

# Effects of multiple stressors on the benthic ecosystem in the Barents Sea



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EA International Conference, Fairbanks 2016  
Session III: Making EA operational  
24 Aug. at 10:50

# Join Annual Russian-Norwegian monitoring of the Barents Sea



Pictures: Vitaliy Syomin

50°W

40°W 20°W

90°E 110°E

120°E

80°N



Johan Hjort

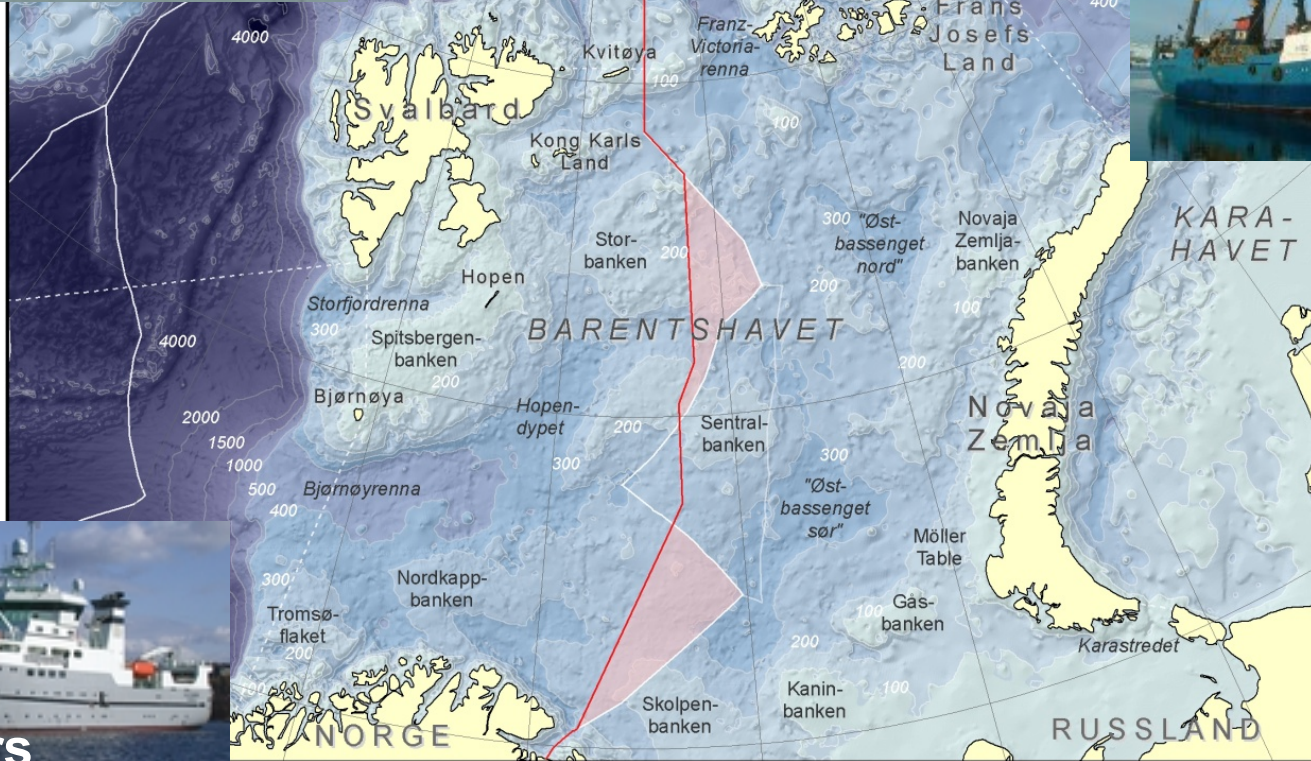


Helmar Hanssen



Vilnius

75°N



75°N

70°N



G.O.Sars

10°E

20°E

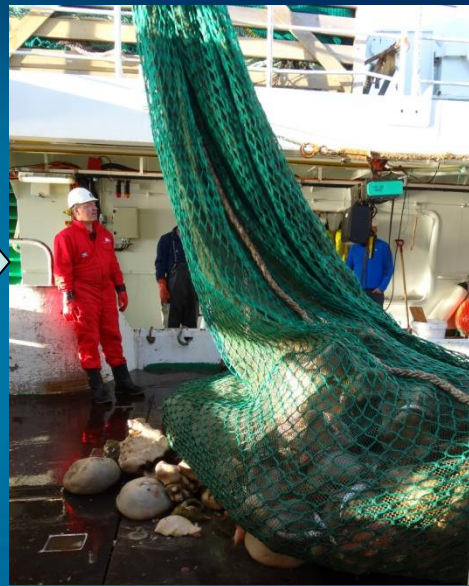
30°E

40°E

50°E

60°E

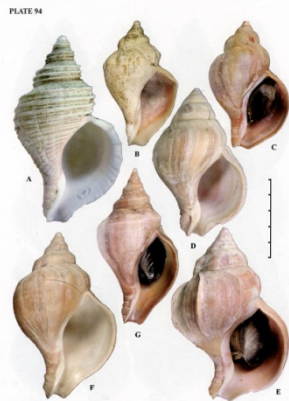
# Time and resource efficient



Standardized knowledge



PINRO-IMR  
database (2007)  
S2D database  
(2014)



