Studies of marine ecosystems in the Barents Sea and off West Greenland

Presented by

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APPLYING OBSERVATIONS AND MODELS FOR ENVIRONMENTAL AND FISHERIES MANAGEMENT

Demonstrate how in situ observational and model data may be used to enhance the environmental and fisheries reporting and management systems of the Barents Sea and Disko Bay, western Greenland

INTAROS

APPLYING OBSERVATIONS AND MODELS FOR ENVIRONMENTAL AND FISHERIES MANAGEMENT

Main Achievements 1 – Barents Sea

Models used to evaluate impacts of climate and environmental change on local marine resources to support management decisions and stakeholder involvement

Successful Observing System Simulation Experiment (OSSE) for Barents Sea monitoring program carried out

NORWECOM.E2E simulations of fishing vessel «behaviour» during calanus finmarchcus zooplankton fishery attracted a lot of interest and media attention

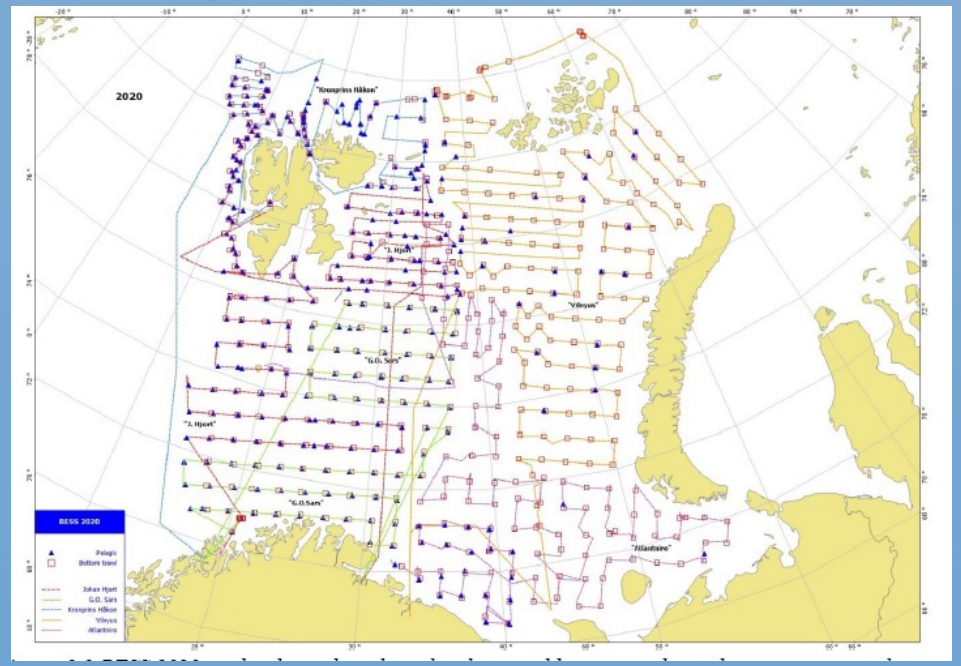
Monitoring: The Barents Sea ecosystem survey

