



Marine Ecosystem Restoration
in Changing European Seas
www.merces-project.eu



Marine ecosystem accounting to support coastal and marine governance

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MERCES



Fram Centre

Marine ecosystems cover the largest part of the Arctic: the Arctic Ocean covers 10 million km².

Figure 2.1. Main features of pan-Arctic ecosystems

Terrestrial

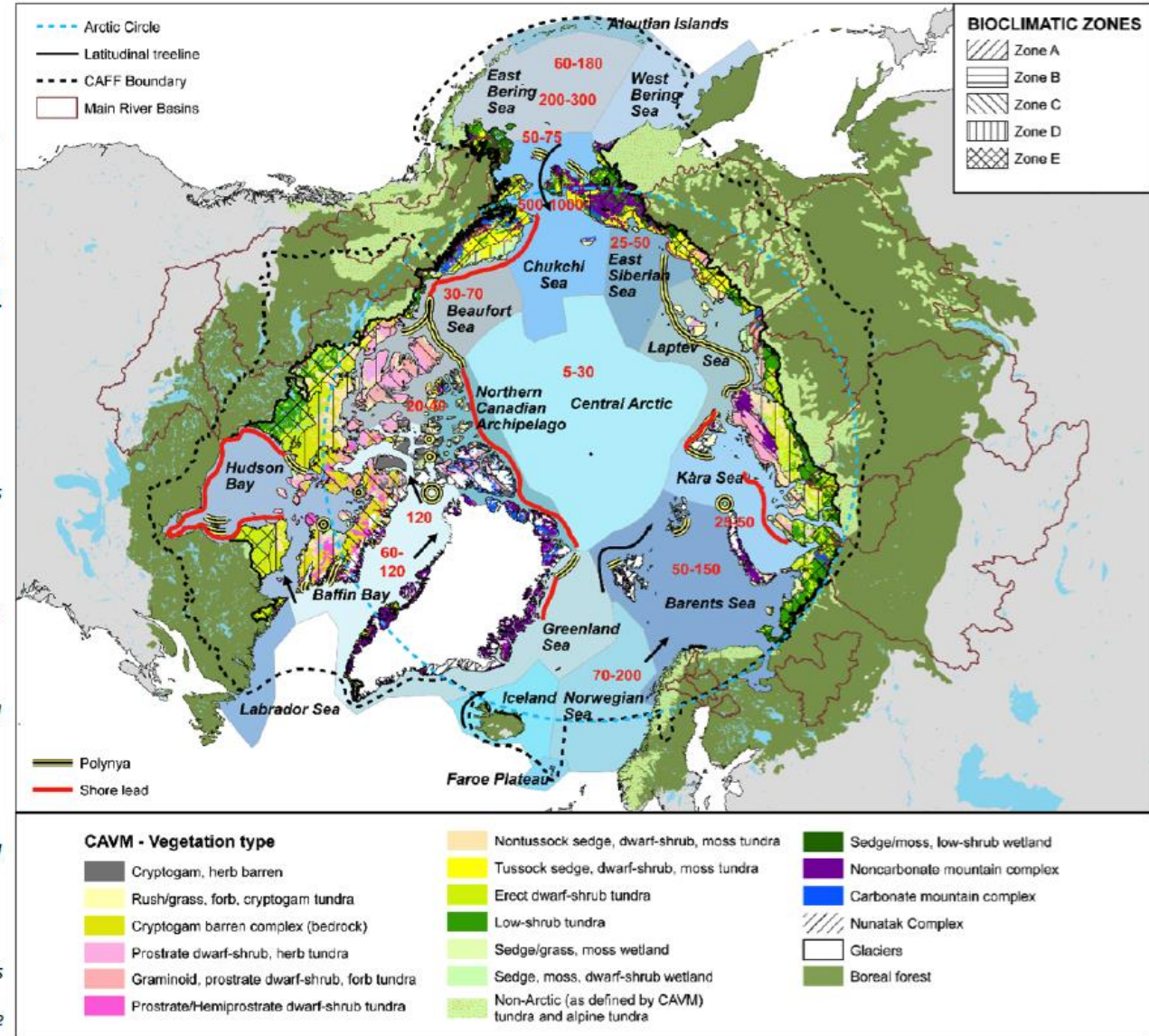
- Terrestrial regions are shown with different types of line patterns (see the legend in the upper right corner). These depict the different bioclimatic sub-zones in the Arctic, as defined by the CAVM Team (2003).
- Vegetation zones of the Arctic (CAVM Team 2003) are shown as colored polygons; see the legend at the bottom of the map. Non-Arctic tundra (alpine tundra) and the boreal forest (taiga) are also included (Terrestrial Ecoregions of the World - TEOW - Olson et al. 2001).