Same literature

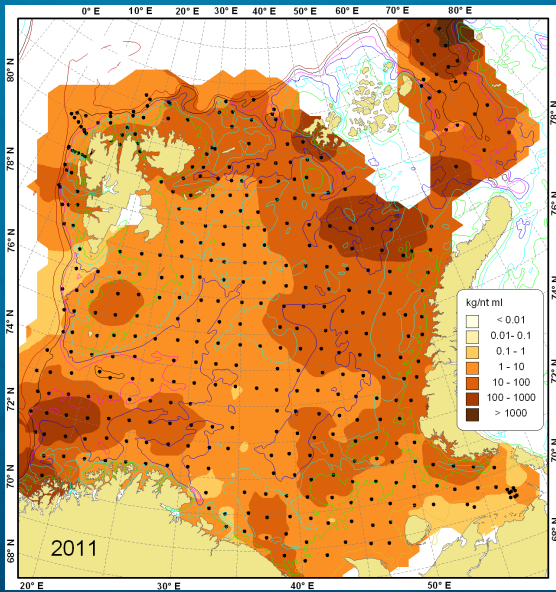


# Results

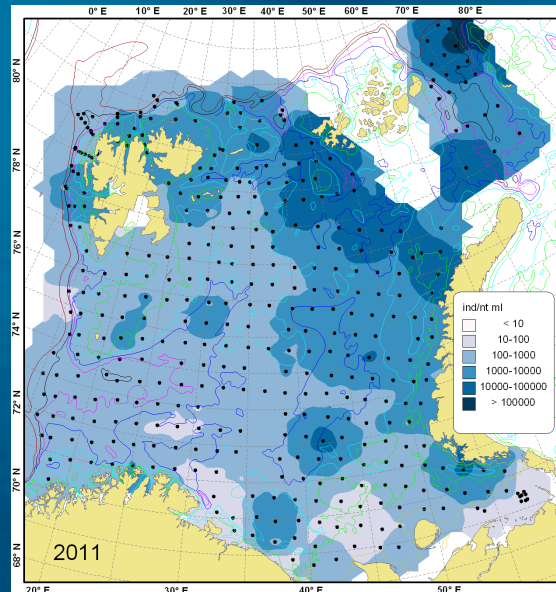


# Bottomtrawl megafauna

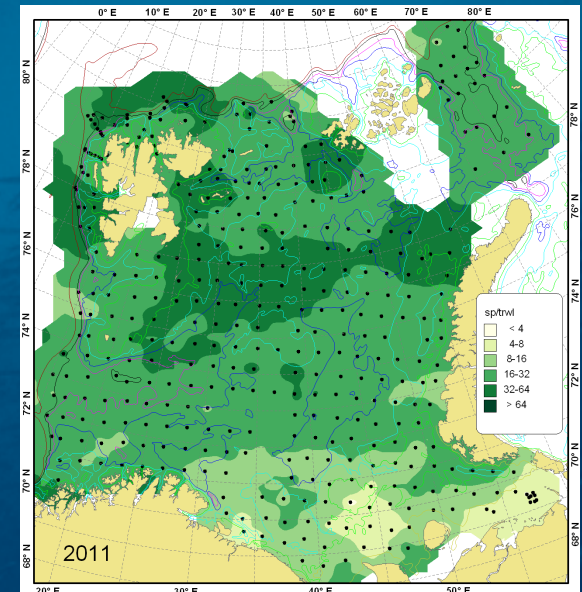
## Biomass



## Abundance



## Species no



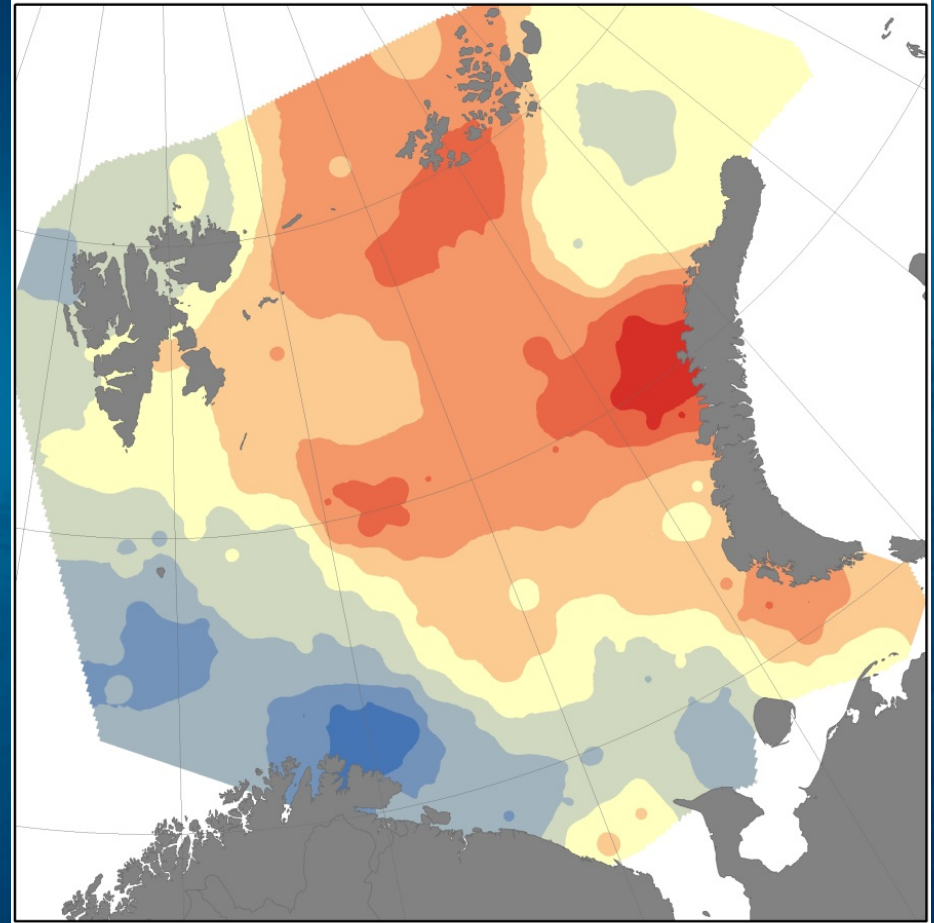
Used in the CAFF-CBMP report:

*“State of the Arctic Marine Biodiversity Report”*



# Secondary Production ( $\text{mg C m}^{-2} \text{ y}^{-1}$ )

North East –  
higher  
secondary  
production

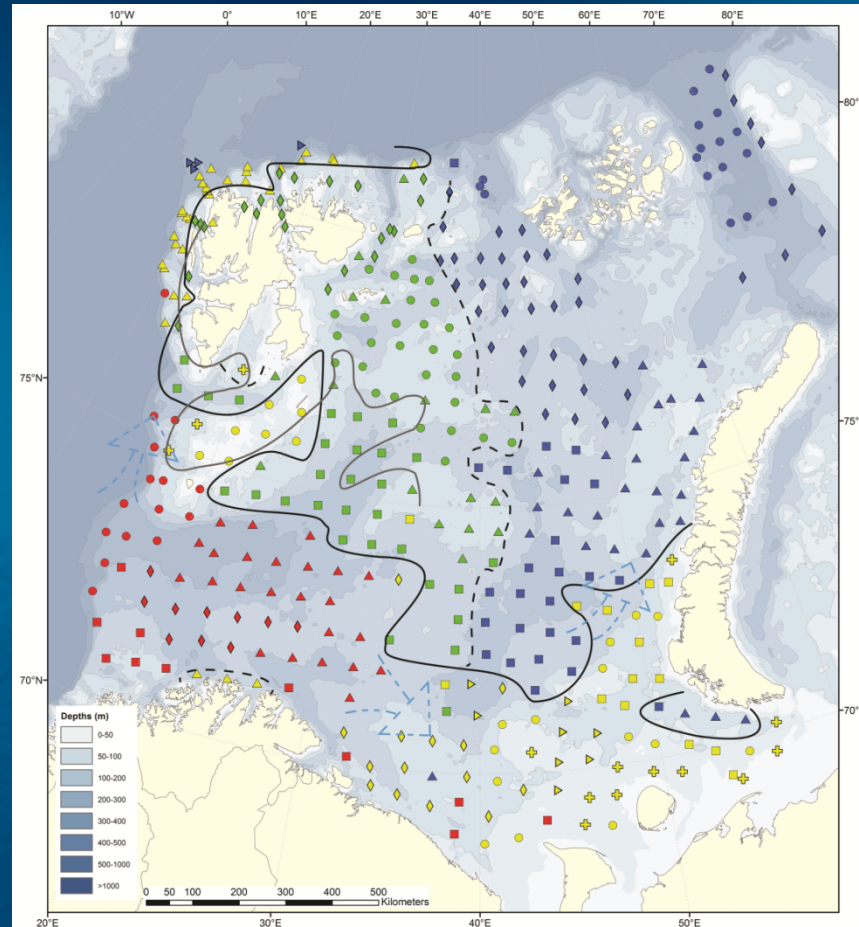


Degen, R. , Jørgensen, L. , Ljubin, P. , Ellingsen, I. , Pehlke, H. and Brey, T. (2016): Patterns and drivers of megabenthic secondary production on the Barents Sea shelf , Marine Ecology Progress Series, 546 , pp. 1-16 . doi: 10.3354/meps11662



# Barents Sea benthic communities

354 taxa  
(218 species)



Jørgensen, Ljubin, Skjoldal, Ingvaldsen, Anisimova, & Manushin. (2015). Distribution of benthic megafauna in the Barents Sea: baseline for an ecosystem approach to management. *ICES J. Mar. Sci.* 72(2), 595-613.



Johannesen, Jørgensen, Fossheim, Primicerio, Greenacre, Ljubin, Dolgov, Ingvaldsen, Anisimova, Manushin (206). Large-scale patterns in community structure of benthos and fish in the Barents Sea. *Polar Biol.* DOI 10.1007/s00300-016-1946-6

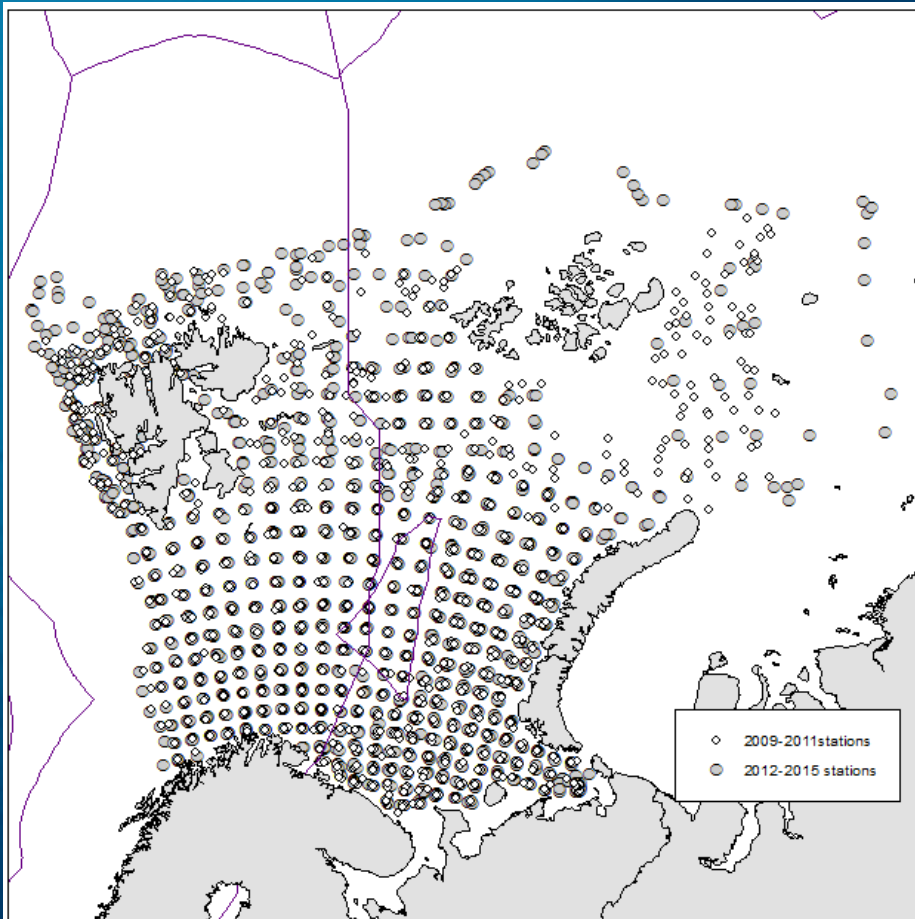


# Multiple impact on sea bed fauna in a warming Arctic



Jørgensen et al (2016). Multiple impact on sea bed fauna in a warming Arctic. In prep.

