. Metadata added to Polar Data Catalogue	
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)</p> <p>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>
	b. Indicators updated with monitoring plan outputs (annually)	Synthesis of existing knowledge in State of the Arctic Marine Biodiversity Arctic Report Card: Benthos chapter
	<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>
	d. Future indicators to develop	
6. Reporting and coordination	a. Annual performance reports and work plans	Completed.
	<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. 	Publications ongoing.
	d. Meeting with the Marine ENs (annual meeting/teleconferences)	BEN members participated in the joint annual meeting of the Steering Group and Expert Networks, Vancouver, December 2012

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.



Herring. Photo: fanfo/Shutterstock.com

Marine Fish Expert Network

Preamble

The Marine Fish Expert Network (MFEN) was established in 2012 with the following members: Kevin Hedges (Co-lead, Fisheries and Oceans Canada), Kitty Mecklenburg (Co-lead, US), Jakup Reinert (Faroe Marine Research Institute), Helle Siegstad (Greenland Institute of Natural Resources), Edda Johannesen (Institute of Marine Research, Norway), Vadim Mokievsky (provisional, PP Shirshov Institute of Oceanology, Russia) and Carolina Behe (Inuit Circumpolar Council, Alaska).

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 Russia 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 <ul style="list-style-type: none"> Kitty Mecklenburg and Kevin Hedges confirmed as co-leads for 2013. 	Jim Reist was confirmed as lead in September 2011. In January 2012, Dr. Reist withdrew from the Marine Fish EN and was replaced by Kevin Hedges. In June 2012, Kitty Mecklenburg and Kevin Hedges were confirmed as co-leads of the Marine Fish EN for the rest of 2012, and confirmed again for 2013
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.
	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 MFEN meeting in December 2012. Data nodes have not been established. <ul style="list-style-type: none"> Shared site established. An Arctic Council database would be preferable for final products.
	b. Nodes linked to portal and web portal analysis tools developed	2013-2014
	c. Metadata added to Polar Data Catalogue	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.

Milestone	Activities & Deliverables	Status
	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.
6. Reporting and coordination	a. Annual performance reports and work plans	Work plan updated and annual report submitted in Dec 2012.
	b. State of the Arctic Marine Biodiversity report (including AMA status reports) – every 5 years	Planned for 2014.
	c. Scientific publications (ongoing)	Publications expected in 2013. <ul style="list-style-type: none"> • Annotated list of arctic fishes (scientific names, common names, zoogeography) • White paper on integration of science and traditional knowledge for fish monitoring • State of monitoring for arctic marine fishes
	d. Meeting with the Marine ENs (annual meeting/teleconferences)	Third meeting held on December 13, 2012 in Vancouver, British Columbia, Canada.

Barriers and Challenges

There was a change in the Marine Fish EN leadership and some members were identified late in the year (Faroe Islands in October 2012; Russia and Iceland still pending). Funding is lacking for data collection, analysis, etc. Development of data sharing agreements still needs to be done.

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

Scientific challenges include:

- ▶ Definition of the Arctic region
- ▶ Does marine fish include anadromous, diadromous?
- ▶ Which variables (biotic or abiotic) need to be considered together with fish distributions?
- ▶ Gear selectivity during surveys
 - Incomplete sample coverage
 - Many species not sampled or inadequately sampled



Kittewake. Photo: Gail Johnston/Shutterstock.com

Seabird Expert Network

The Seabird Expert Network role is being fulfilled by the CBird expert group under CAFF (<http://www.caff.is/seabirds-cbird>). CBird has nearly completed the development of its monitoring plan.



Seal. Photo: Gnohz/Shutterstock.com

Marine Mammal Expert Network

Preamble

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 is affecting 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 facing marine mammals in the Arctic, current monitoring efforts are limited and largely uncoordinated. To meet these challenges, the Marine Mammal Expert Network (MMEN) has the task of coordinating monitoring and conducting analyses of marine mammals on a pan-Arctic scale.