Marine

- The 18 LMEs of the Arctic (AMAP et al. 2013; PAME 2013c) are shown as colored marine regions; their names are shown in black print on the map.
- The location of polynyas and coastal leads is shown with thick lines: yellow for polynyas and red for leads (AMAP et al. 2013).
- Annual primary production estimates (g Carbon/m²) are shown as red numbers (AMAP et al. 2013).
- Advective water and zooplankton transport (AMAP et al. 2013) are indicated by black arrows.

Freshwater

- Boundaries of the main river basins draining to the Arctic are shown as empty brown-contoured polygons (www.wri.org).
- Main freshwater bodies are shown as light blue polygons.
- Geographic boundaries
- The boundary of the Arctic region as defined by CAFF (www.caff.is) is shown as a dashed black line.
- The latitudinal limit of the treeline, which coincides with the southern limit of the Arctic as defined by the CAVM Team (2003) is shown with a solid black line.
- The Arctic Circle is shown with a dashed blue line.



CAFF 2015. The Economics of Ecosystems and Biodiversity (TEEB) for the Arctic Scoping Study for the Arctic. Conservation of Arctic Flora and Fauna, Akureyri, Iceland. ISBN: 978-9935-431-46-2

Ecosystem services for the Arctic Coast and Ocean

Box 2.2. List of ecosystem services in the draft Arctic Ecosystem Services Inventory prepared for this scoping study

CULTURAL SERVICES

- Aesthetic information
- Cultural identity, heritage, and sense of place
- Information for cognitive development
- Inspiration for human creative thought and work
- Knowledge systems and education
- Recreation and tourism
- Spirituality and religion
- Well-being: psychological and physical health

HABITAT / SUPPORTING SERVICES

- Food web maintenance
- Genetic resources
- Nutrient cycling
- Primary productivity
- Soil fertility (including soil formation)

PROVISIONING SERVICES

- Biochemical and medicinal resources
- Food – reindeer husbandry, other terrestrial mammals, berries and mushrooms, birds, marine mammals, commercial fisheries, small-scale fisheries, aquaculture, agriculture
- Fresh water for human consumption and use
- Raw materials – timber, fibres, resins, animal skins, feathers and down, ornamental resources, biomass fuel

REGULATING SERVICES

- Air quality regulation
- Biological control (disease regulation and pest regulation)
- Carbon storage and sequestration
- Climate regulation (e.g., carbon storage and sequestration, atmospheric and oceanic circulation, frequency of extreme events):
 - global, regional, and local
- Erosion regulation
- Natural extreme events (e.g., storms, floods)
- Pollination
- Water flow regulation
- Water purification and waste treatment