# Long Term Monitoring 2009-2015



**2280 stations**

**->**

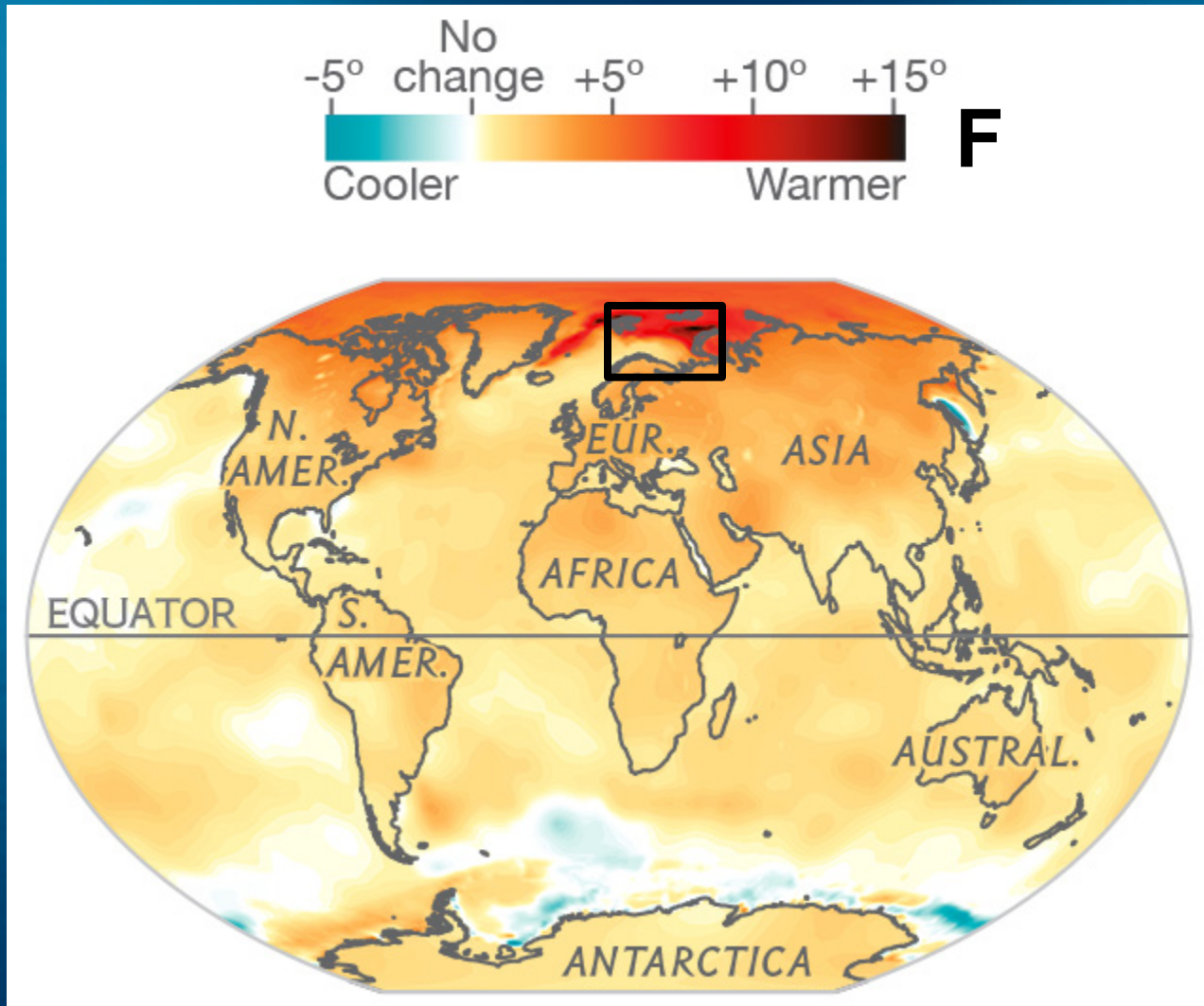
**70 T of megabenthic  
biomass**

**4.4 mil. individuals**

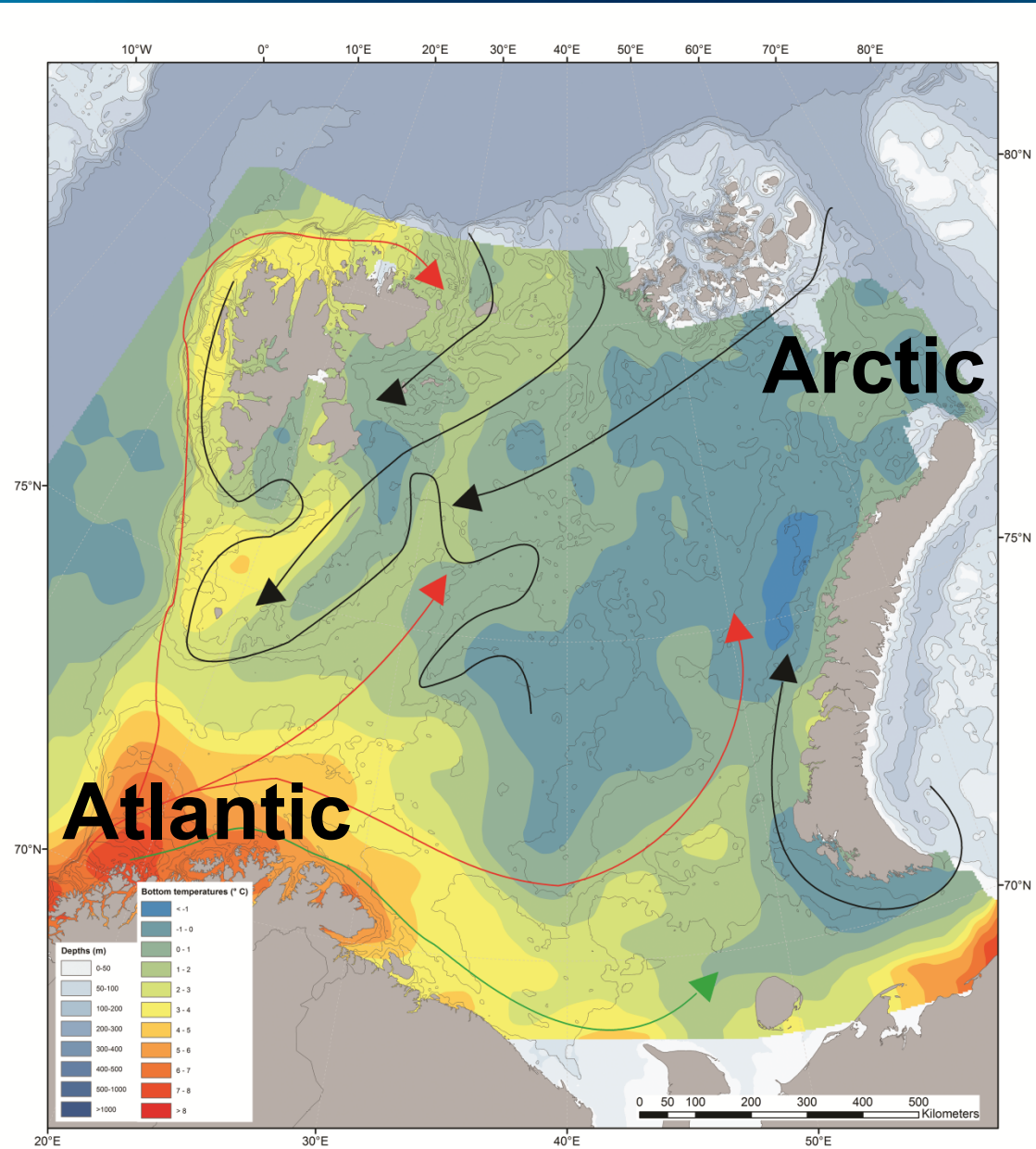