The members of the MMEN are Dag Vongraven (Norwegian Polar Institute), Stanislav Belikov (All-Russia Research Institute for Nature Protection), Rosa Meehan (US Fish and Wildlife Service), Peter Thomas (US Marine Mammal Commission), Steve Ferguson (Fisheries and Oceans Canada), Kristen Laidre (Greenland Institute of Natural Resources), Fernando Ugarte (Chair 2012, Greenland Institute of Natural Resources), Bjarni Michelsen (Museum of Natural History, Faroe Islands), and Vera Metcalf (Inuit Circumpolar Council).

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 Circumpolar Biodiversity Monitoring Program's Arctic Biodiversity Data Service.

- ▶ 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 Arctic Biodiversity Data Service (ABDS) (www.abds.is). 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. Work in 2013 will focus on 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: <ul style="list-style-type: none"> • Work in 2012 linked to Arctic Biodiversity Assessment and focus on baseline data on abundance • 2013 incorporation of past abundance estimates to the database • 2013 – 2014 harvest data • 2014 – 2015 body condition and health
2. Governing structure activated	a. Marine Expert Networks established	Dag Vongraven (Norway) Stanislav Belikov (Russia) Rosa Meehan (US) Peter Thomas (US) Steve Ferguson (Canada) Kristin Laidre (Greenland) Fernando Ugarte (chair 2012, Greenland) Bjarni Mikkelsen (Faroe Islands) Vera Metcalf (ICC)
	b. Adoption of the Terms of Reference	Completed
	c. Confirm Expert Network lead	Fernando Ugarte confirmed as lead for 2012 and 2013.
3. Establish coordinated monitoring in each AMA	a. Arctic-based monitoring networks adopt parameters and sampling approaches	Work in 2012 and 2013 focused on abundance estimates. Next parameters include harvest, body condition and health. CAFF Ringed Seal Circumpolar Monitoring group developed indicators specific to ringed seals (Norway as lead) – workshop held in Tromsø in October 2012 (financed by Norway).
	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

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"> • Data nodes identified and establish framework for database on historical abundance estimates • Data nodes established 	Not started yet
	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. Past abundance estimates need to be incorporated. It was decided that after abundance, the work will focus on harvest, and then on body condition and health. This is an adjustment from the original plan, which included Movement/distribution as the third set of parameters Canada has developed an historic database of abundance estimates for Arctic whales (beluga, narwhal, bowhead). Work has started to summarize historic abundance estimates for pinnipeds (walrus, ringed seals, bearded seals).
	b. Indicators updated with monitoring plan outputs (annually)	Not yet
	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
	d. Future indicators to develop	Past abundance estimates/trends in abundance (next step) Harvest (22013-14) Body condition and health (2014-15) 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, 5 members (Laidre, Meehan, Ferguson, Vongraven & Ugarte) and one guest present (Lisa Loseto, Canada) E-mail exchange in 2012. Application to the US Marine Mammal Commission for meetings in 2013 in progress

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 which 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.

More technical challenges that have not yet been addressed include the design of a final database and the transfer of data to this database.

Financial Report

Status of Funding for 2012, and Outlook for 2013

2012 Budget:

Note: the costs outlined in the table are focused on new efforts to coordinate and integrate marine biodiversity monitoring, data management and reporting. They do not reflect the actual ongoing monitoring costs and they do not reflect the existing CAFF CBIRD group which is already operational. Some of the costs in the table represent the full cost of establishing some of the data portal platforms. Therefore, these costs will not be duplicated in the other CBMP Arctic monitoring plans.

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

Milestone	Activities & Deliverables	Total Cost (USD)	Cost Details	Responsibility
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
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 Office in Canada jointly are working to implement the CBMP-Marine Plan with specific responsibilities in the areas of communication and data management support. In this regard, CAFF and the CBMP have successfully secured funding to hire a data manager and communications officer in the CAFF Secretariat who are providing daily support for the implementation of the CBMP-Marine Plan. There are also two program officers (one in the CAFF Secretariat and one at the CBMP Office in Canada) as well as the CBMP Chair who provide ongoing support in data management, fundraising and communications.

For 2012, 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. This involved US\$37K from within Environment Canada, US\$10K from the CAFF Secretariat and DKK400K from the Nordic Council of Ministers as well as over US\$5K of in-kind support from the University of Laval for metadata entry into the Polar Data Catalogue.