Extensive ecological research cruise, annually August-October 2004-

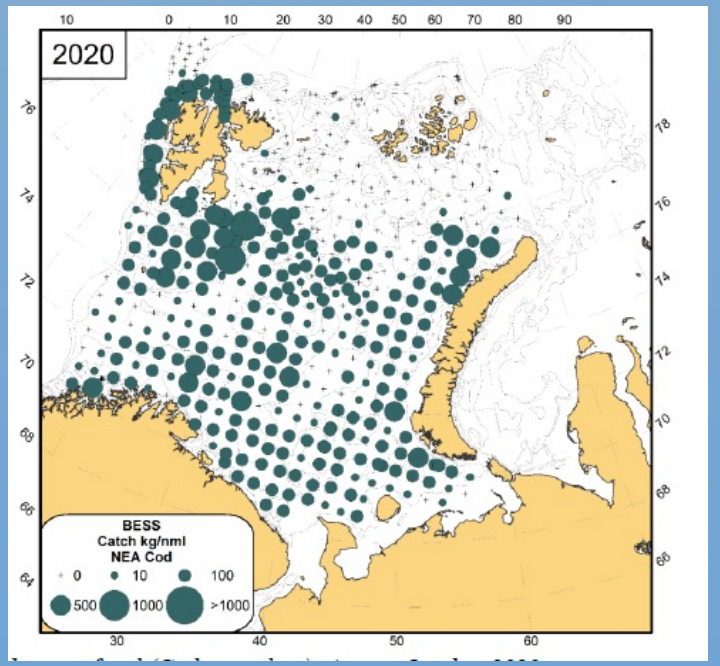
Physical and chemical oceanography, meteorology, plankton, fish, benthos, marine mammals, seabirds, litter and contamination

