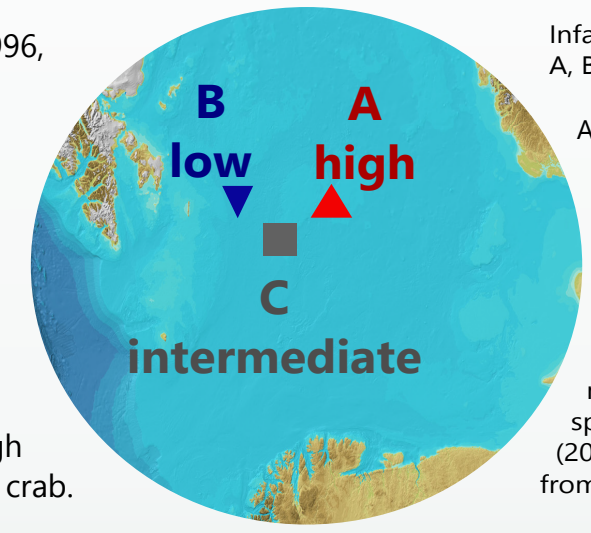
Structural and functional effects of the invasive snow crab on benthic ecosystems in the Barents Sea

Helena Kling Michelsen1, Sabine Cochrane2, Gunhild Borgersen1, Eivind Oug1, Rosalyn Fredriksen[2], Paul E. Renaud[2], Marta Coll[3]

Background and objectives

Since its appearence in the eastern Barents Sea in 1996, the invasive snow crab (*Chionoecetes opilio*) has increased and spread toward the west. The species is a generalist predator feeding on benthic epi- and infauna. As the population continues to spread, they can have direct and indirect effects on benthic ecosystems in the Barents Sea. It is thus crucial to investigate changes in the benthic community structure and function. In this study we compare the structure and function of epi- and infauna at three locations in the Barents Sea with high (A), intermediate (C) and low (B) abundance of snow crab.

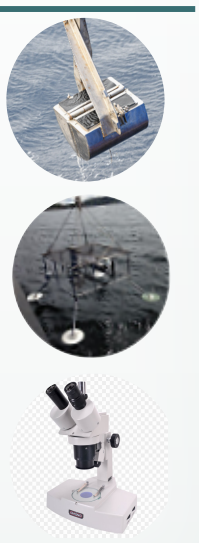


Methods

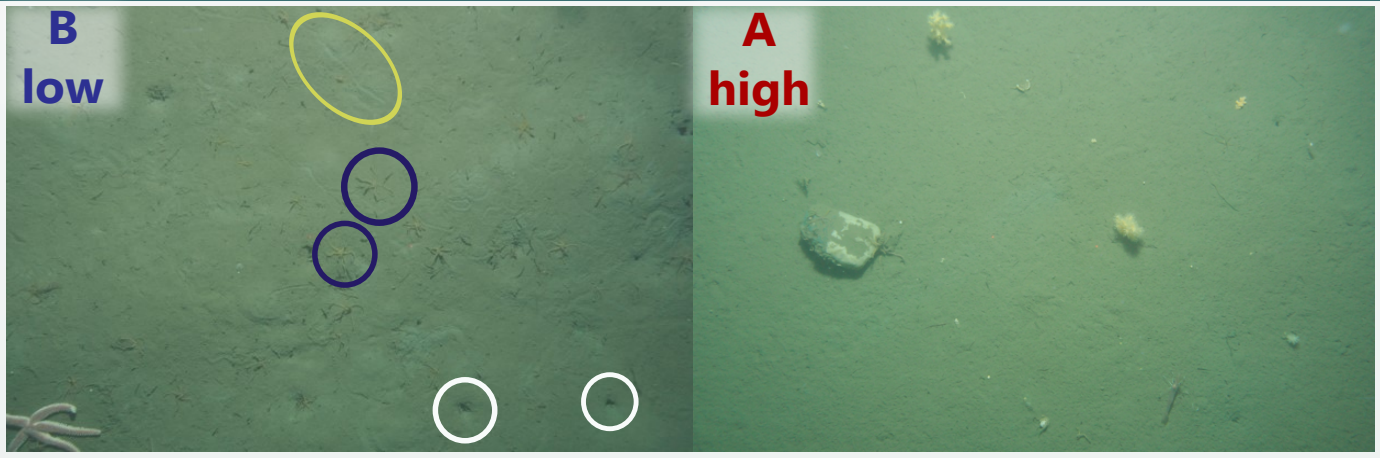
Infauna was sampled by 8 van Veen grabs at location A, B and 10 grabs at location C.

A "yo-yo" camera was used to photograph epifauna along transects of the seafloor at locations A and B. Three transects of 40 images were carried out at both locations.

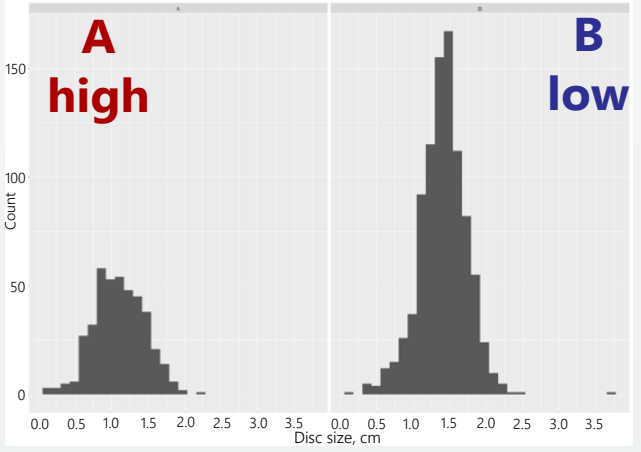
Taxa in photos and grab samples were identified to the lowest taxonomic level and counted while brittle star discs were measured. Trait scores were assigned for 137 species comprising 15 traits with 70 categories (20 presented here). Traits data were assembled from literature or extracted from trait databases.