This funding supported the development of a number of communications products for the CBMP-Marine Plan: a brochure, video and poster. As well, the funding supported ongoing development of the Arctic Biodiversity Data Service with the interoperable, distributed system being developed to allow for the ingestion, access and integration of existing marine datasets.

For 2013, it is anticipated that CAFF will continue to be able to support the data manager, communications officer and program officer positions who will continue their support work 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 internal and external communications support and product development (e.g. for AC Ministerial, Arctic Report Cards, etc.) will be provided. Data management support will continue in the form of providing direct assistance for database development as well as ongoing development of the Arctic Biodiversity Data Service involving development of data nodes and interoperable links.

b. Canada

Canada chaired the CBMP-Marine Steering Group during 2012, and scientists from government and academia participated on all Expert Networks.

Canada completed primary publications through the Canadian Science Advisory Secretariat (CSAS) process. Two research documents (one scoping all indicators for ecosystem monitoring and one focused on monitoring corals and sponges) and a science advisory document were completed and are now available online http://www.dfo-mpo.gc.ca/csas-sccs/Publications/ResDocs-DocRech/2012/2012_003-eng.html, http://www.dfo-mpo.gc.ca/csas-sccs/Publications/ResDocs-DocRech/2012/2012_123-eng.html, and http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2012/2012_053-eng.html. To complement these publications, Canada is in the process of drafting a Canadian Plan for monitoring to support national and international objectives including the CBMP-Marine Plan. The Canadian Plan will be reviewed in 2013.

The Canadian National Network was established with representation consisting of Canadian Expert Network members, northern co-management boards, and the national Inuit organization Inuit Tapiriit Kanatami (ITK). The National Network met four times during 2011-2012 to discuss national priorities. ITK is assisting with developing the traditional knowledge component of the Canadian Plan.

Part-time staff were hired, dedicated to secretariat support, data rescue and digitization, to support the Canadian fish and marine mammal EN groups. Forty-two (42) legacy metadata sets were added to the

Polar Data Catalogue.

Finally, Canada is working with APECS Canada to begin a mentoring program between government CBMP scientists and students. It is hoped that the students will be exposed to government research/activities in a meaningful way and that together with scientists complete project work (e.g., research papers). Several scientists have been identified to participate in the program and we are looking to match the youth up with the scientists.

Canada provided US\$54K in 2011-2012, and US\$77K in 2012-2013 (April-March) in funding to support these activities. Considerable in-kind contributions were provided by all participating members and organizations. For 2013-2014, approximately US\$45K will be available for Canadian involvement in the CBMP-Marine Plan, in addition to in-kind contributions.

c. Greenland

In 2012 funding consisted of approximately US\$10K for travel and about US\$15K from a grant from the Danish Ministry of Environment for CAFF work, mainly related to the ABA but with synergies with the CBMP-Marine Plan. In addition, there were many in-kind hours of work contributed by experts on the Steering Group and Expert Networks.

For 2013, an internal application has been submitted to the Greenland Institute of Natural Resources (GINR) for US\$10K for experts to participate in Expert Network meetings. An external application to the Danish Ministry of Environment has also been made for 6 months of work to support Greenland's involvement on the Steering Group and Expert Networks. The CBMP-Marine Plan component of the external application is approximately US\$70K.

Most of the marine biodiversity monitoring in Greenland is carried out by the GINR. Fisheries are monitored through yearly surveys in East and West Greenland, focusing mainly on the commercially important species: shrimp, cod, Greenland halibut and snow crab. Data on other species is collected but not analyzed, unless it forms part of specific research projects, e.g., a recently started MSc study on Greenland shark. The research vessels can be used in collaborative research and monitoring projects. The Department of Fish and Crustaceans is understaffed and it has been difficult to support the work of the Fish Expert Network.

The GINR also conducts monitoring programs for marine mammals and marine birds. The data from these programs is available to the CAFF CBird group and the CBMP Marine Mammal Expert Network.

The Greenland Climate Research Centre (GCRC) at GINR runs two marine ecosystem monitoring programs, one in a high Arctic system in Young Sound, in Northeast Greenland and one in a low Arctic system in Nuuk. Data from these two monitoring programs is expected to contribute to the CBMP-Marine Plan through the Expert Networks primarily on Plankton. Although Sea-ice Biota and Benthos biodiversity are not part of the monitoring programs, Greenland representatives collaborate closely with these (and the other) Expert Networks through the GINR.