The changing Arctic

Increase in ocean economics and growth

- New oil and gas fields
- Potential new shipping routes
- Increasing tourism

Increase in other challenges

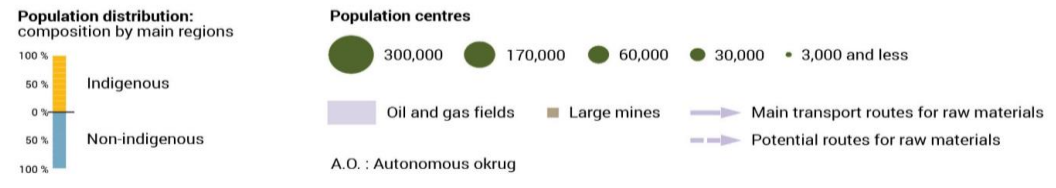
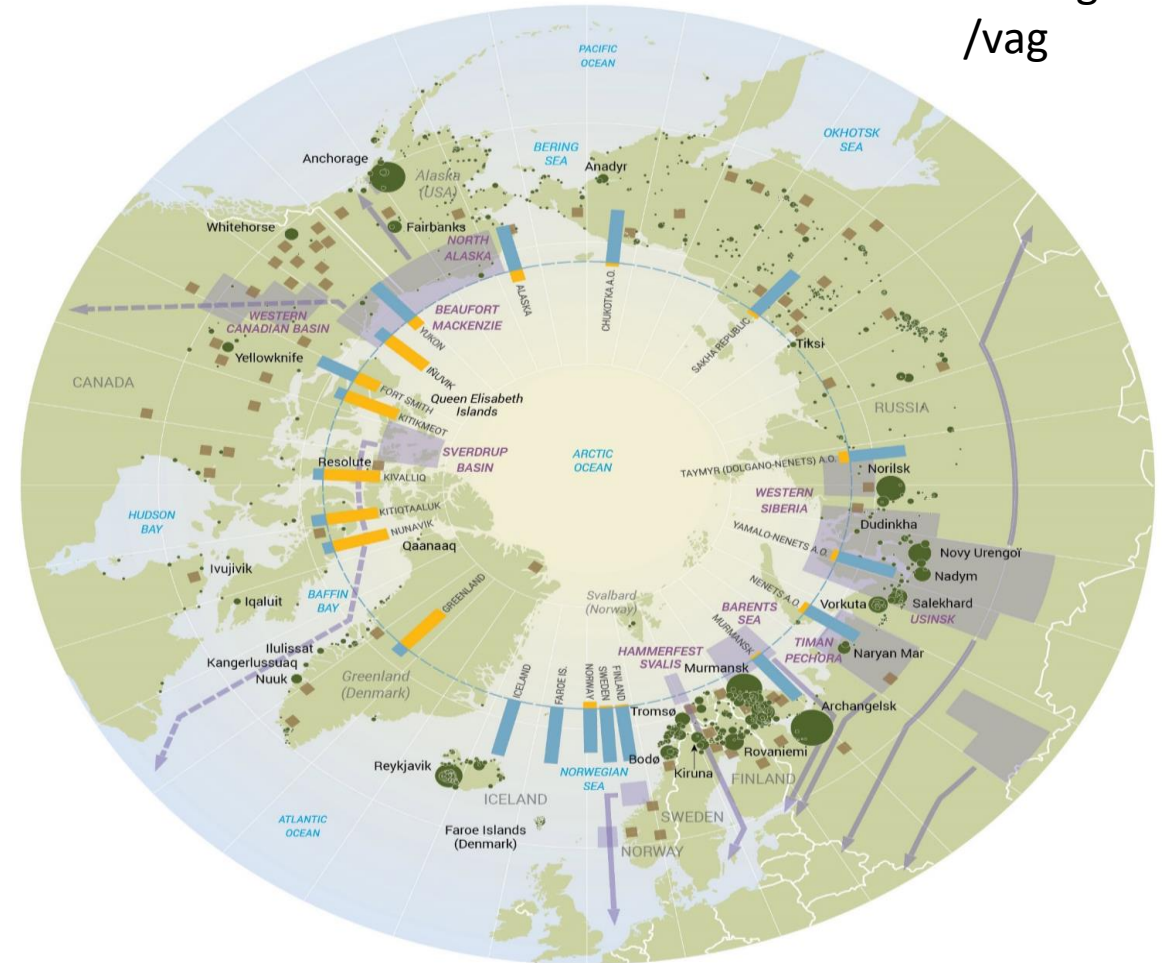
- Climate change
- Persistent organic pollutants (POPs)
- Radioactive waste

Arctic Regions and its concerns, threats and potential challenges PRETEAR report 2010

http://ec.europa.eu/echo/files/civil_protection/civil/prote/pdfdocs/pretear_final_report_en.pdf

