The Atlantic Gateway:
proposal of a standardized long-term monitoring of benthos

Circumpolar Biodiversity Monitoring Program:
Marine Benthos Expert Network
**CAFF Designated Agencies:**

- Directorate for Nature Management, Trondheim, Norway
- Environment Canada, Ottawa, Canada
- Faroese Museum of Natural History, Tórshavn, Faroe Islands (Kingdom of Denmark)
- Finnish Ministry of the Environment, Helsinki, Finland
- Icelandic Institute of Natural History, Reykjavik, Iceland
- The Ministry of Domestic Housing, Nature and Environment, Government of Greenland
- 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 Organisations:**

- Aleut International Association (AIA)
- Arctic Athabaskan Council (AAC)
- Gwich’in Council International (GCI)
- Inuit Circumpolar Council (ICC)
- Russian Indigenous Peoples of the North (RAIPON)
- Saami Council


Front cover photo: *Synidoteta nodulosa* and Ophiura ub the Kara Sea: Alexey Solodov/Shutterstock.com

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REPORT 1

Circumpolar Biodiversity Monitoring Program
- Marine Benthos.

The Atlantic Gateway proposal of a standardized long term monitoring of benthos

The main goal of CBMP is to respond to significant biodiversity-related trends and pressures affecting the circumpolar world. But repeated long term monitoring programs on benthic fauna is strikingly missing for large areas of the Pan-Arctic, and in areas having repeated monitoring, comparative studies are difficult due to different approach of sampling and different benthic faunal component targeted. If CBMP-marine benthos is to succeed, there is a need for an international standardization of benthic - long term monitoring.

In 2013 Norway, Island, the Faroes and Greenland have been discussing the possibility of developing an international time- and cost-effective long term monitoring series with possibility to be compared across nations.

This development take place within the already existing national scientific fish-surveys analyzing target commercial fish stocks. We suggest that by adding a minimum of two extra persons onboard (benthic expert) the national scientific fishery research vessels, the entire trawl catch, including both vertebrates and invertebrates will be analyzed, and this will increase the knowledge of biodiversity and the possibility to monitor all components of the ecosystem from small invertebrates, to the entire vertebrate community in time and space. This has already been done in the Barents Sea (Institute of Marine Research).

The Barents Sea example:

The single stock fish-survey (1960ies) of the Institute of Marine Research (the scientific institute for the ministry of fishery and coastal affairs) developed toward a multi-stock fish survey (1970is), and further into an Ecosystem fish survey (2003). This means that all ecosystem components are monitored every year from 3 Norwegian and 1 Russian vessel in the entire Barents Sea (Fig 1).

From 2006 two benthos experts was added to the survey staff. There job was to split the benthic invertebrates from the demersal fish-trawl for further analyses. The benthic component was identified down to closest possible taxon, counted and weighed on board. The data are further processed on land. This has, in year 2013, resulted in an 8 year long term monitoring series on the benthic community. The data are further considered with reference to climate change, trawling impact, and effects from invasive species. The data has shown to be given valuable scientific results and opportunities to evolve the national management into an ecosystem based management. This is work under publication.
Possibilities for Island
Within Icelandic waters, fish stock assessment surveys using an otter-trawl are carried out annually, both in autumn and spring. During the spring survey, a total of 562 stations are sampled by 5 vessels, while 380 stations are sampled by 2 vessels in the autumn survey (Fig. 2). All fish species from the catch is analysed in a conventional manner for stock size estimation purposes. We propose to establish a long-term monitoring program to evaluate spatial and temporal trends in megabenthic invertebrate communities within Icelandic waters based on the analysis of bycatch collected during stock assessment surveys. We would adopt the methodology that has been developed in the Barents Sea and is described here above. On each vessel, two trained research assistants would identify all invertebrates to the lowest taxonomic resolution possible that are captured at each station. These data will be analysed jointly with other partners involved in the project consortium.
Fig. 2. Distribution of otter-trawl hauls taken during spring (above) and autumn (below) surveys.
**Possibilities for the Faroe Islands**

As with Iceland, fish stock assessments are carried out twice a year. 100 stations are monitored in early spring and 200 stations are monitored in August, where 100 are the same as in the spring survey (Fig 3). Faroe Bank south off the Faroes is monitored in a similar way. Before 1993 the stations were randomly chosen, but have been fixed since 1993. The gear used is a 112 feet “box” trawl with 40 mm mesh size. Both gear and vessel have been unchanged.

The main objective is to monitor the most economical important fish species, cod, haddock and saithe. These are measured in different ways while all fish species are only registered in numbers and weight. Except for Nephrops and cephalopods, invertebrates are not registered.

The Faroese Fisheries Laboratory has considered the possibility to include invertebrate bycatch in their registrations to get a more complete picture of ecosystem trends for the area (from oral communication with staff). It is also noteworthy/interesting that there seems to be very little invertebrate bycatch in the monitoring at the Faroe Islands, which could indicate a difference in method/gear or a real biological difference compared to at least the higher latitude areas.

It is therefore considered beneficial for the whole idea of monitoring to adapt the ecological approach in the Faroese monitoring program which is to register and measure not only economically important species but less important fish species as well as all invertebrates.

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**Fig. 3. Trawling station (no 200) for summer (R/V Magnusi Heinasyni). Some of the stations are resampled.**
Possibilities for Greenland

Within Greenlandic waters, fish stock assessment surveys using a bottom-trawl are carried out annually each summer. A total of about 230 stations are sampled in West Greenland waters and a total of about 200 stations are sampled in East Greenland waters (Fig. 4). All fish and shrimp species from the catch is analyzed in a conventional manner for stock size estimation purposes.

Fig 4. The Greenlandic water fish stock assessment survey. Bottom-trawling are carried out annually each summer.
It is obvious that the Atlantic Gateway coverage by trawl stations (Fig. 2) will provide great opportunities to cover an extensive area with long term monitoring of benthic epifaunal megafauna.

FIG 2. The coverage of scientific trawl stations from the Atlantic countries: Norway, Island, Faroe Island and Greenland. This station grid will cover AMA 1 and 2 and LME 1-5, 16 (see Box 1 below). Today only Norway/Russia has, since 2006, identifying the entire trawl catch including the epibenthic megafauna in the Barents Sea.
Conclusion
All the countries in the Atlantic area have annually monitoring of commercial fish-stock in their national waters.

We encourage the nations to also identify the benthic component of the trawl catch, and that this is done by a standardized method among the nations via a benthic expert exchange program added to the fish research vessels.

This is possible by adding two benthic experts on each of the vessels in the already existing national surveys. This will increase the total budget with hours at sea for the added persons, and for hours for one person on land to analyze the data.