The Arctic Research Partnership collaboration started in 2012 between the University of Manitoba in Canada, the University of Aarhus in Denmark and the GCRC in Greenland. Researchers from Canada, Denmark and Greenland are encouraged to carry out collaborative projects through funding opportunities and shared logistics in Greenland.

Due to the growing interest for hydrocarbon and mineral exploration, the Greenland Bureau of Minerals and Petroleum has channelled funding from the industry into a series of environmental studies to gather baseline information for strategic environmental impact assessments. One such program has been running in the Baffin Bay during the period 2011-2014, and a new program will probably start in

the Greenland Sea in 2014, depending on the outcome of a licencing round for offshore exploration (applications were due in December 2012).

The Government of Greenland is considering an application for a large iron mine close to the ice cap near Nuuk. Anticipated effects include discharges to the fjord and substantially increased ship traffic. If approved, a plan to monitor the effects of this mine on the fjord system will be established.

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 2012 and about two weeks of work. Funding has also been secured to attend one meeting in 2013 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.

e. Faroe Islands

No dedicated national funding is provided for involvement in the CBMP. Faroese members contribute according to the budget of their respective institutions. A formal application for funding travel expenses in 2013 has been made to the Ministry of Internal Affairs and Environment.

The Faroes have members on the CBMP-Marine Steering Group and Expert Networks for Plankton, Marine Fish, Marine Mammals, Seabirds and Benthos but due to very limited resources the Faroese contribution has been mostly to observe progress.

The Faroese Marine Research Institute has a mandate to monitor commercial fish stocks and collects data for this purpose on a regular basis. They also monitor marine plankton and seabirds in general. The Natural History Museum monitors small cetaceans in Faroese waters and holds data on marine benthic invertebrates. To obtain access to data, the CBMP Marine Expert Networks will need to make formal requests to the institute that owns the data.

f. Norway

The Norwegian Ministry of the Environment (MoE) 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 Directorate for Nature Management (DN) by application.

The available 2012 budget was US\$51K to cover travel costs for the Norwegian participants, plus US\$73K from the 2011 budget contracted especially for the Sea-ice Biota Expert Network data review. Additionally the MoE supported the Norwegian Polar Institute (NPI) with US\$57K to arrange the Ringed Seal workshop.

The Steering Group representative from DN and the alternate from NPI as well as the Expert Network representatives from NPI and the Norwegian Institute for Marine Research (IMR) have contributed many hours of work in-kind.

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 2013, DN has applied to the MoE for US\$135K to support Norwegian participation on the Steering Group and Expert Networks, including funding the continued work of a post-doc for the sea-ice biota data review.

g. US

The US has contributed to the participation of US members on the Marine Steering Group and the Expert Networks, as well as the Alaskan representative of the Inuit Circumpolar Council through funding from the Arctic Research Program, NOAA.

- ▶ 1. In 2012, NOAA contributed US\$199K towards data management of Pacific Arctic observations.
- ▶ 2. In 2013, NOAA expects to contribute to the salaries of the non-governmental ENs members if US budgets allow these expenditures.
- ▶ 3. NOAA plans to contribute US\$1.5M in 2013 to the analysis and synthesis of RUSALCA (Pacific Arctic Region) data.

RUSALCA (US and Russia) stations have overlapped with US DBO stations since 2004. Plans to continue monitoring are being developed.

h. 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 Directorate for Nature Management 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, we will build on the successes we've achieved during the first year of implementing the CBMP-Marine Plan. 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. We will continue to strengthen connections with and contributions to national and other international efforts, e.g., the annual NOAA Arctic Report Cards.

The coming year will also see 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, we 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 (APECS).