Arctic population and development

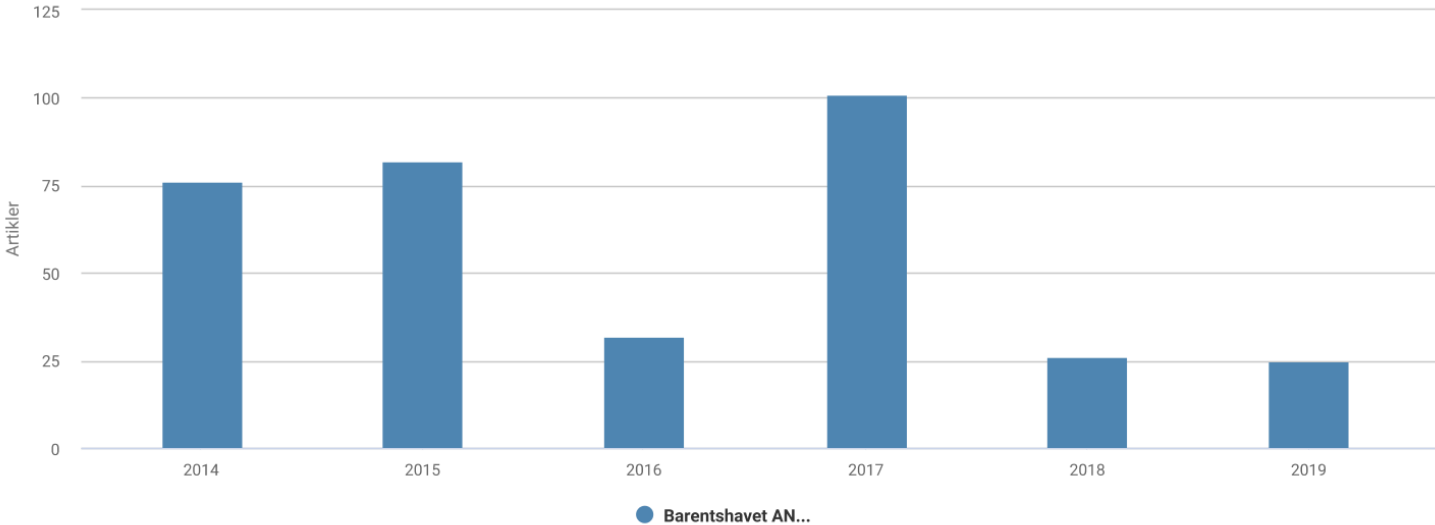
www.grida.no
/vag



User conflicts:

Examples from Barents Sea

Barentshavet AND olje AND konflikt



Når vi etter hvert blir mindre oljeavhengige – hvilke utfordringer må vi løse?

– Jeg skulle ønske vi kunne ha samme engasjementet i diskusjonen om hvordan vi kan øke arbeidstilbudet og legge til rette for effektivisering og økt lønnsomhet, som vi opplever i iveren etter å erstatte olje og gass med noe annet, sier Equinors sjeføkonom.

Equinor-søknad om å bore i Barentshavet må ut på ny høring

Selskapet vil bore brønnen Koryffell Deep som ligger tett på den russiske grensen og 500 kilometer fra Sjøerens.

Redusere forbruk av kjemikalier

Endringene i den nye søknaden består blant annet i størrelsen på plattformen, i tillegg til noen endringer i forbruk og utslipp av kjemikalier.

«Forbruk av vannstoff i oljebassent borevasker er redusert fra ca. 21 til 12 tonn, og utslipp av vannbaseret borevasker med stoffet av stoff i gul vaskeløsting er et redusert fra 32 tonn til ca. 12 tonn, når det er resultatet.

«Lettene etter olje og gass i Barentshavet pågår for fullt. Er det et økonomisk gjennomslag? Her oppstod en etat vi lever av som oljeselskaper ligger helt nær i Norge»

Seks spørsmål som gir deg full kontroll på egen økonomi – anbefaler alle å sjekke dette jevnlig

SYSLA | **OPPLASNING** | **Skole** | **Skole** | **Skole**

52.44 | 100% | 100% | 100% | 100% | 100%

Our business is growing and we need more people! To handle the increased business volume, we seek:

