

Project information

Project title

AVEC - Assessment of ecosystem Vulnerability and functioning of Coastal fish

Year

2020

Project leader

Ulf Lindstrøm, Raul Primicerio

Geographical localization of the research project in decimal degrees (max 5 per project, ex. 70,662°N and 23,707°E)

62°N – 71°30N and 11°E – 31°38E

Participants

PL: Ulf Lindstrøm (IMR), Raul Primicerio (UiT)

Participants: Øystein Varpe (NINA), Magnus Aune (Akvaplan-NIVA), Pål-Arne Bjørn (IMR), Erik Berg (IMR), Jofrid Skardhamar (IMR), Lis Jørgensen (IMR), Henning Steen (IMR)

Flagship

Fjord and Coast

Funding Source

Fjord & Coast flagship

NRC project CoastRisk

Summary of Results

This project contributes to the integrated assessment of climate change impact on coastal ecosystems in northern Norway. We address the combined impact and risk associated with climate change, fishery and aquaculture on state of fish communities and on ecosystem functioning empirically, assessing variation and change in vulnerability, by integrating fish community analyses, trait-based methods and food web analyses. Project AVEC works in close collaboration with NRC projects BarentsRisk, SalCod, CoastRisk and Fram MIKON project ESCE.

In 2020, the main activities have been to compile and quality check fish community data from the coastal ecosystem survey (IMR), functional traits and feeding links. Further, environmental data (e.g. depth, temperature, salinity, chlorophyll) were compiled from field measurements and oceanographic modelling outcomes, and data on human activities were explored and evaluated in collaboration with MIKON project ESCE and NRC project CoastRisk. In addition to exploratory data analyses, the main research focus in 2020 was on climate effects on the structure of fish communities. Structural and gradient analyses revealed extensive spatial variation in fish community composition and structure along the Norwegian coast, with indications of spatio-temporal change concurrent with warming.

Highlights:

- Substantial water temperature increases during the study period 1995-2019 along coast of Norway (Fig. 1).
- Strong spatial gradients in fish community structure and diversity (Figs. 2 and 3).
- Temporal change in fish community spatial patterns.

