UNIVERSITY OF COPENHAGEN
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Snowchange COOPERATIVE

NORDECO
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An assessment of community based monitoring in the Arctic

Integrating local and Indigenous knowledge with scientific knowledge in environmental monitoring

Simone Gress Hansen
M.Sc. Biology, Copenhagen University in collaboration with NORDECO and Snowchange Cooperative
Simonegress@hotmail.com

Introduction

Scientific environmental monitoring is often challenged when trying to unravel the complexities of ecosystem dynamics, especially in the Arctic where field work is extraordinarily expensive and logistically difficult. Instead novel approaches are being developed to improve the monitoring of the Arctic environment. One of these approaches is community based monitoring (CBM) which integrates local and Indigenous knowledge with scientific knowledge.
CBM has been found to cost-efficiently strengthen conventional scientific monitoring while at the same time resulting in advantageous co-benefits for the local participants and communities.
However not much is known about the status, characteristics or results of Arctic CBM programmes.

This study aims to provide a detailed assessment of currently running CBM programmes in the Arctic. This was done by investigating both: The applied work, the general characteristics and the actual data from Arctic CBM programmes, in order to answer the following **research questions:**

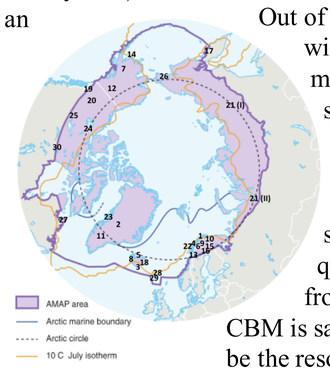
1. **What are the general characteristics of Arctic CBM programmes?**
2. **What are the most distinguishing features of CBM compared to scientific monitoring?**
3. **Is there a difference in the format and the results between CBM data and scientific data?**

Additionally, this thesis work feeds into the big EU project INTAROS (Integrated Arctic Observation System) and will result in a joint meta- database of Arctic scientific and CBM programmes. Thus creating an easy accessible overview of both conventional and CBM monitoring programmes in the Arctic, hopefully bringing together these two approaches

Methods

Three different methods were used

1. A hands-on investigation of the applied work of CBM alongside the first ever Saami led restoration project in Finnish Lapland together with Skolt Saami and Snowchange Cooperative
2. Questionnaire of 30 circumpolar CBM programmes providing a general characterisation
3. An in-depth analysis of fish stock abundance CBM data from a "best-example" Greenlandic case study of two study species: Greenland halibut (*Reinhardtius hippoglossoides*) and Atlantic cod (*Gadus morhua*)



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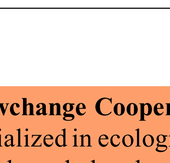
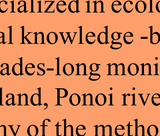
Box: **What is community based monitoring ?**

Stage of involvement \ Monitoring type		Scientific monitoring	Citizen science	Community based monitoring
Scientists 	Design	✓	✓	✓
	Data collection	✓		✓
	Interpretation	✓	✓	✓
	Use	✓	✓	✓
Citizens/volunteers/ community members 	Design			✓
	Data collection		✓	✓
	Interpretation			✓
	Use			✓

Conventional monitoring /scientific monitoring: Monitoring that is designed, collected, interpreted and used by scientists (adapted from Danielsen et al. 2008)

Citizen science: Monitoring where professional scientists design the research project and have volunteers/citizens help with the data collection (adapted from Bonney et al. 2009 and Danielsen et al. 2008)

Community based monitoring: Monitoring where community members are involved in more than just data collection, and the monitoring is done in relation to aims and objectives valued by them (adapted from Danielsen et al. 2008 and Danielsen et al. 2014)

Snowchange Cooperative is an independent, non-profit organization based in North Karelia, Finland. It has specialized in ecological monitoring in the Boreal and Arctic for close 20 years. Methods rest on Indigenous and local knowledge -based cultural indicators, oral histories, science assessments and CBM tools. Large scale, decades-long monitoring efforts are under way for example in Alaska, NE Siberia (Kolyma basin), Sámi areas of Finland, Ponoi river, Murmansk, as well as several sites in Canadian boreal and Arctic. Snowchange presented many of the methods and results at the AOS 2014 held in Helsinki, Finland. In recent years Snowchange has launched large-scale Indigenous and local -driven ecological restoration activities to combat negative impacts of climate change

Results

Research question 1: The characteristics describing Arctic CBM programmes

- Wide circumpolar distribution, across all eight nations in the Arctic
- Very diverse and interdisciplinary attribute monitoring
- Mainly biological attributes are monitored - however, also abiotic and socio-cultural attributes are covered to a high degree.
- Very high temporal coverage, with monitoring being performed throughout the whole year
- CBM especially contributes to the communities by enhancement of pride and self-esteem, increased participation in natural resource decision-making and improved education and learning skills.