Expanding into the high Arctic with new ice-going vessel and less ice

Vessel tracks BESS 2020

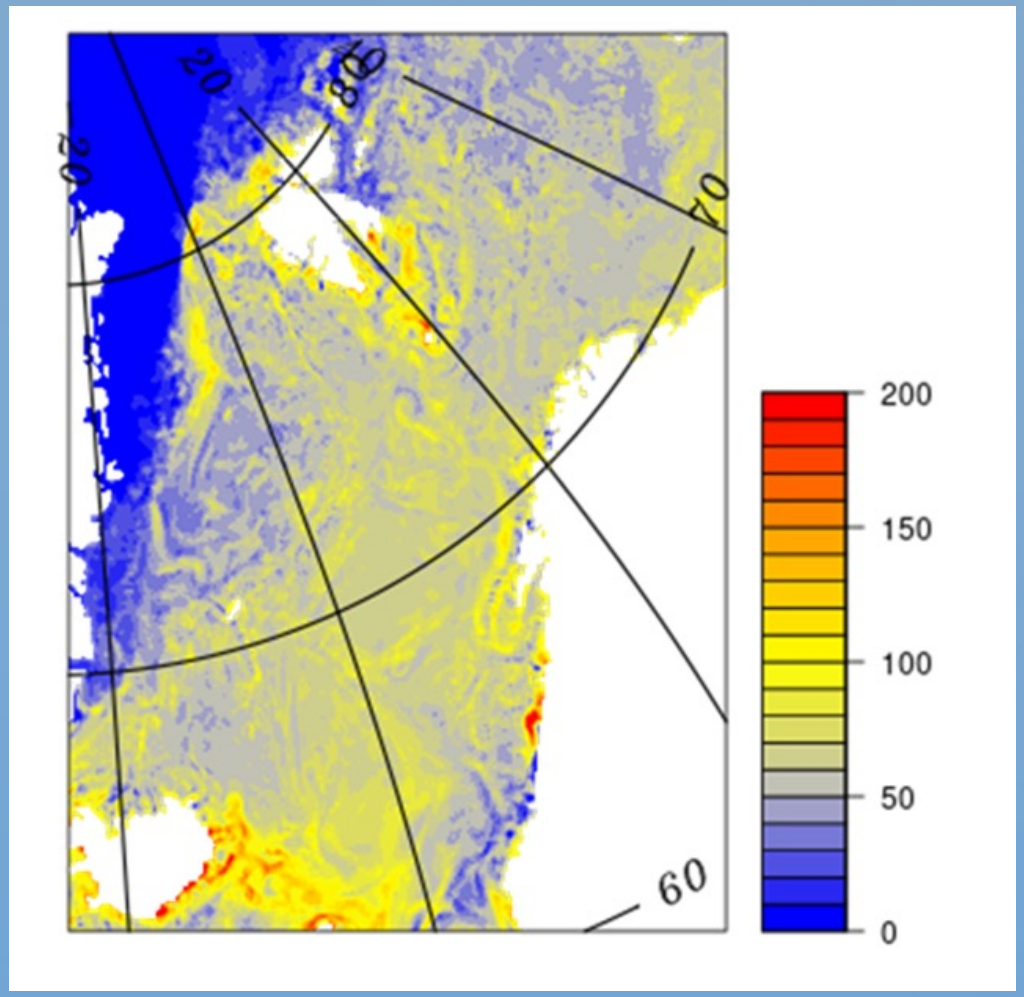


Cod distribution Aug-Oct 2020

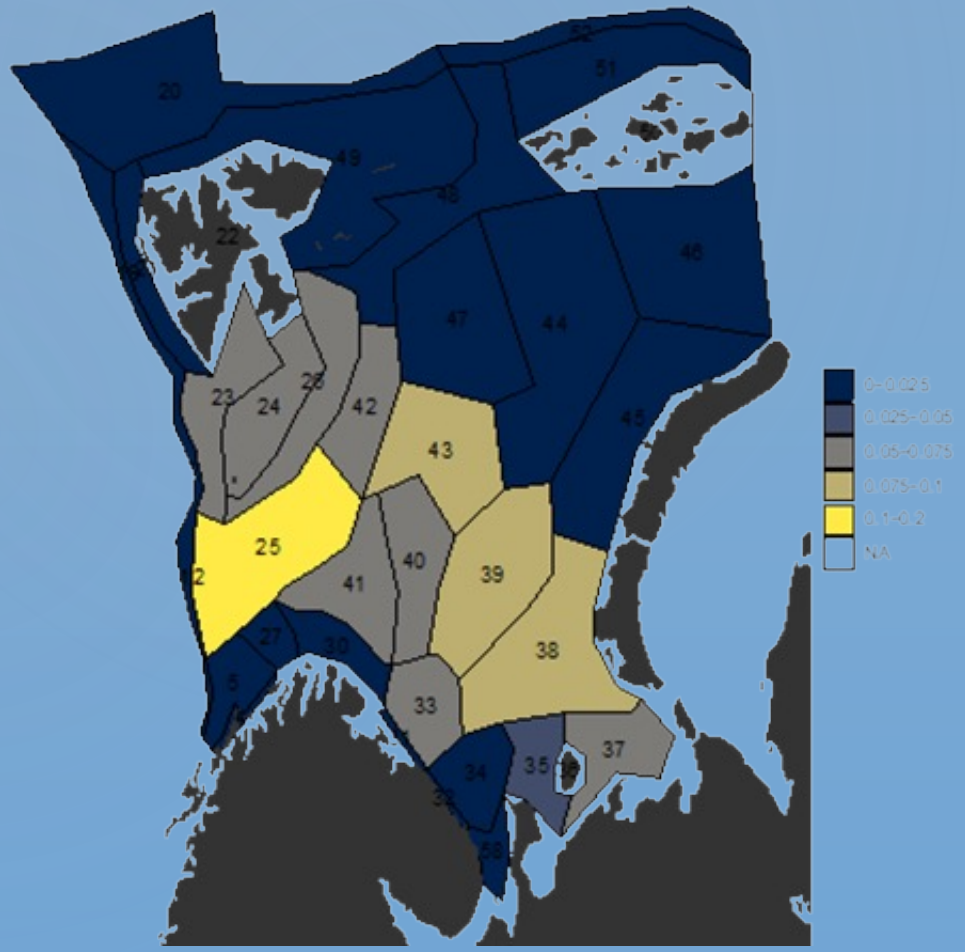


Examples of Barents Sea model products

NORWECOM.E2E
new primary production



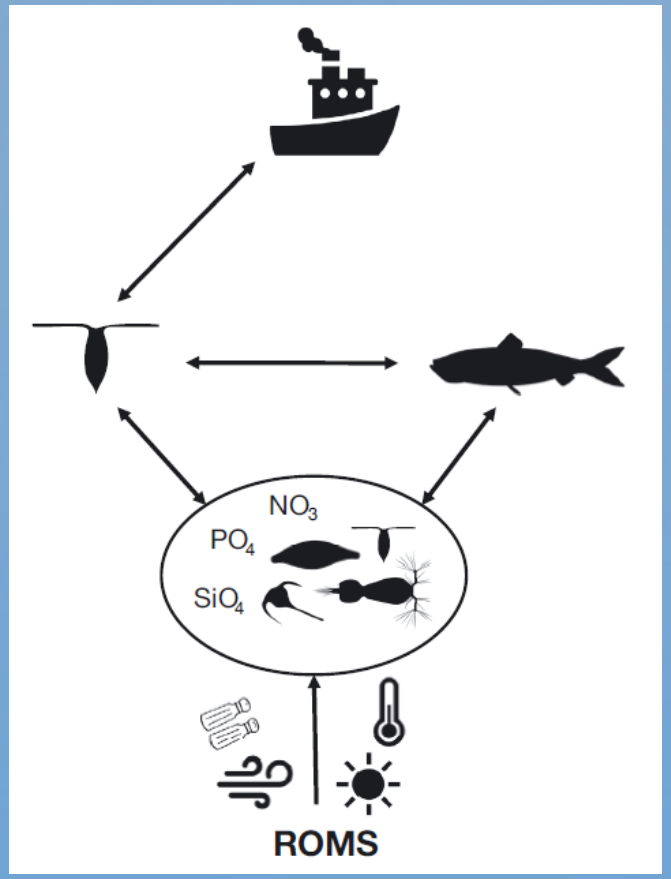
Atlantis:
cod biomass (winter) per polygon



Institute of Marine Research, Norway

Model simulations of zooplankton fishery

NORWCOM.E2E with IBM module and forcing from ROMS used to study difference in fishing patterns efficiency between ordinary fishing vessels and vessels with perfect knowledge of *Calanus finmarchicus* distribution



Hansen et al. 2021

Model simulations of zooplankton fishery

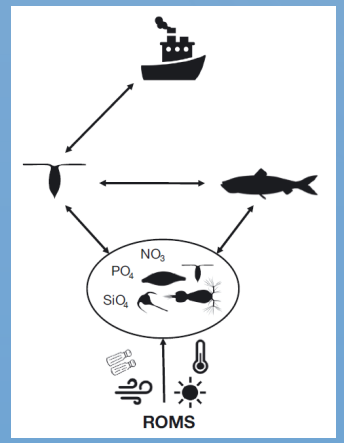
CONCLUSIONS

Calanus finmarchicus fisheries in the Norwegian Sea have potential for high yields

«Perfect vessels» have a more offshore pattern and much higher efficiency, indicating the challenges of today's real fishing vessels

Even ten «Perfect vessels» were not close to catching the quota

Results suggest potential for increased *Cal fin* fisheries still being sustainable



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Main Achievements 2

A coupled hydrodynamic and biogeochemical model was set up for Disko Bay, W Greenland, using the FlexSem model system

Analyses of impact of climate variability on Greenland fish distributions indicates positive effects on fish community, including range expansion, of reduced sea ice

Good involvement and interaction with stakeholders from fisheries, maritime, and petroleum management and industry, and especially environmental management, both in Norway and on Greenland