**467 species/taxa**



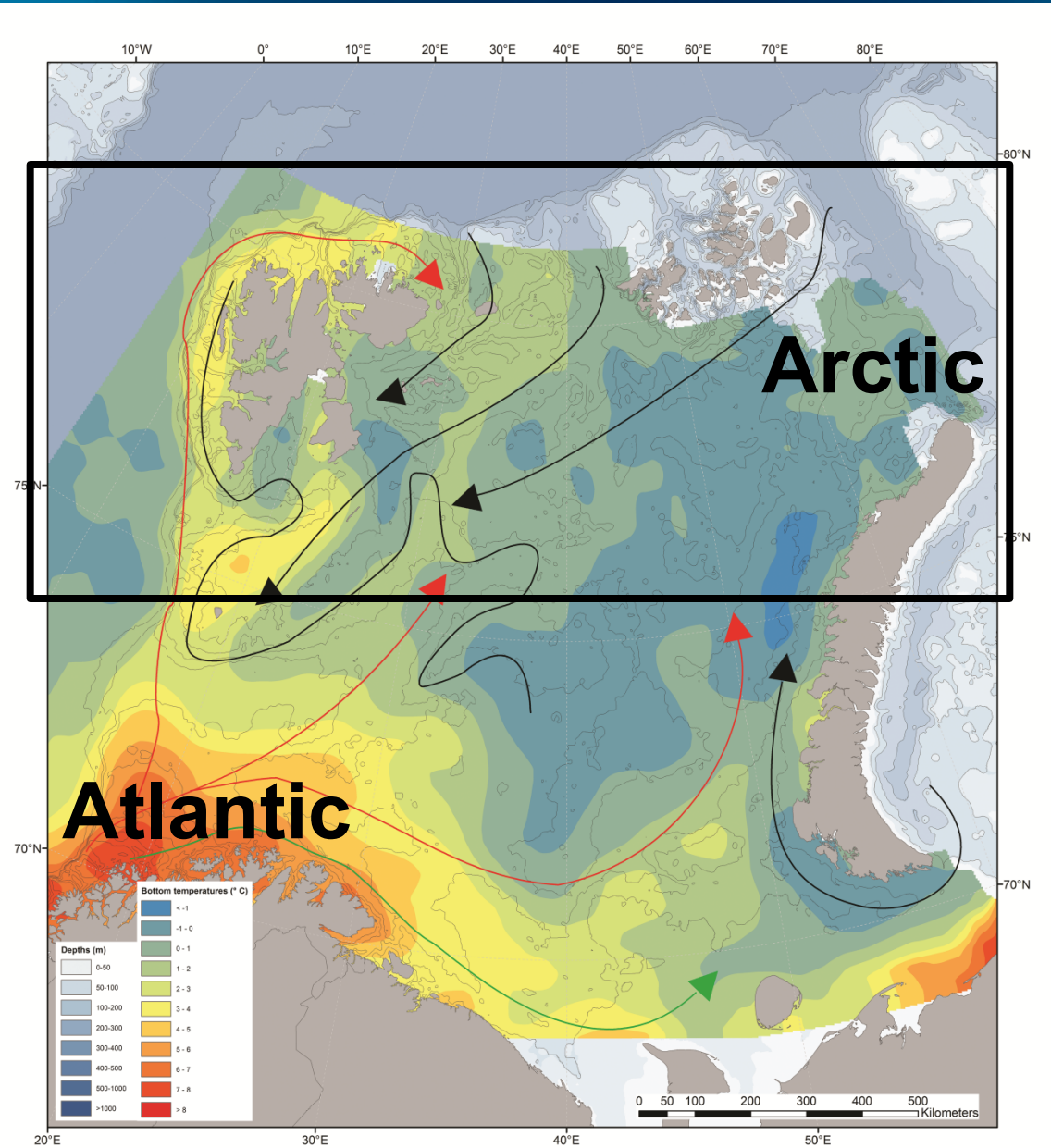
# Climate change



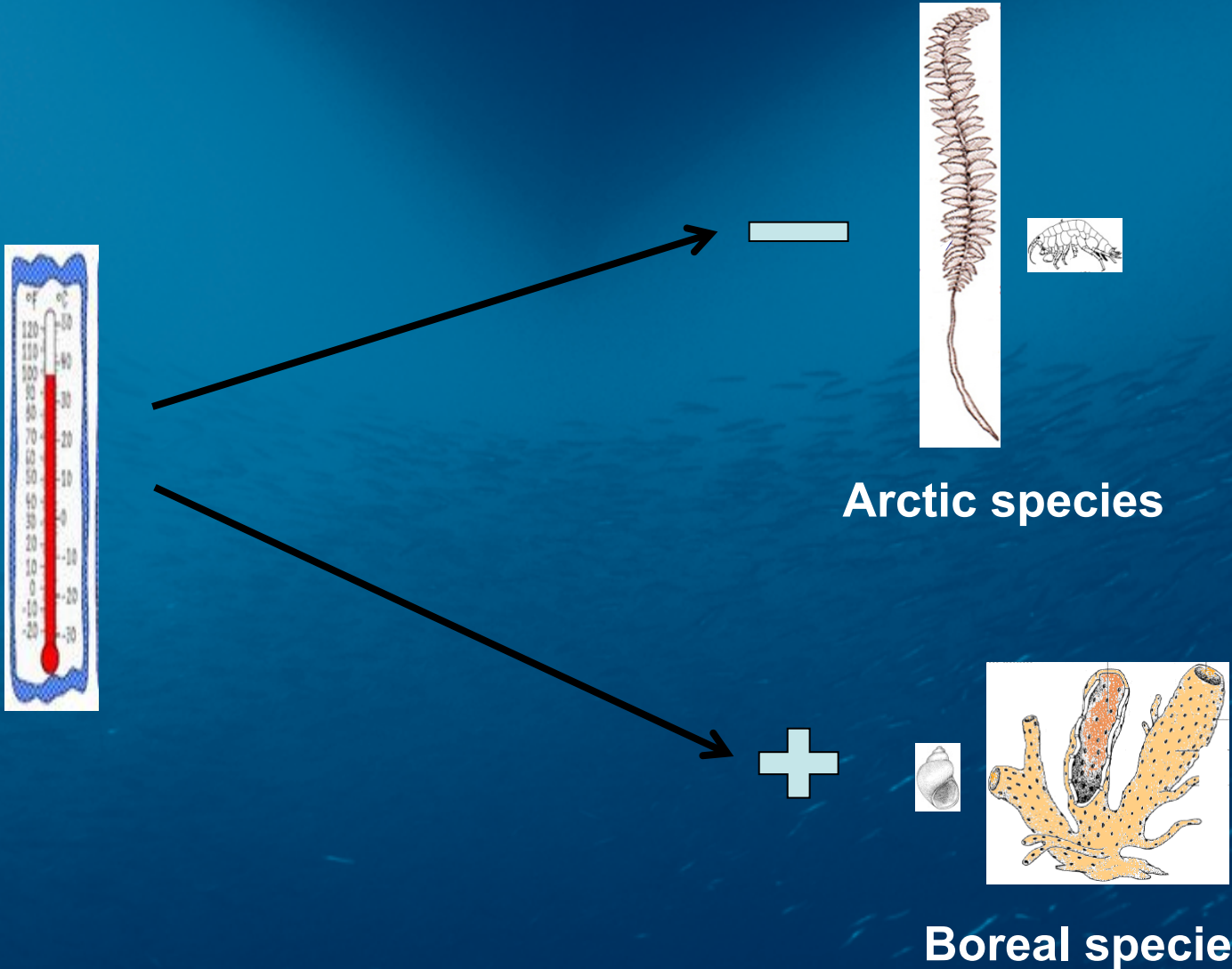
# Stressor: Bottom temperature



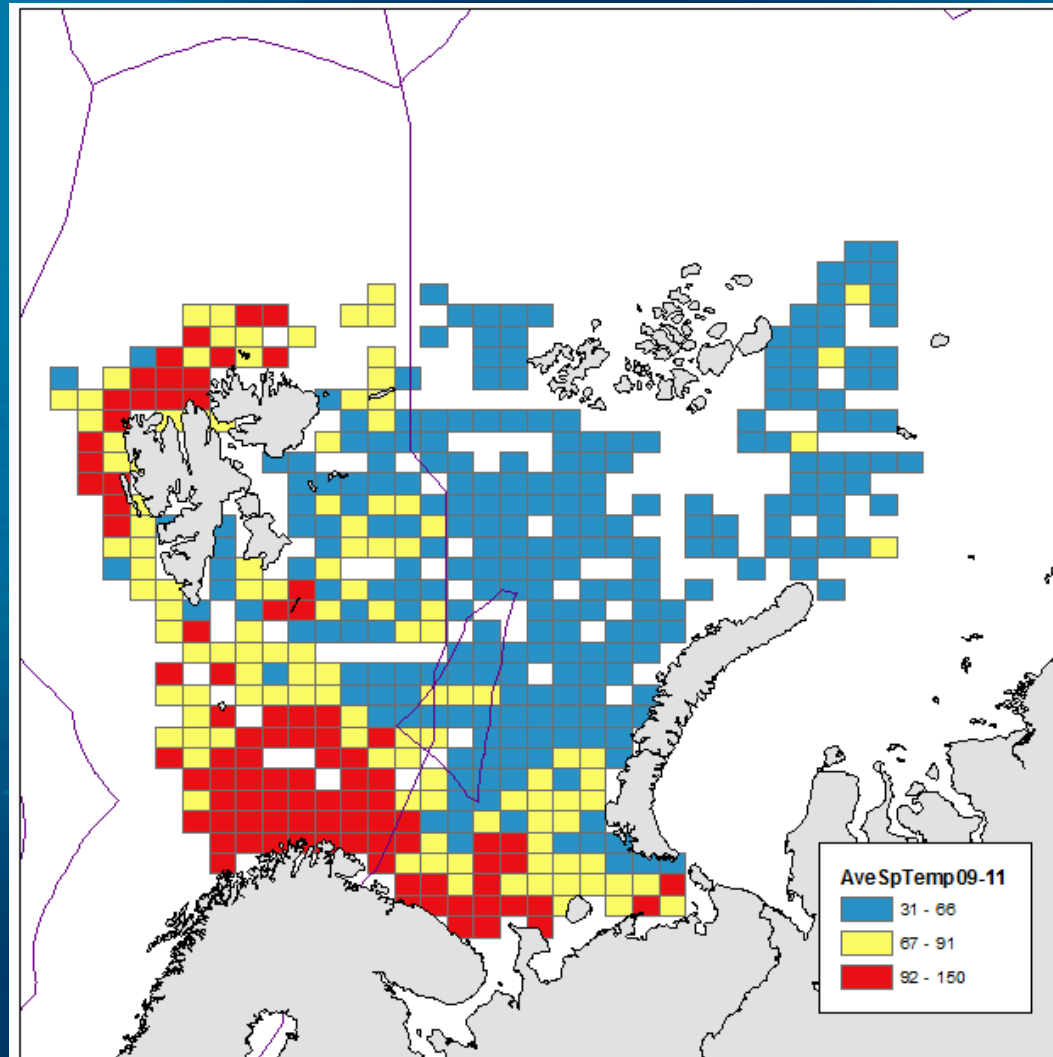
# Stressor: Bottom temperature



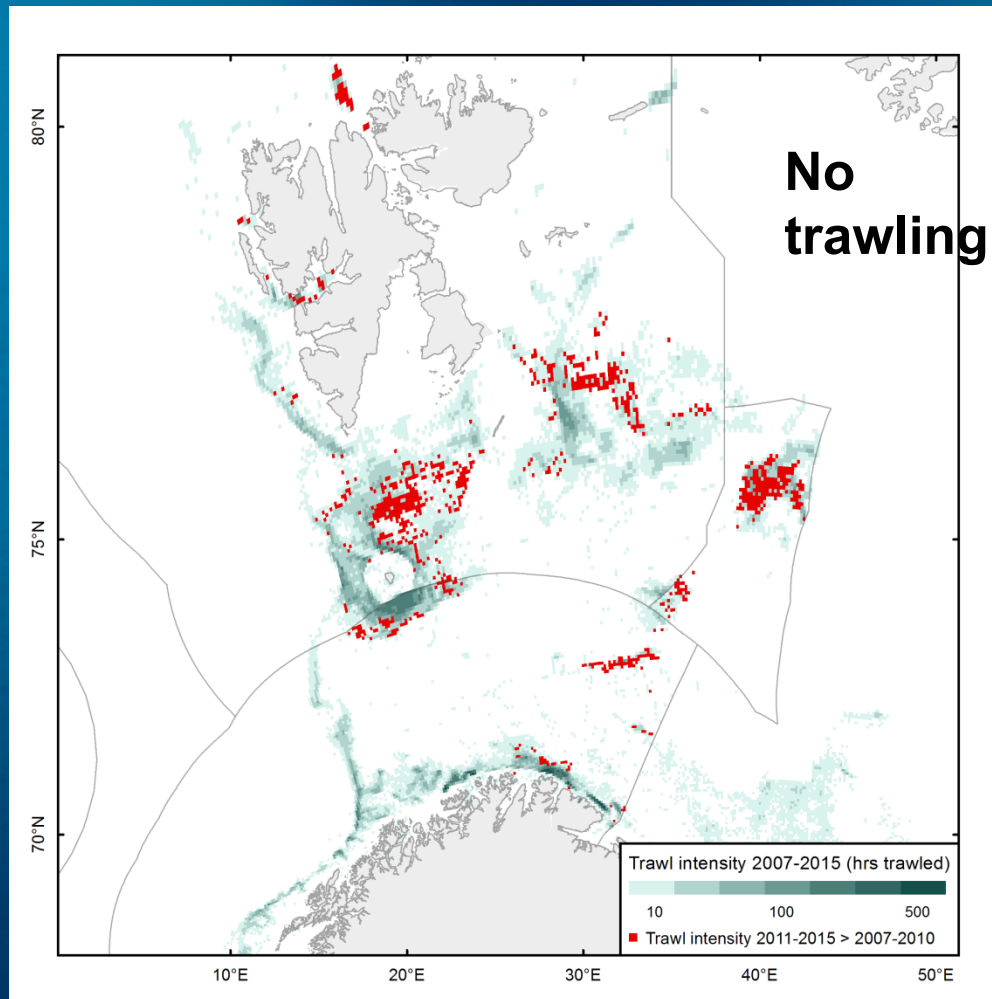