Visible changes in epifaunal structure and size

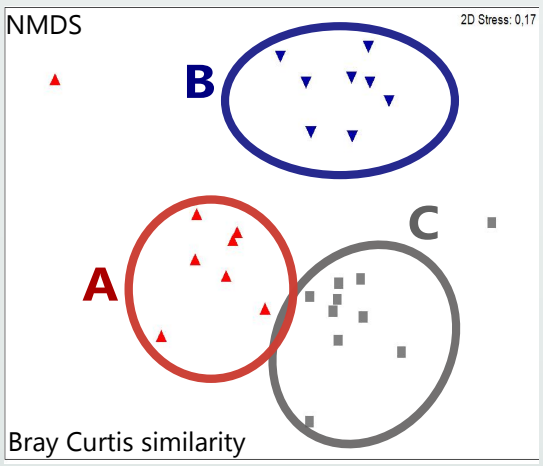


At location B there were signs of bioturbation: visible holes in the sediment (white circles), patches of light coloured clay on the surface and various tracks (yellow oval) while location A had little sign of bioturbation. Brittle stars were more abundant at location B (blue circles) while there was a tendency for a lower number of visible prey at location A.



There was overall fewer brittle star individuals across a majority of size classes at location A.

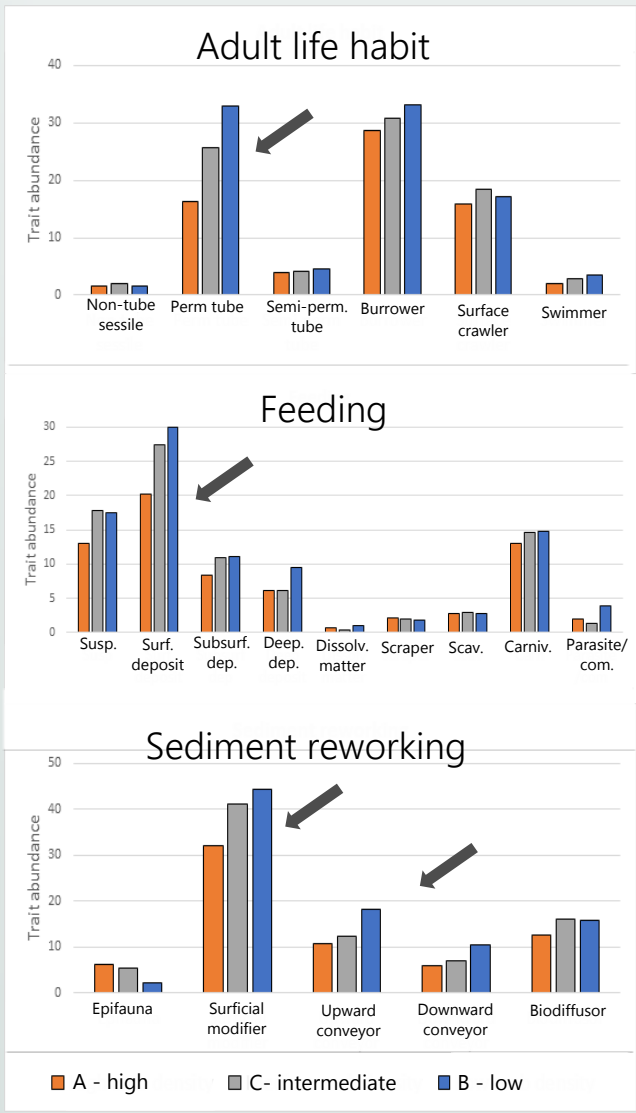
Infaunal changes due to predation



There was variability in community at each location. ANOSIM also indicated a significant difference between location B and A (R = 0.787, 0.1 % significance level).

Mean number of taxa and abundance was lower at location A (38 ± 7 and 286 ± 79 ind/0.1 m^2) compared to location B (50 ± 7 and 258 ± 96 ind/0.1 m^2).

Decrease in sediment reworking taxa



Due to lower abundances at location A there was a general decline in most traits, but some were more striking:

The abundance of permanent tube building organisms at location A was half that of location B.

A decline in deposit feeders, surface feeders in particular, but also suspension feeders was observed at location A.

A reduction in surface modifiers and important upward/downward conveyors of sediments was seen at location A.

It appears that snow crabs are removing taxa that are important for sediment activity and functioning of soft bottom ecosystems.

Conclusions and further work

At the location with a high crab abundance there was a change in benthic community composition and functioning and a decrease in number of taxa, abundance and visible bioturbation as well as the size of some prey (e.g. ophiuroids).

These findings suggest that high densities of invasive snow crab can restructure the benthic community and cause a degraded sedimentary environment due to the removal of organisms important for sediment biomixing and bioirrigation in the Barents Sea.

To further investigate the food web effects of snow crab on a temporal and spatial scale, an Ecopath with Ecosim food web model of the Barents Sea is currently being built and run.

[1]Niva, Gaustadalléen 21, 0349 Oslo; Jon Lilletuns vei 3, 4879 Grimstad; Fram Centre, 9296 Tromsø,
[2]Akvaplan-niva, Fram Centre, 9296 Tromsø,
[3]Institut de Ciències del Mar (ICM-CSIC), Passeig Marítim de la Barceloneta, nr 37-49, 08003 Barcelona, Spain
Contact: helena.michelsen@niva.no

Norwegian Institute for Water Research

Photos: Christian Skauge
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