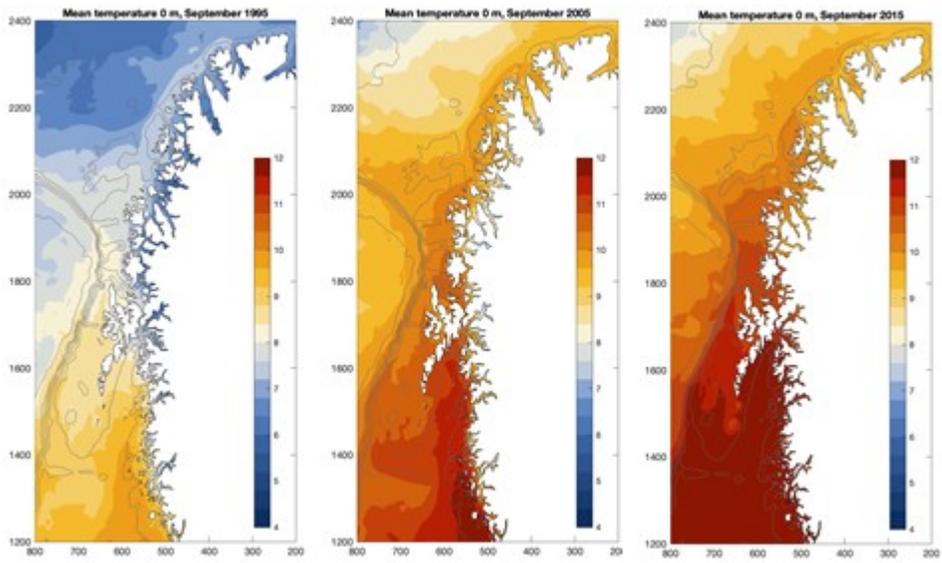


Figure 1. Temporal changes in SST along the Norwegian coast

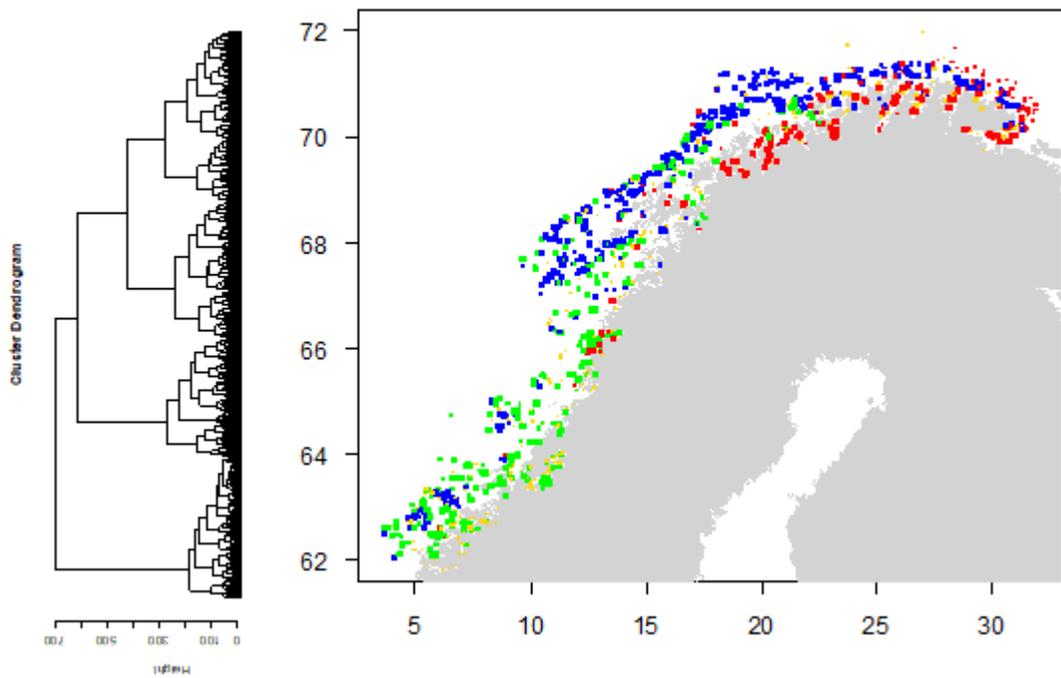


Figure 2. Spatial variation in fish community structure along the Norwegian coast as obtained via hierarchical clustering (color code for cluster affiliation).

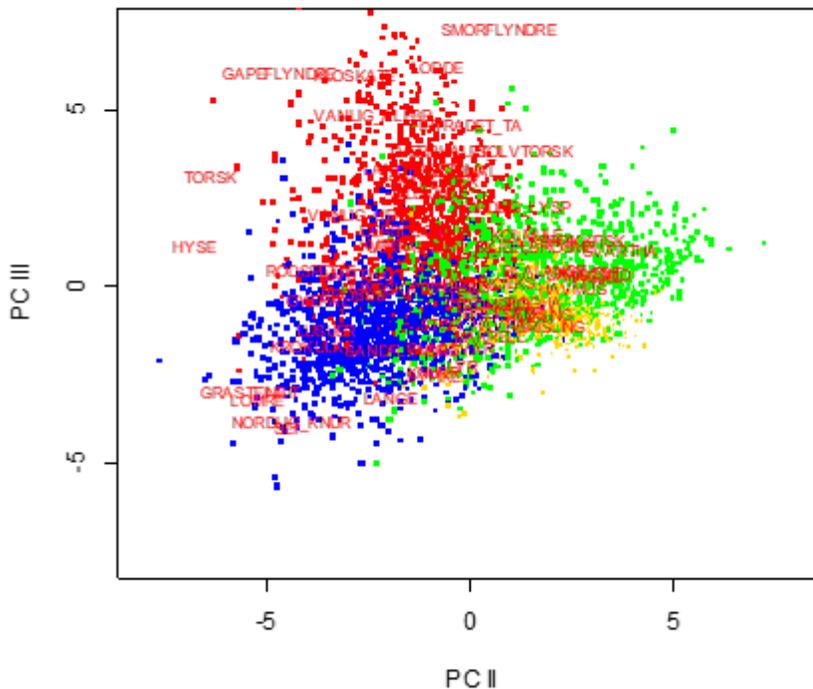


Figure 3. Biplot of principal component analysis (PCA) results for fish community structure along the Norwegian coast (color code for cluster affiliation as in Fig. 2).