# Sensitivity to warming



# Species temperature tolerance

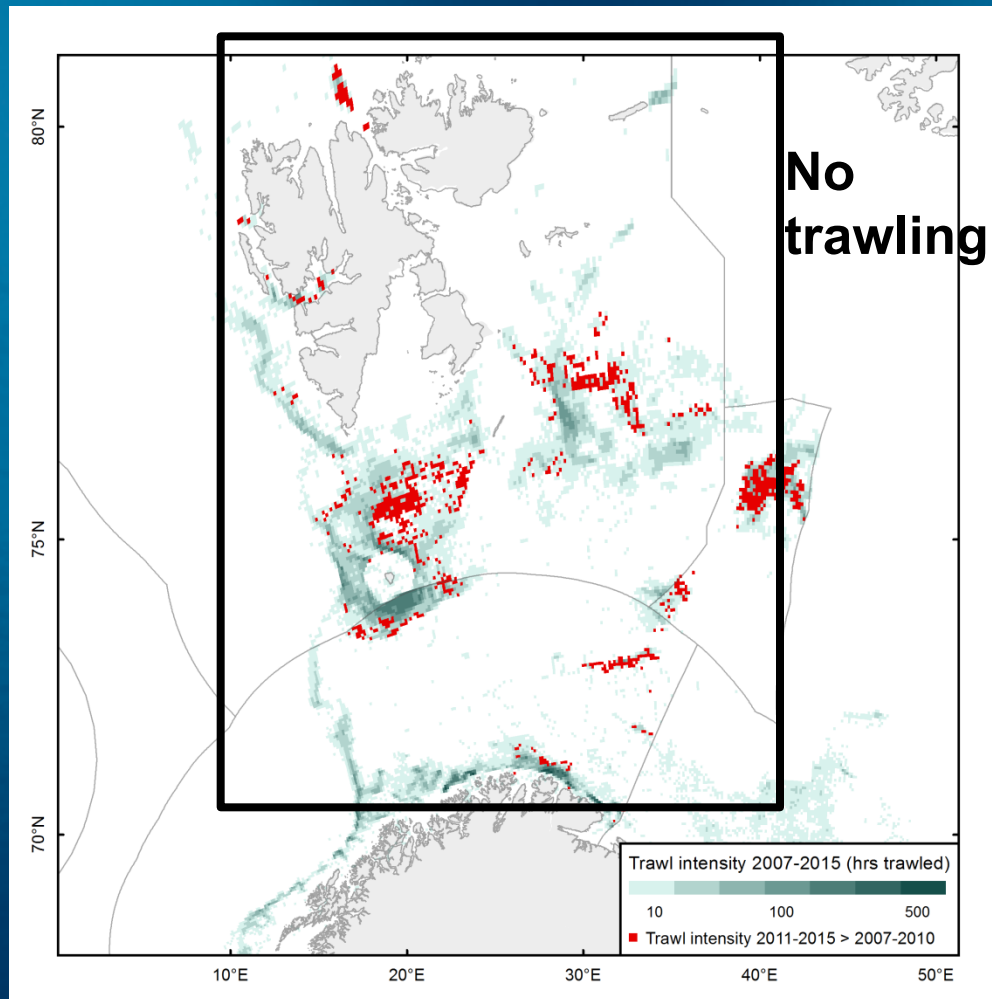


# Stressor: Bottom trawling

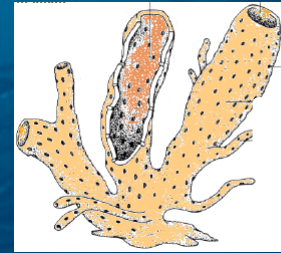
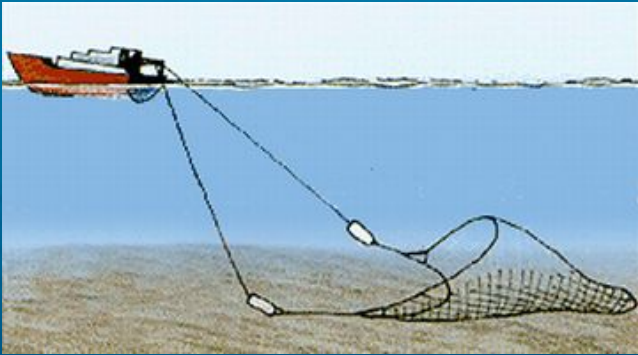