Ship Operator

HANSA TANKERS

Equinor

Equinor-søknad om å bore i Barentshavet må ut på ny høring

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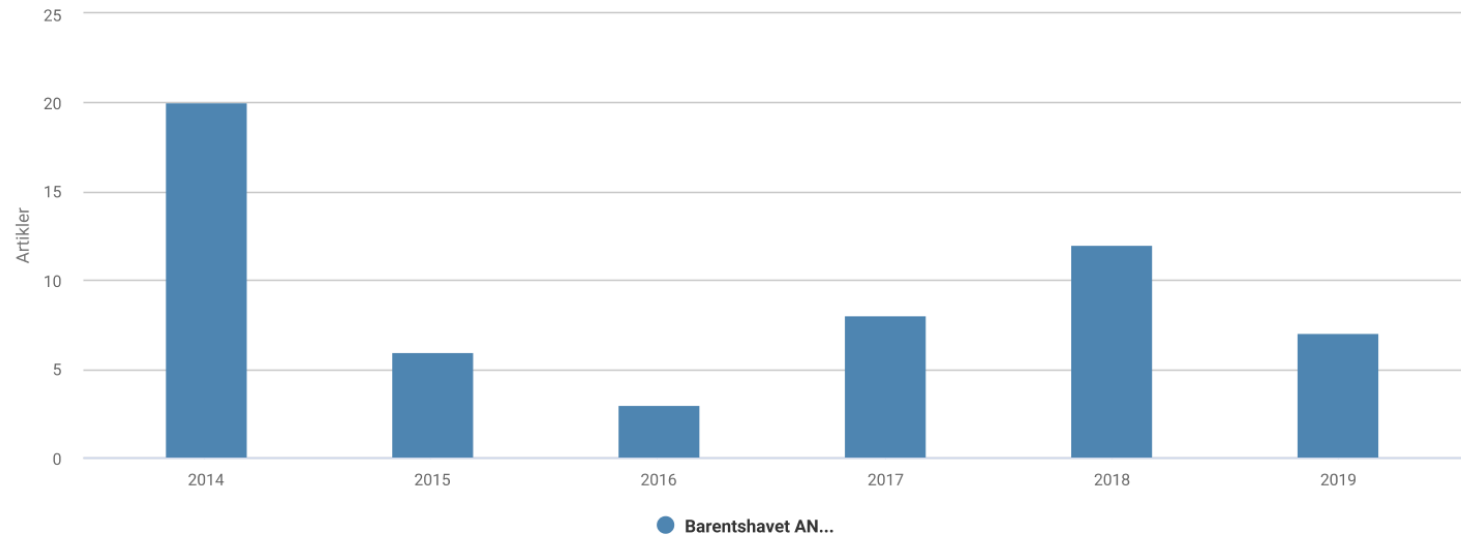
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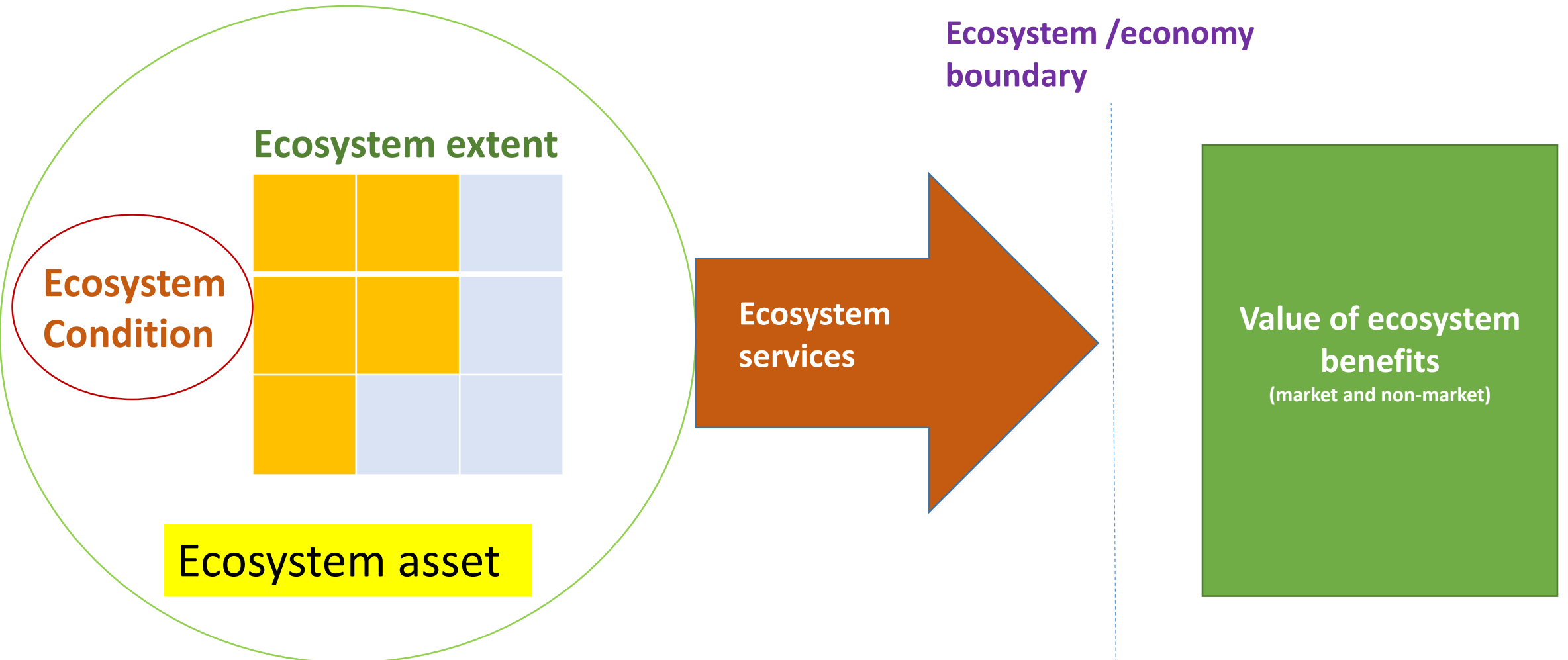
Examples from Barrents Sea

Barentshavet AND klimaendringer AND konflikt



Natural Capital and Ecosystem Accounting

An holistic approach for measuring ecosystem, ecosystem services and their benefits to economic and human activities **spatially** and **over time**.