Overcoming these barriers will help us 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 2013:

Milestone	Activities and Deliverables	Timeline	Responsible	Cost (\$)/ Source
1. Plan Published	a. Final plan endorsed by CAFF Board and published	done	CBMP Office	
	b. Executive Summary report published	Not done. Brochure and video instead (see below)	CBMP Office	
2. Governing structure activated	a. CBMP-Marine Steering Group established	September 2011/done	Marine SG	
	b. Marine Expert Networks established	September 2011/done	Marine SG/ENs	
	c. Adoption of the ToRs	October 2011/done	CBMP Office/CAFF Board	
	d. New Marine SG and EN leads confirmed	January 2013/done	nominated leads and Marine SG/EN members	
	e. Support involvement by all participating countries	2013 and ongoing	Arctic Council coastal states on Marine SG and ENs	400K/Arctic Council coastal states (100K travel; 300K scientific support)
3. Establish coordinated monitoring in each AMA	a. Arctic-based monitoring networks adopt parameters and sampling approaches	ongoing till 2014	ENs	Covered/Arctic Council coastal states
	b. Non-Arctic countries' Arctic monitoring networks added	after 2015	CBMP Office/Marine SGs	
	c. Explore options for including traditional knowledge in the monitoring effort	2014 and ongoing	Marine ENs/SG	Covered/CBMP/CAFF Sec.
4. Data management structures established	a. Data nodes and hosts, web-entry and data standards established for each Marine Expert Network	ongoing till 2014	Marine ENs/CBMP Office/CAFF Sec.	60K/CBMP Office
	b. Nodes linked to portal and web portal analysis tools developed	ongoing till 2014	Marine ENs/CBMP Office/CAFF Sec.	30K/CBMP Office
	c. Metadata added to Polar Data Catalogue	ongoing	CAFF Sec.	Covered/CAFF Sec.
5. Indicator development	a. Existing data sets identified, aggregated and analyzed to establish indicator baselines	ongoing till 2014	ENs/CBMP Office/CAFF Sec.	Covered/CAFF Sec./Arctic coastal states
	b. Indicators updated with monitoring plan outputs (annually)	ongoing annually	Marine ENs	Covered/Arctic Council coastal states

Milestone	Activities and Deliverables	Timeline	Responsible	Cost (\$)/ Source
6. Reporting and coordination	a. Annual performance reports and workplans	February 2013; December 2013	Marine ENs/SG/CAFF Sec.	Covered/Arctic Council coastal states
	b. Products for Arctic Council CAFF Board, SAOs and Ministers	mid-February 2013	Marine ENs/SG/CAFF Sec.	Covered
	c. State of the Arctic Marine Biodiversity report (incl.. AMA status reports every 5 years)	2016	Marine SG/ENs/CBMP Office	
	d. Scientific publications (ongoing)	ongoing	Marine ENs	Covered/AC coastal states
	e. General communications	ongoing	CBMP Office/CAFF Sec./Marine SG members	Covered
	f. Meeting of the Marine SG (tel. conf.)	ongoing/TBD	Marine SG lead/CBMP Office	6K/Arctic Council coastal states
	g. Meeting with the ENs (tel.conf.)	ongoing/TBD	Marine SG lead	30K/Arctic Council coastal states
	h. Annual face-to-face meeting of SG and ENs			5K/Arctic Council coastal states
	i. Meeting with other CBMP steering groups	annual calls	Marine SG lead/CBMP Office	Covered
7. Fundraising and promotion	a. One-pagers developed for each country to use to promote the CBMP-Marine Plan and raise funds/support	February 2013	Marine SG/CAFF Sec.	Covered/CAFF Sec.
	b. Actively seek funding and other support/capacity for Expert Networks and Permanent Participants	ongoing throughout 2013	Marine SG/ENs/CAFF Sec./Marine SG members	Covered/CAFF Sec.
	c. Information at other events	International conf. 2013	CBMP Office/CAFF Sec./Marine SG members	4K/Arctic Council coastal states
	d. Making an information brochure	done	CAFF Sec./CBMP Office/CAFF Board	0.5K/CAFF
	e. Information videos	done	CBMP Office/CAFF Sec.	4K/CAFF/CBMP
8. Program review and adjustments	a. Independent review of parameters, sampling approaches, data management approach, analysis and reporting (every 5 years)	2015		

Total Budget (2013): US\$542.5K (US\$448K Arctic Council coastal nations i.e., US\$64K per country; US\$94.5K CAFF CBMP).

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