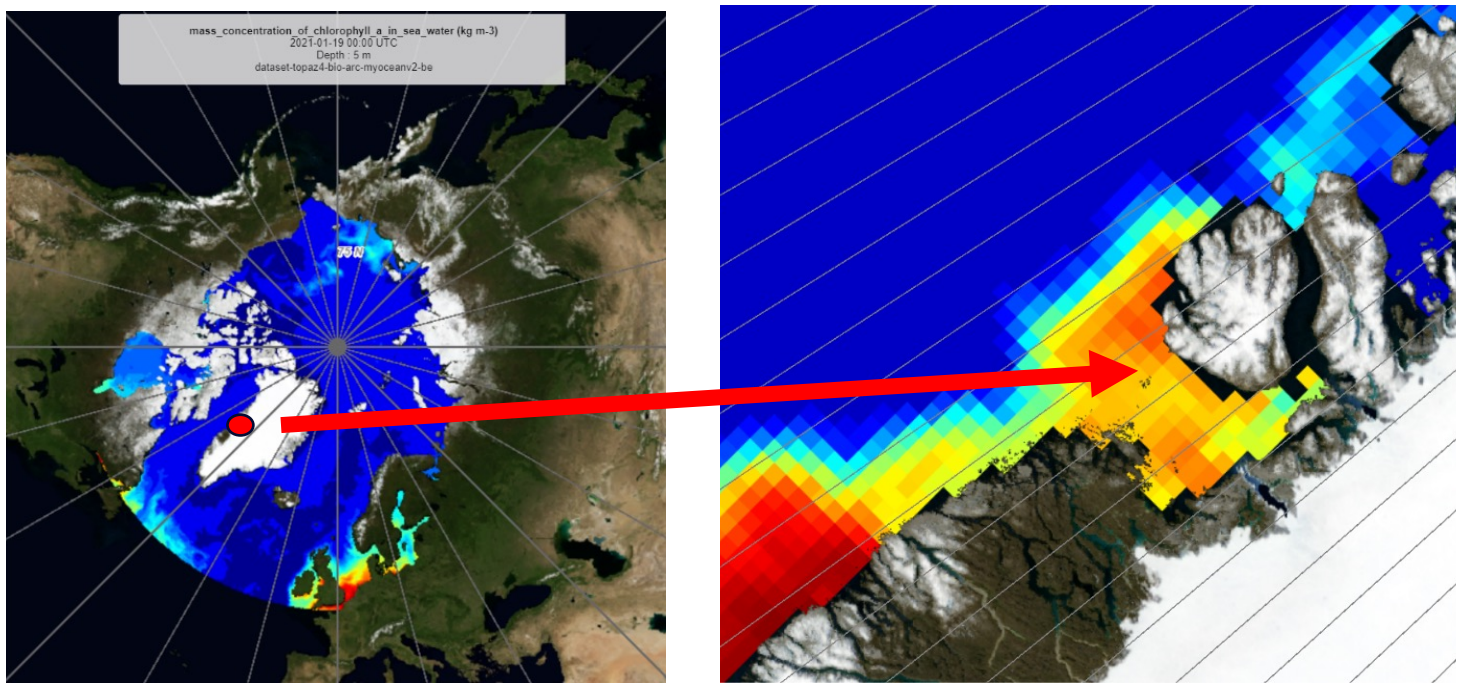
ECOSYSTEM MODEL FOR DISKO BAY(FlexSem-ERGOM)

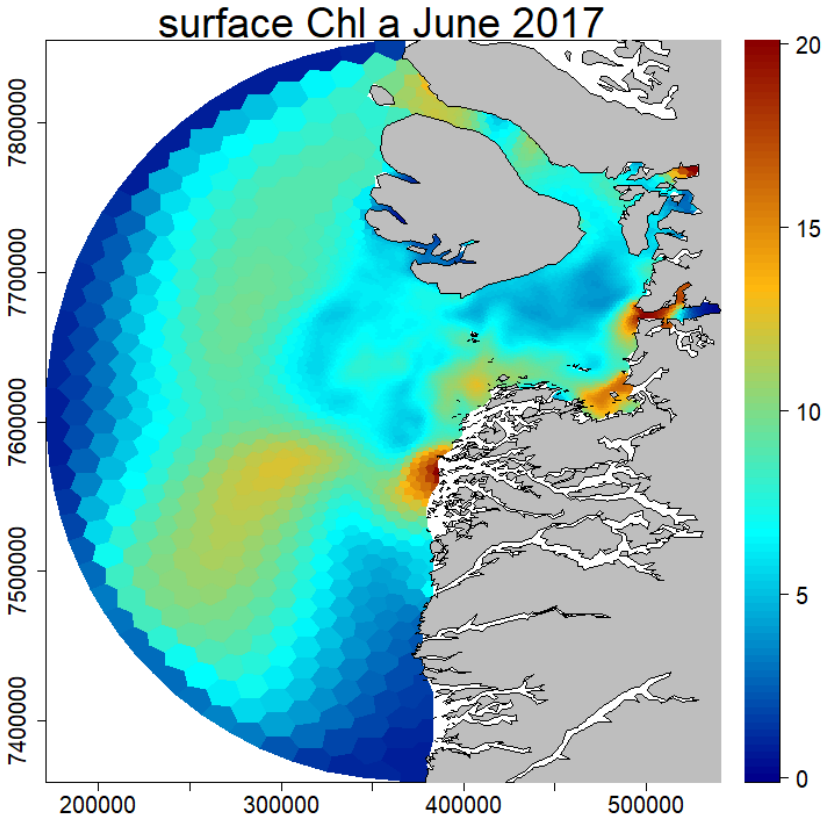
Copernicus topaz4
large-scale model (12.5 km)