# Stressor: Bottom trawling



# Sensitivity to trawling



**Large-bodied  
upraised species**



# Example of vulnerable species



**Basket stars (40 cm diameter)**



**Sealilies (20 cm arms)**

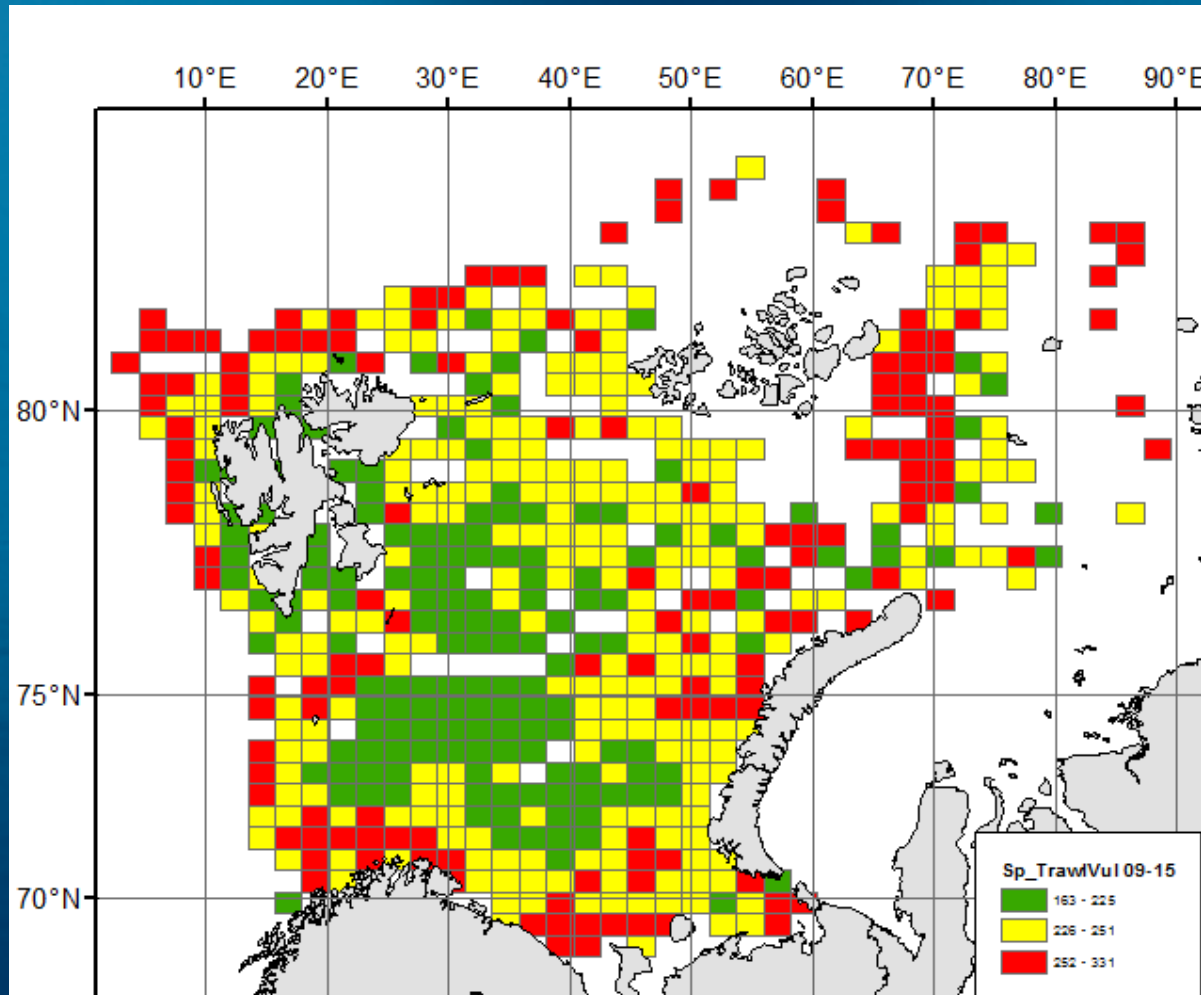


**Sea pens (3 m length)**

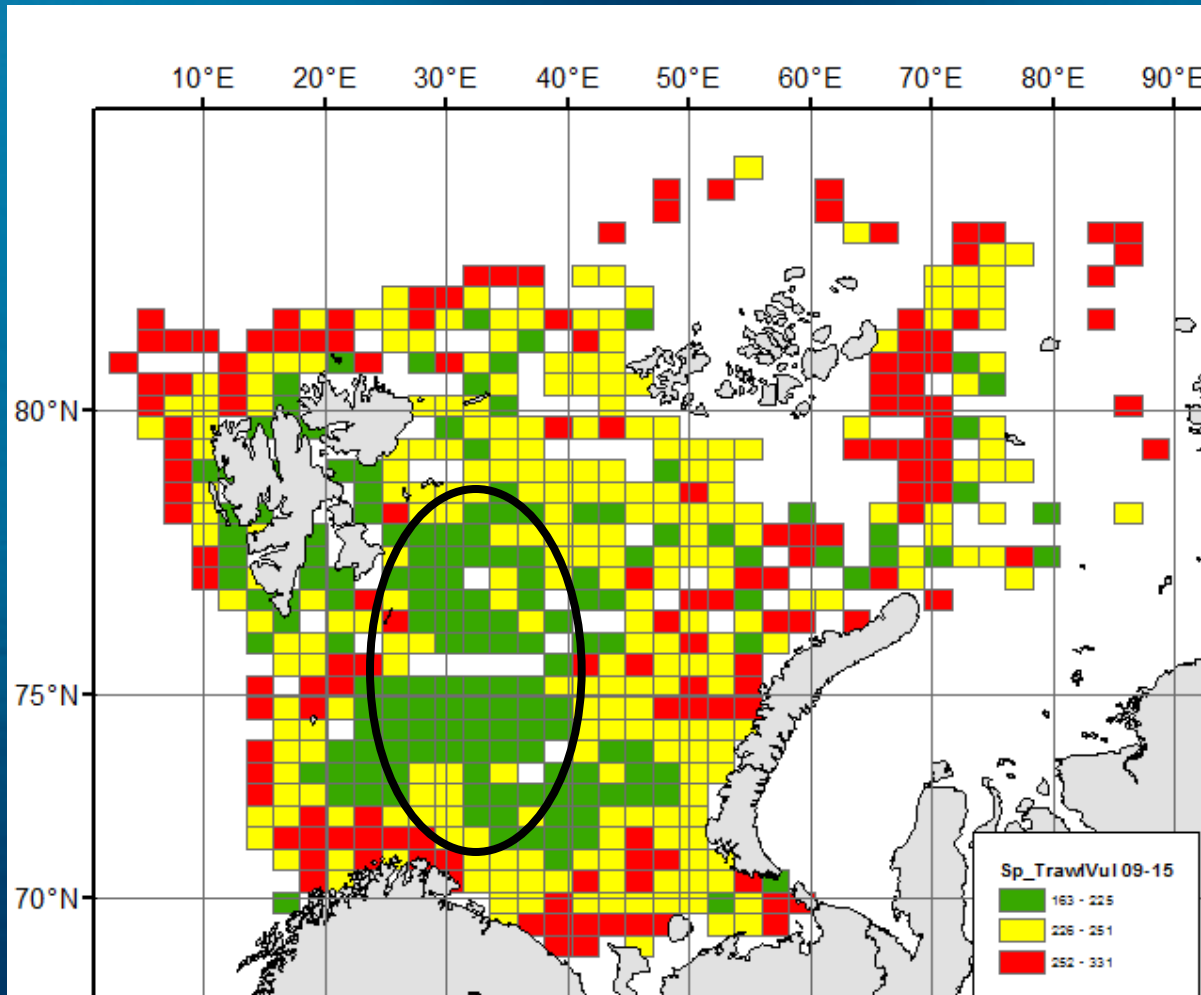


**Sponges (15 kg)**

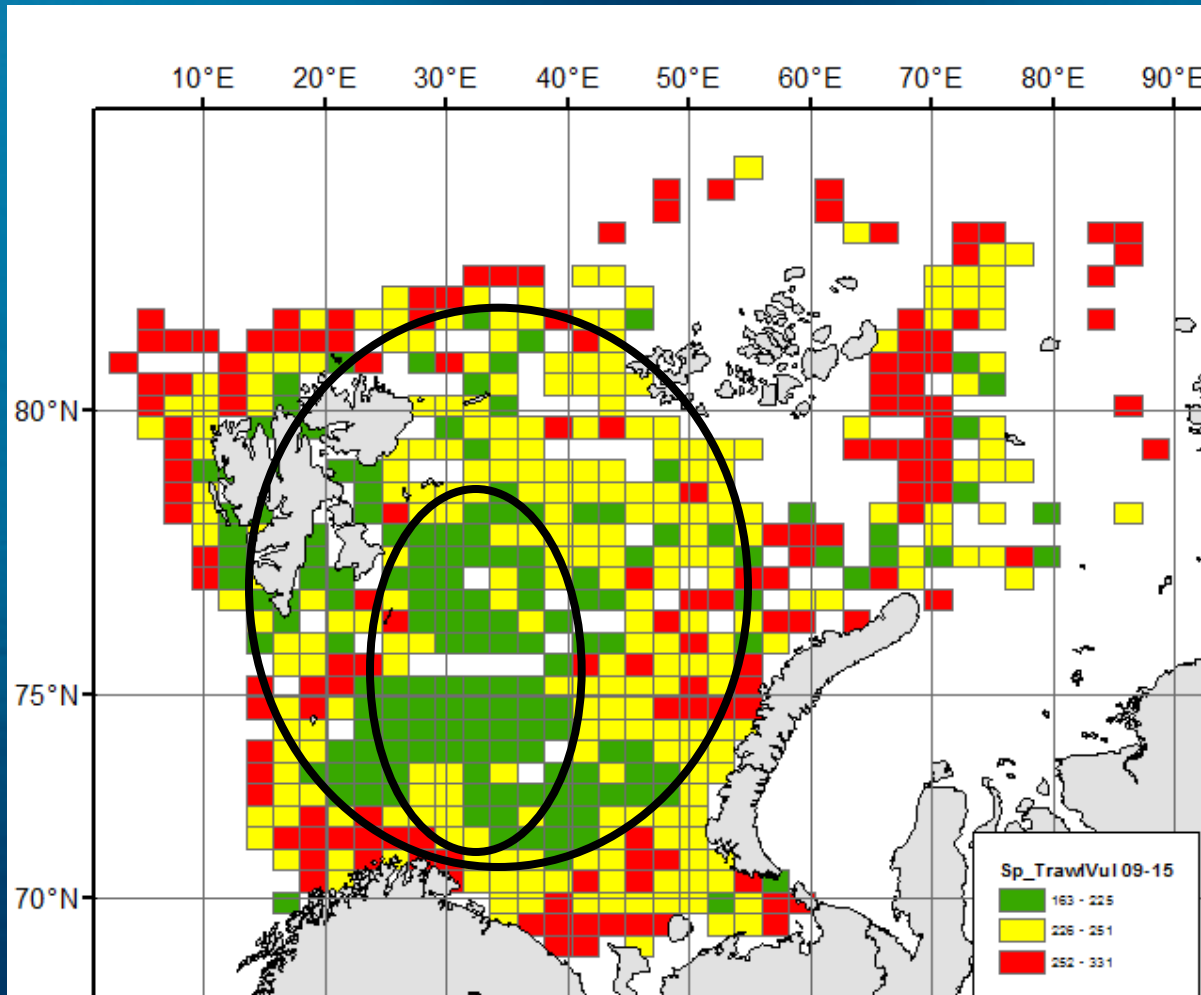
# Station trawl-vulnerability (2009-2015)