Master and PhD-students involved in the project

As part of the training activities in AVEC, two former UiT master students (Mathea Born, Amalia Keck) were involved in the research activity.

For the Management

AVEC found extensive spatio-temporal variation in coastal fish communities, relevant for fishery and aquaculture management. The variation in fish communities is associated with functional and trophic variability with implications for ecosystem functioning and vulnerability. The findings are relevant for areal management and spatial planning.

Published Results/Planned Publications

- Bøhn T, Gjelland KØ, Serra-Llinares RM, Finstad B, **Primicerio R**, Nilsen R, Karlsen Ø, Sandvik AD, Skilbrei OT, Elvik KMS, Skaala Ø, **Bjørn PA**. 2020. Timing is everything: Survival of Atlantic salmon *Salmo salar* postsmolts during events of high salmon lice densities. *Journal of Applied Ecology* doi: 10.1111/1365-2664.13612
- Pecuchet L, Blanchet M-A, Frainer A, Husson B, **Jørgensen LL**, Kortsch S, **Primicerio R**. 2020. Novel feeding interactions amplify the impact of species redistribution on an Arctic food web. *Global Change Biology* doi: 10.1111/gcb.15196

Planned publications are related to:

- - Changing fish communities in northern coastal areas

- - Functional characterization of fish communities along a latitudinal gradient in coastal areas in northern Norway.
- - Functional diversity and vulnerability of coastal ecosystems
- - Impact of human activities on high latitude coastal ecosystems

Communicated Results

Workshops:

- AVEC workshop – May 2020
- SalCod workshop, Tromsø - October 2020
- CoastRisk meeting, videoconference - November 2020

Outreach:

- Primicerio R *Conservation and management of Arctic ecosystems under climate warming* Arctic PhD Research School U Venice, Italy
- Primicerio R *Arctic ecosystems and global environmental change* U Parma, Italy

Conference oral presentations:

Primicerio R and U Lindstrøm *Climate change and coastal fish communities AVEC - Fram Fjord & Coast annual meeting – October 2020*

Interdisciplinary Cooperation

Through the project CoastRisk, AVEC is in dialogue with relevant stakeholders and contributes to the communication between governance, management and ecosystem science, providing insights into the socio-ecological processes affected by climate change and informing advice for climate adaptation in fisheries and aquaculture.

Budget in accordance to results

The primary funding source for AVEC is FRAM center, flagship Fjord and Coast. The funding was essential to support data acquisition, analyses and communication of results on climate effects and integrated ecosystem assessment in coastal areas. The funding has also contributed to method development within integrated ecosystem assessment that integrates traits and food web approaches. The project findings will inform ecosystem-based management of coastal areas and climate adaptation of fishery and aquaculture.

Could results from the project be subject for any commercial utilization

No

Conclusions

- The AVEC preliminary findings suggest climatic effects on spatio-temporal variability in fish community composition and diversity across spatial scales. The findings invite in-depth mechanistic studies of climate induced distributional shifts and community re-organization.
- The documented changes are likely to have consequences for the functioning and vulnerability of the system since they species differing in functional traits, trophic characteristics and food-web role. These ecosystem implications will be investigated.
- The re-organization of coastal communities will affect fisheries and the impact of aquaculture and are thereby relevant for management of coastal resources and areal planning. Implications for management will be addressed in collaboration with projects SalCod, CoastRisk and ESCE.
- New integrated quantitative analyses of traits and food-web data are being developed in the context of AVEC and related

projects.