Down-scaling

Local fine-scale model

Near-surface Chl *a*





Aarhus University, DTU, GINR, Denmark

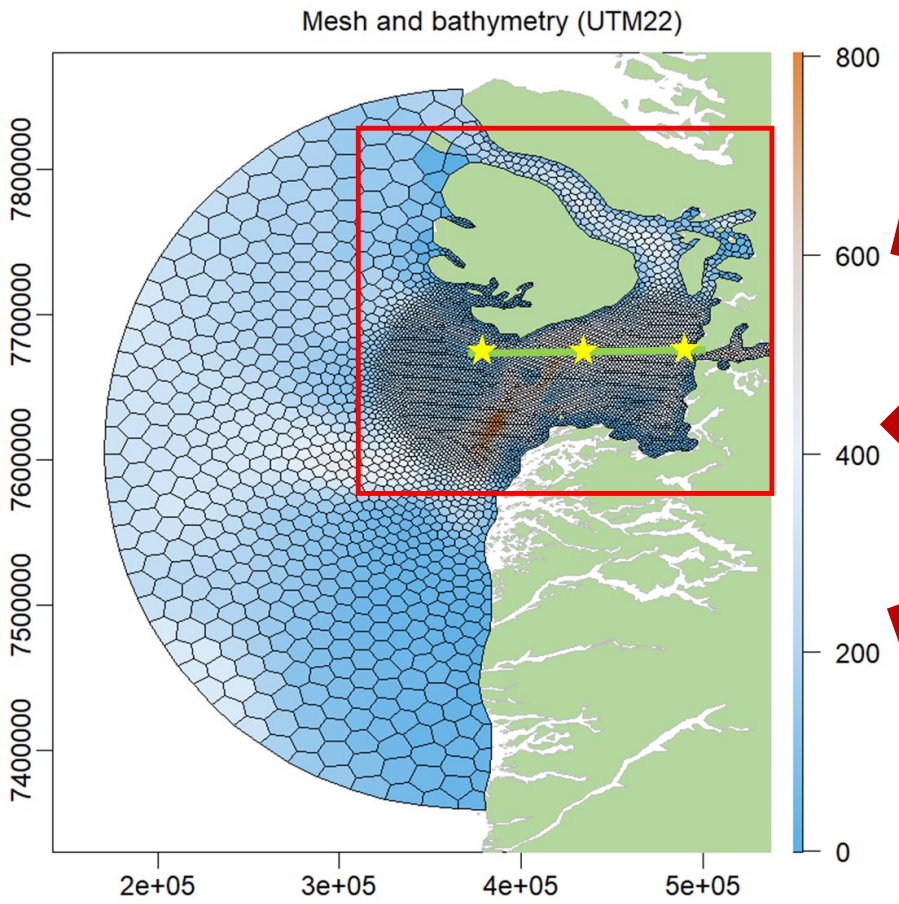
ECOSYSTEM MODEL FOR DISKO BAY(FlexSem-ERGOM)