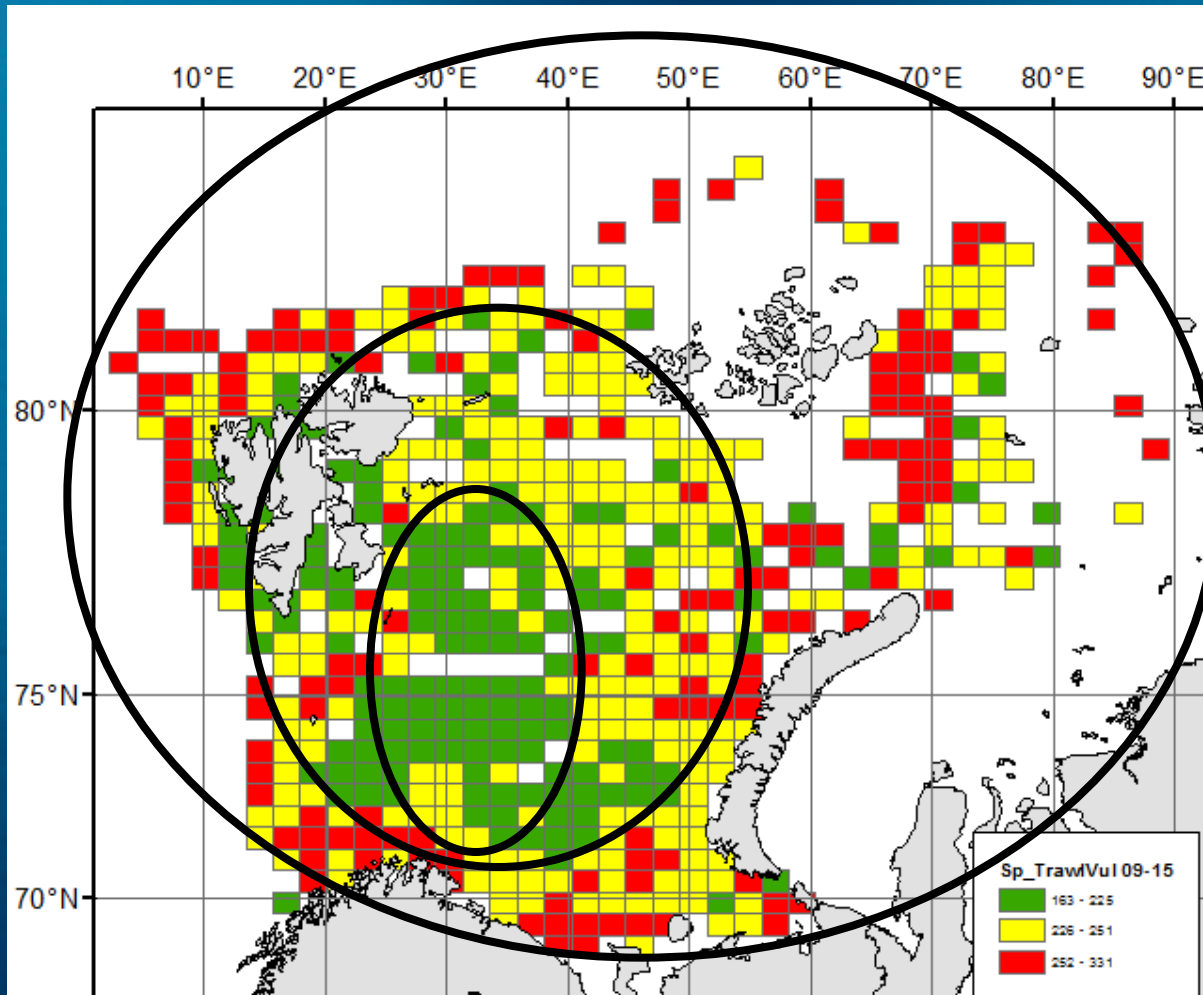
# Station trawl-vulnerability (2009-2015)



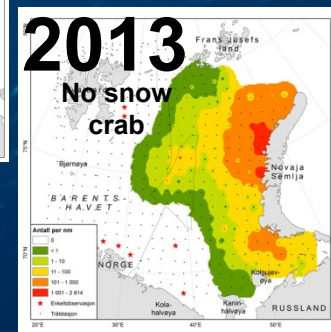
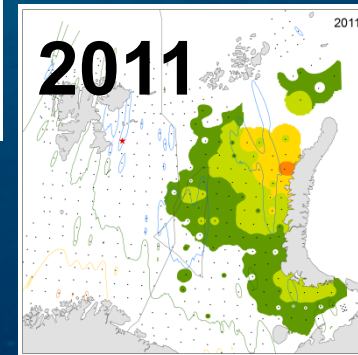
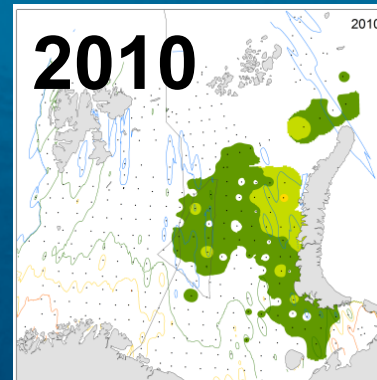
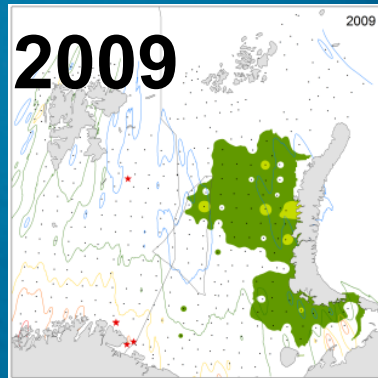
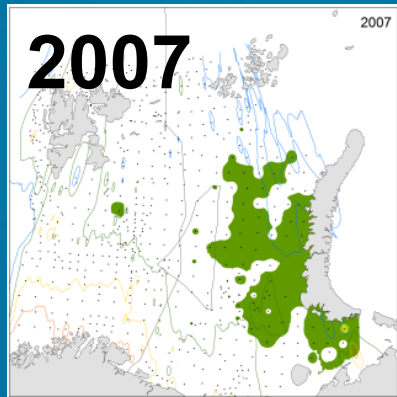
# Station trawl-vulnerability (2009-2015)