Ecosystem Accounting and Marine Governance

(UN SEEA EEA Technical Recommendation 2017)

- Provide information on the **quantity** and **location** of the supply of wide range of **ecosystem services**, vital for monitoring and achieving sustainable use of ecosystem assets and preventing further loss of biodiversity.
- **Monitoring** status of ecosystem assets: not only physical indicators but also ecosystem assets values.
- Identify the ecosystem assets and ecosystem types and services that changing most significantly hence help to **determine the priorities** for policy interventions.
- By **addressing causes of changing** or degradation, relevant measures can be identified for focus area for effective policy responses.

SEEA Experimental Ecosystem Accounting:

Technical Recommendations

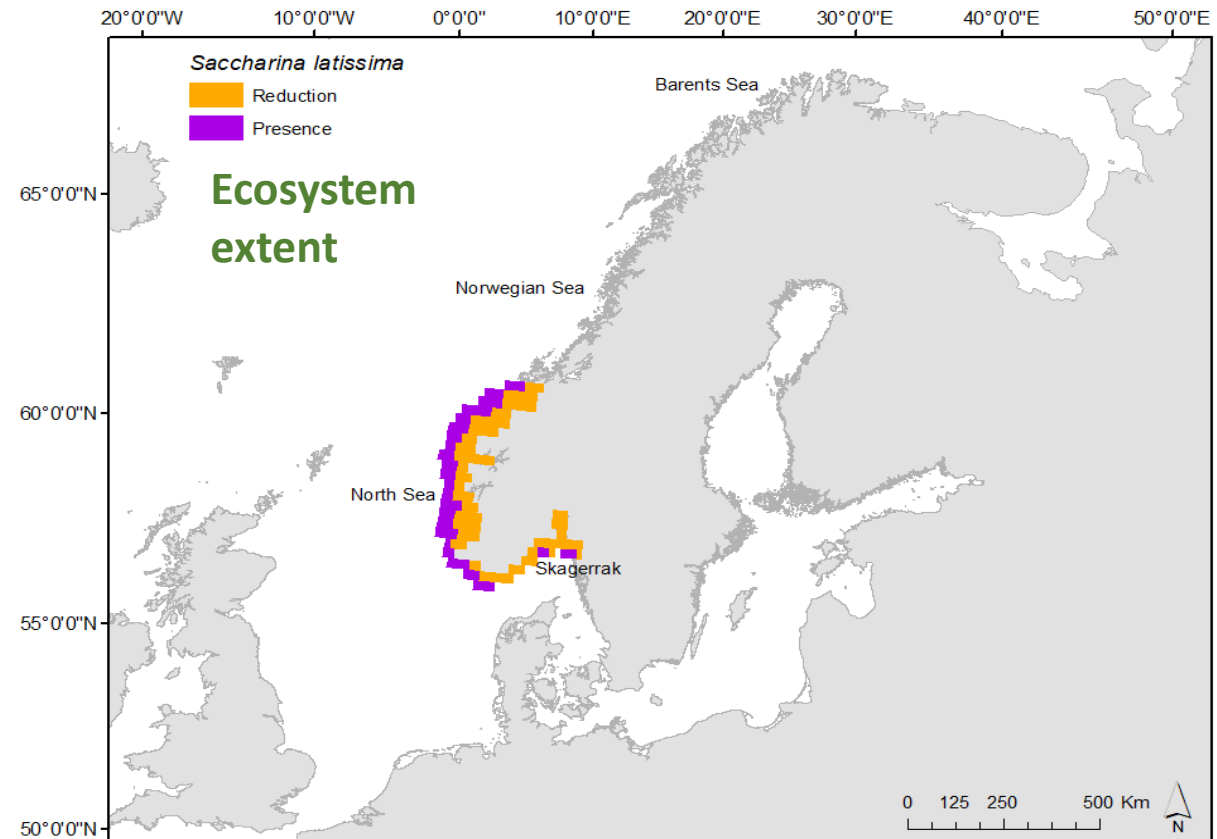
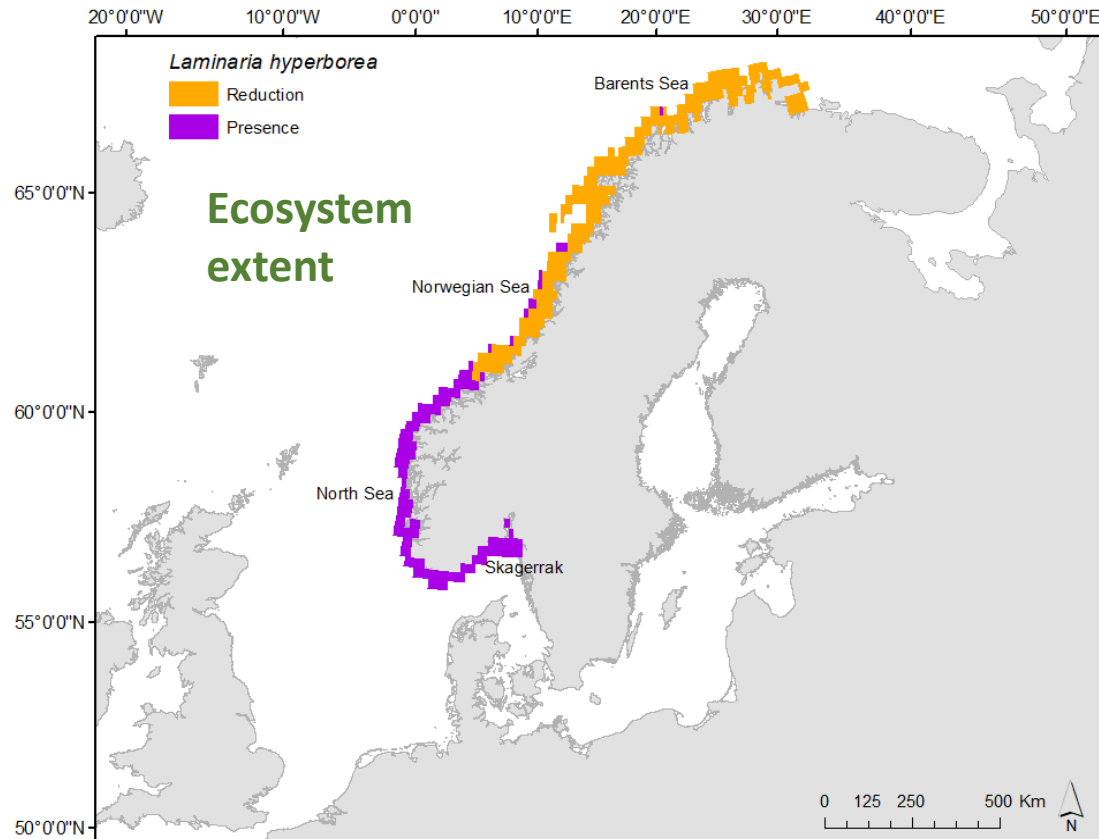
Final Draft

V3.2: 16 October 2017

Prepared as part of the joint UNEP / UNSD / CBD project on Advancing Natural Capital Accounting funded by NORAD

A case for Norwegian kelp forest

Chen et al. (2019) Ecosystem accounting's potential to support coastal and marine governance (under review)



- Full forest at 1970s
- Data available in 2010
 - Extent (monitoring data +GIS modelling)
 - Condition (Lacking → scenario analysis: 100% versus 50%)

Ecosystem accounting for Norwegian Kelp forest

Change in
- Extent
- Biomass

-Regulating
service
-Supporting
service
- Provisioning
service

- Carbon deficit
/ Social cost of
carbon
- Value of
supporting
services
- Value of
provisioning
service