Integrates and utilizes a broad range of model output and observations

Sea ice model (CICE, DMI)

Large scale hydrodynamic ocean model (HYCOM, DMI)

Large scale ecosystem model (ERSEM, NIVA)



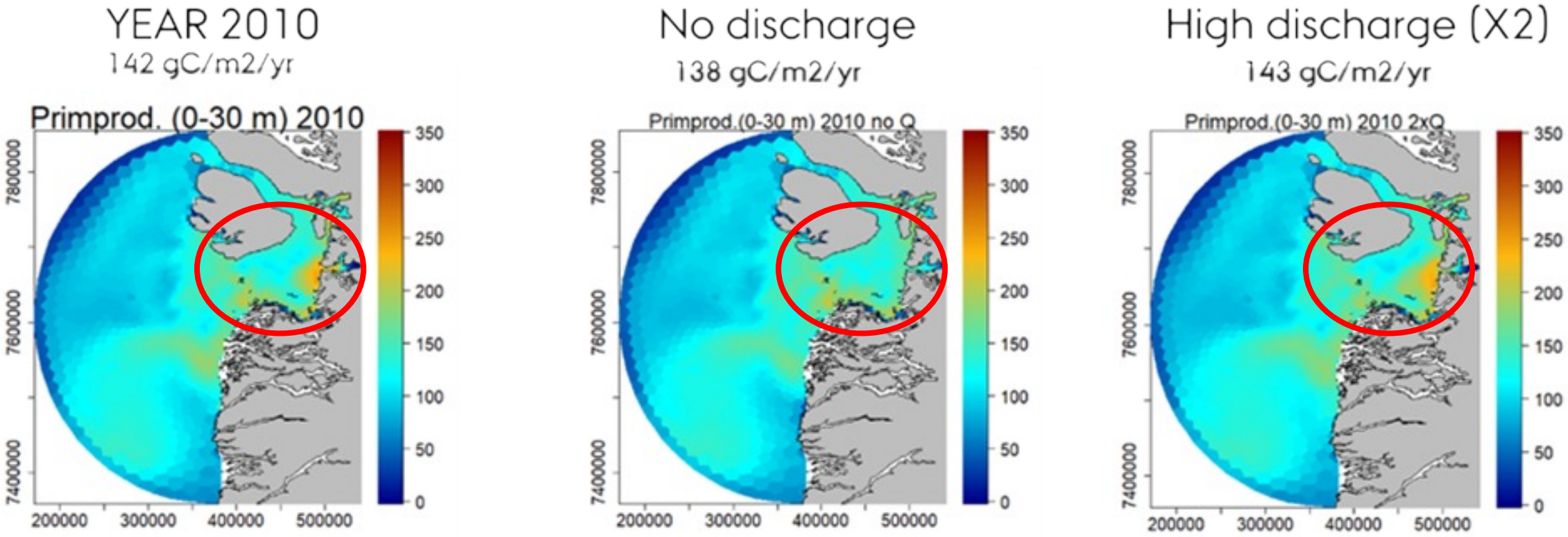
Greenland IS discharge (PROMICE, GEUS)

Satellite data assimilation (DTU)