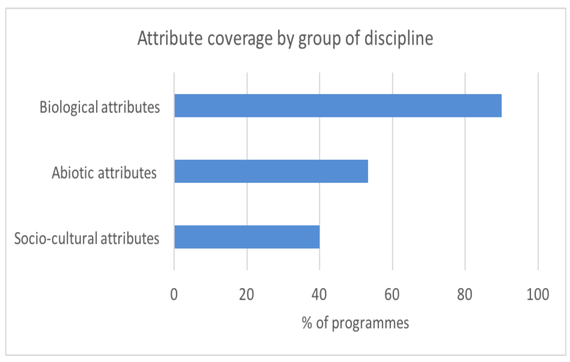
Research question 2: The most distinguishing features of CBM compared to science-driven monitoring

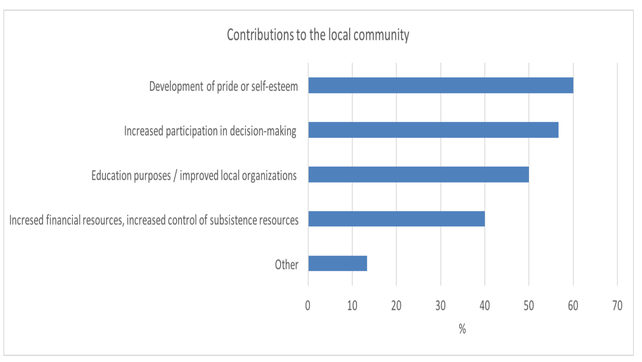
Out of the factors investigated in this study, the most distinguishing feature of Arctic CBM programmes is the wide temporal coverage. CBM is conducted throughout all seasons of the year whereas science-driven monitoring is strongly limited by the academic calendar and is almost only conducted during the field season from June to September.

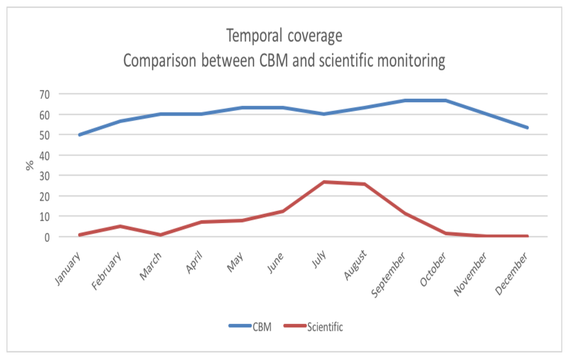
Research question 3: Differences in the format and results between CBM data and scientific data

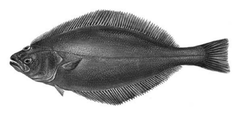
CBM tend to be qualitative and provide holistic diachronic (i.e. a record of observations from a single location over a long time period) observations. Whereas, Science-driven monitoring tend to be quantitative and represent deductive, synchronic observations (, i.e. "value-free" short-term observations from a range of sites).
CBM is said to be tested and validated through trial and error methods through generations. The observers tend to be the resource users themselves – hunters, fishers, and gatherers who are intimately linked to the land.
In contrast, scientific observations are made by professional researchers, the knowledge is based on reductionist reasoning and make use of abstractions, yielding generalized models.

Thus there are fundamental differences in the format between CBM data and scientific data, meaning that direct 1:1 comparison between CBM and science-driven monitoring often is not a suitable method to evaluate or integrate the two methods. This was also found in this study, where consensus between CBM and scientific fish abundance trends were not straightforward to determine. Consensus depended on the species in question and the resolution (monthly or quarterly scale) used in the analysis.
Consensus existed for Atlantic cod, however only for Greenland halibut by downscaling the resolution from monthly to quarters of a year.

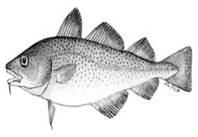








Monthly: No correspondence between CBM and scientific trend (p=0,0034)
Quarterly: Correspondence (p=0,4257)



Monthly: Correspondence (p=0,0640)
Quarterly: Correspondence (p= 0,1774)

Discussion & Conclusion

This study finds that not much is gained from strictly comparing scientific monitoring and CBM 1:1. Rather by combining the two methods instead of trying to verify them against each other, synergies can emerge and both methods will be strengthened. One method might be as valid as the other, the two types of monitoring simply provide different formats of knowledge and different possibilities for analysis.

This study concludes that CBM can provide strengthened reliable environmental monitoring, novel discoveries and information that are directly relevant for managers while also making a significant difference in the communities. However, in order to obtain the full potential of CBM it requires researcher to be able to work with various knowledge systems, adapting new interdisciplinary methods and establishing equity and mutual trust.