Stressors

Measures

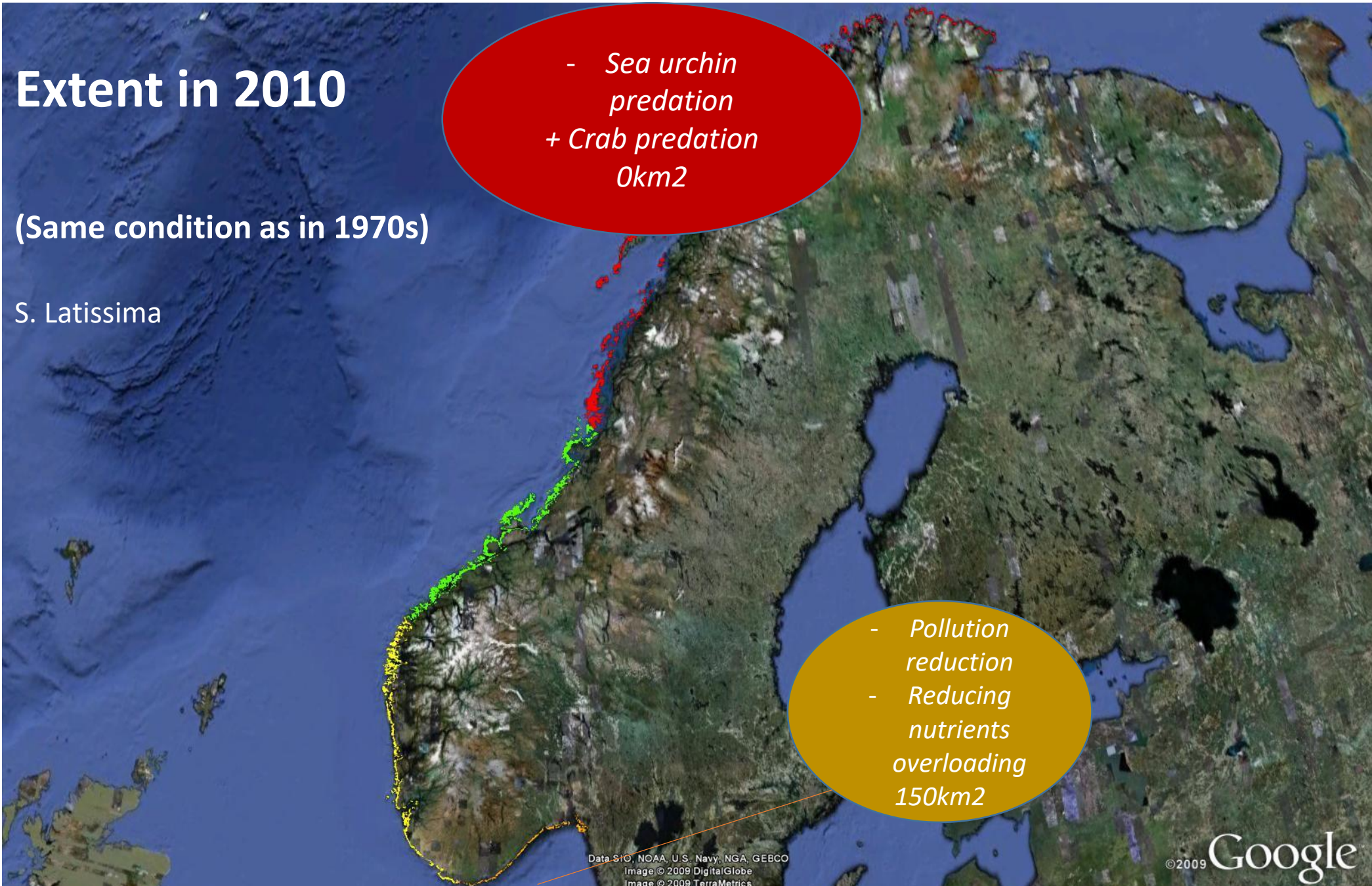
Extent in 2010

(Same condition as in 1970s)

S. Latissima

- Sea urchin predation
+ Crab predation
0km²

- Pollution reduction
- Reducing nutrients overloading
150km²



Change in extent/biomass

Social cost of carbon

Value of supporting services

Value of provisioning services

- Sea urchin predation + Crab predation -1094km²

Social cost of carbon	5326 million NOK
Supporting service	-101 billion NOK
Provisioning service	-74512 million NOK

S. Latissima

- Sea urchin predation + Crab predation -5445km²

Social cost of carbon	26502 mill NOK
Supporting service	-505 billion NOK
Provisioning service	--370855 million NOK

(same condition as in 1970s)

Way forward

- A tool to include both ecological impacts and social impacts of ecosystem change over time and space
- Identify management hotspots
- Experiment SEEA EEA studies for the Arctic
 - Study the effectiveness of MPAs
 - Support MSP/ICZP
- Make use of existing monitoring and socioeconomic data for example from coastal communities.