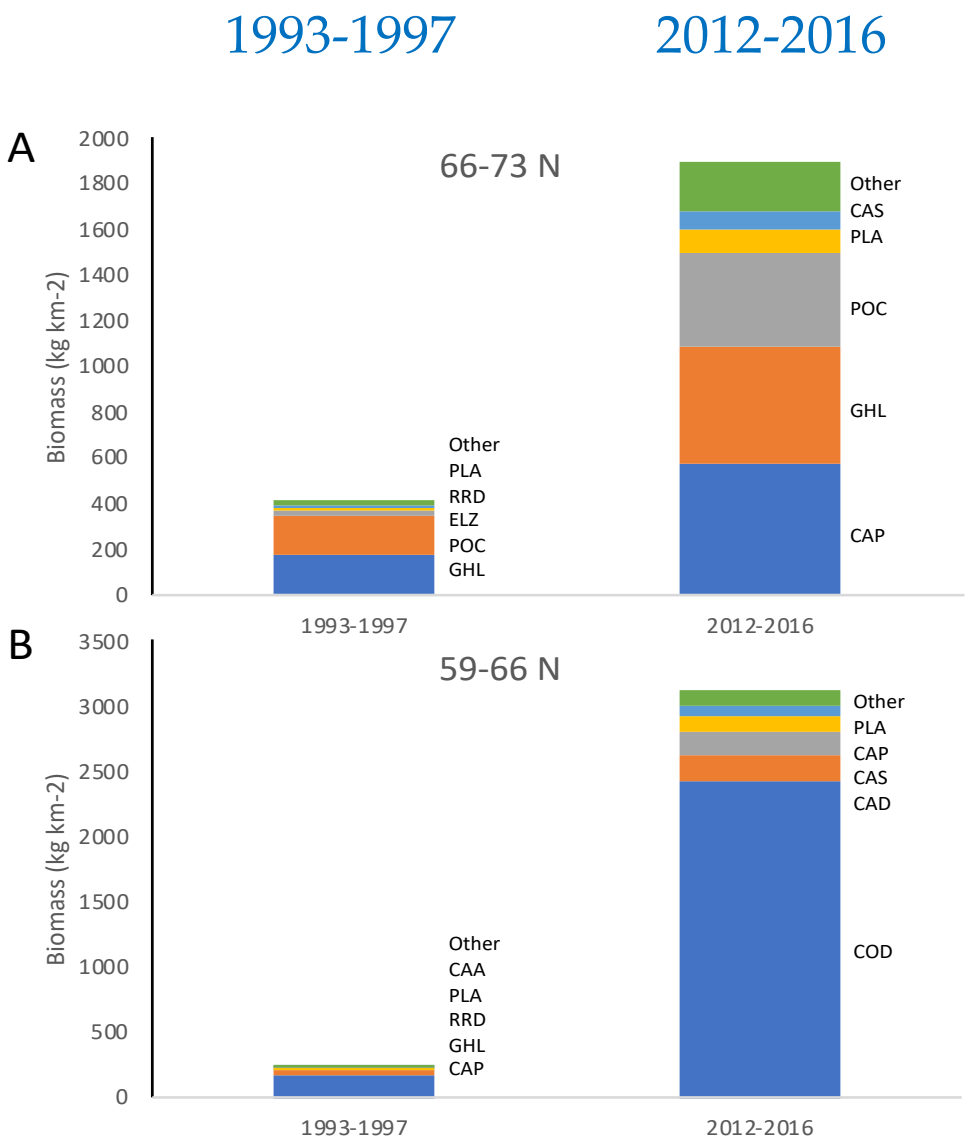
In situ data integration (Greenland monitoring program, AU)

ECOSYSTEM MODEL FOR DISKO BAY(FlexSem-ERGOM)

EXAMPLE OF RESULTS: Modelled annual primary production (0-30 m) for Disko Bay and the surrounding area for year 2010 (left), with no freshwater discharge (mid) and double freshwater discharge (right).



Changes in summer demersal fish biomass on the SW Greenland Shelf



Extensive changes in the fish community: Increase in biomass, average individual weight and trophic level, and alterations in species composition.

Range expansion of most species

Mechanism: climate change driven melt of sea ice and Greenland ice sheet, increasing the productivity of the coastal ocean

APPLYING OBSERVATIONS AND MODELS FOR ENVIRONMENTAL AND FISHERIES MANAGEMENT

Recommendations:

Long-term monitoring of key variables must continue

OSSEs should be made integrated part of management plan work

Evaluation of indicators should be expanded to an Arctic international setting

Indicators based on more complex set of time series should be used to better monitor a broader range of human pressures

Support, contribute to and use results from new Greenland GIOS program

Establish new NAFO/ICES working group on the west Greenland-Canadian system

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THANKS FOR YOUR ATTENTION!

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