# Station trawl-vulnerability (2009-2015)

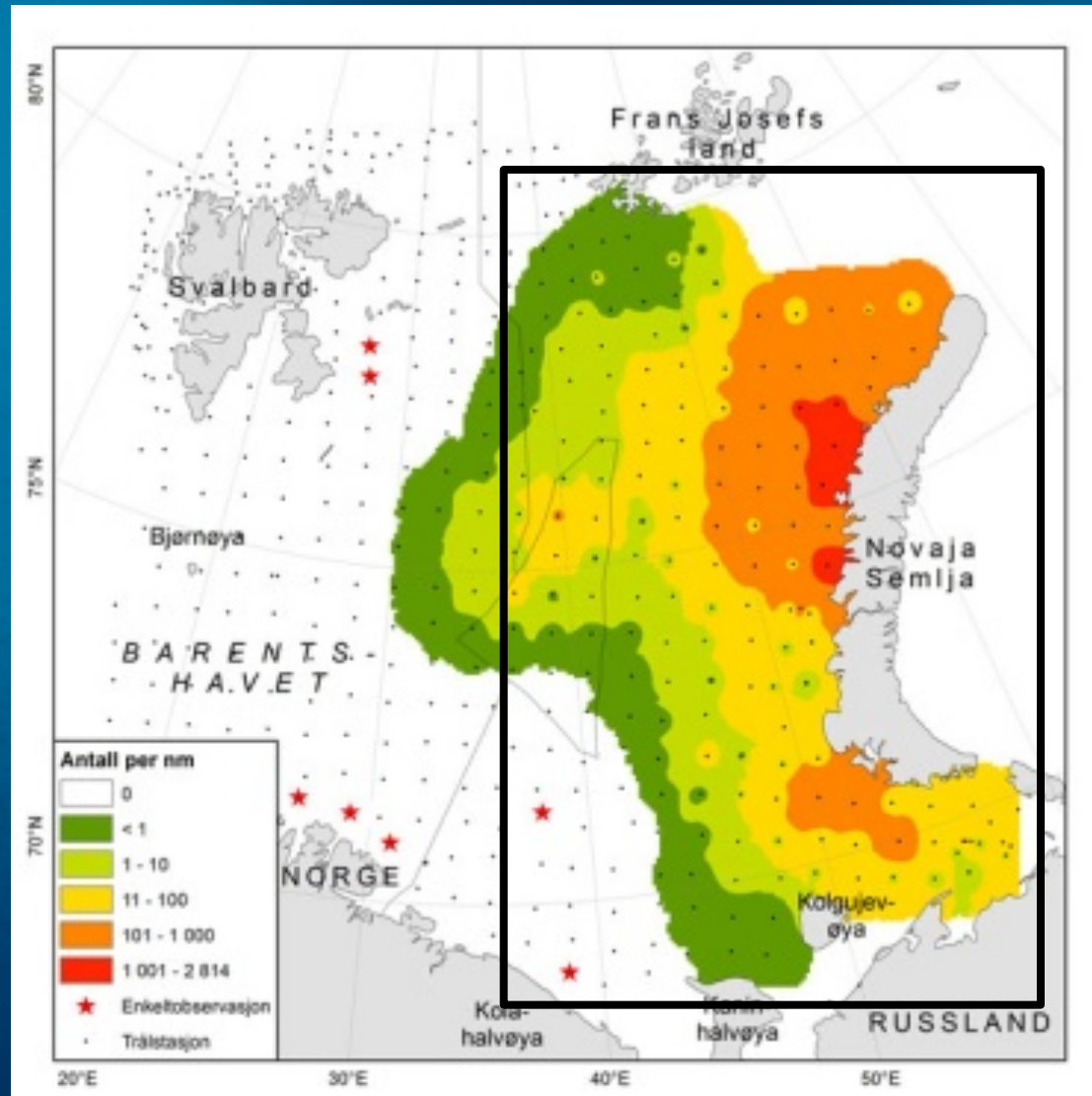


# Stressor: Snowcrab predation





# Stressor: Snowcrab predation 2013



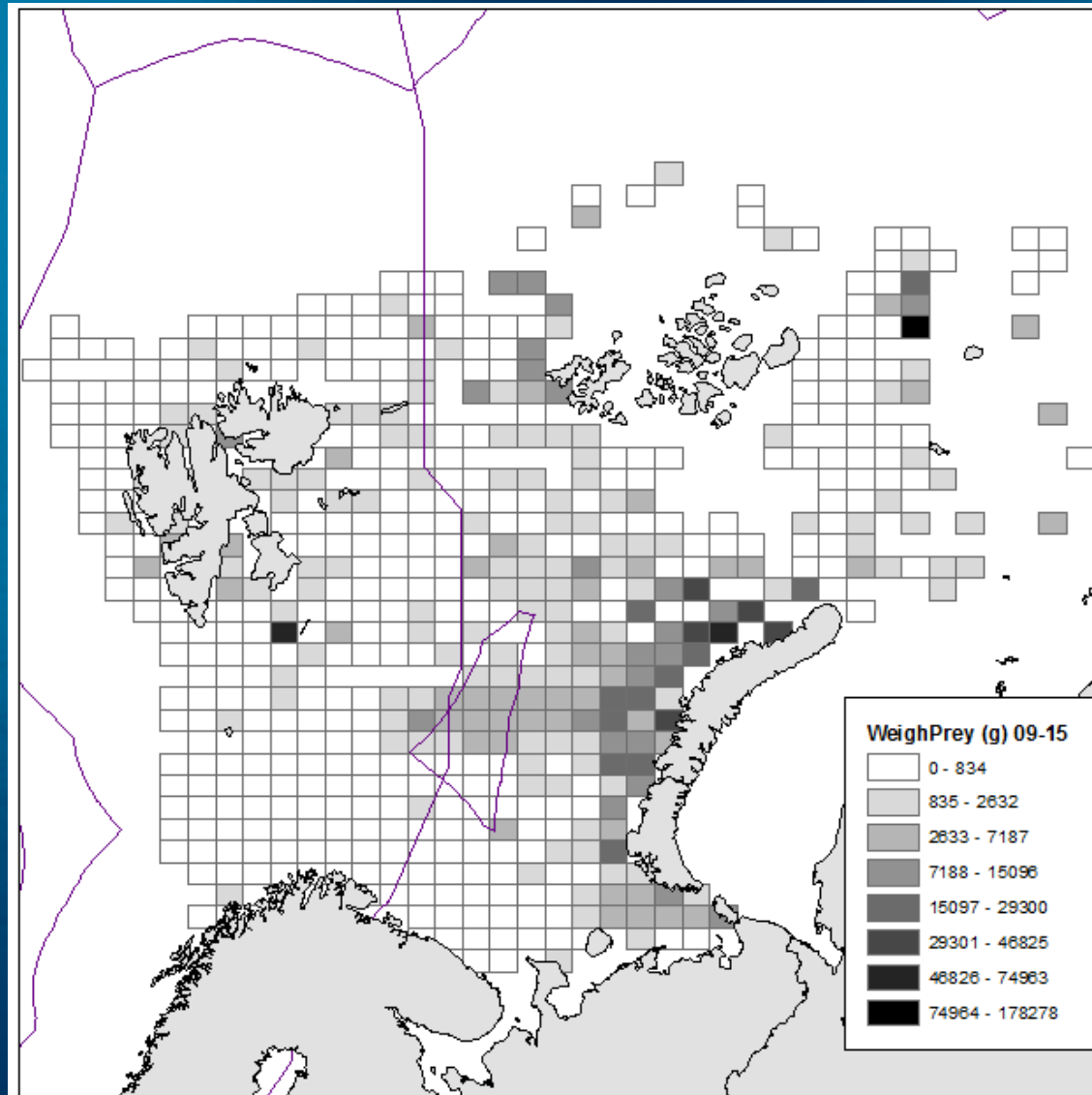
# Snowcrab prey sensitivity



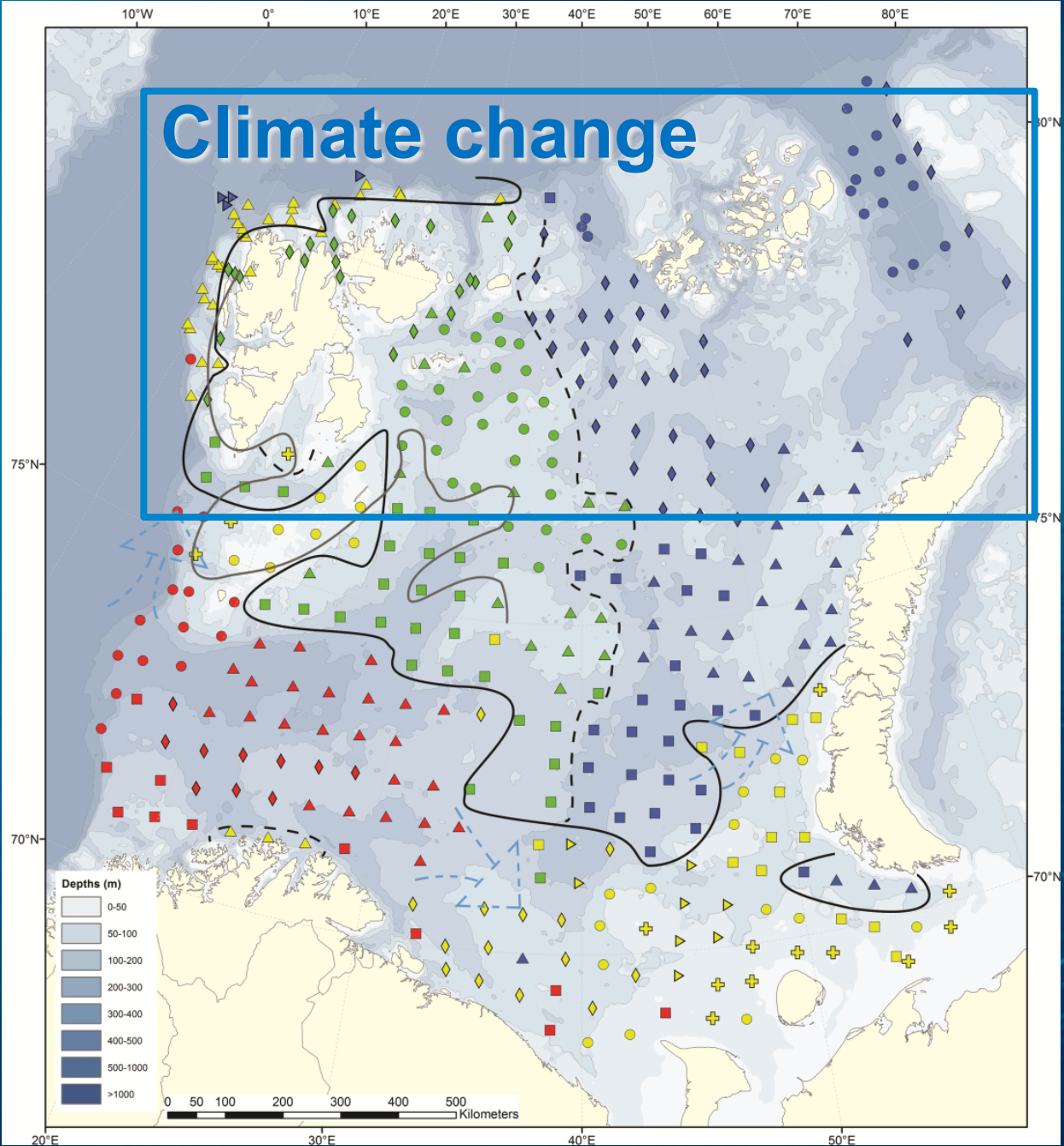
**Small prey  
species**



# Station snow-crab food

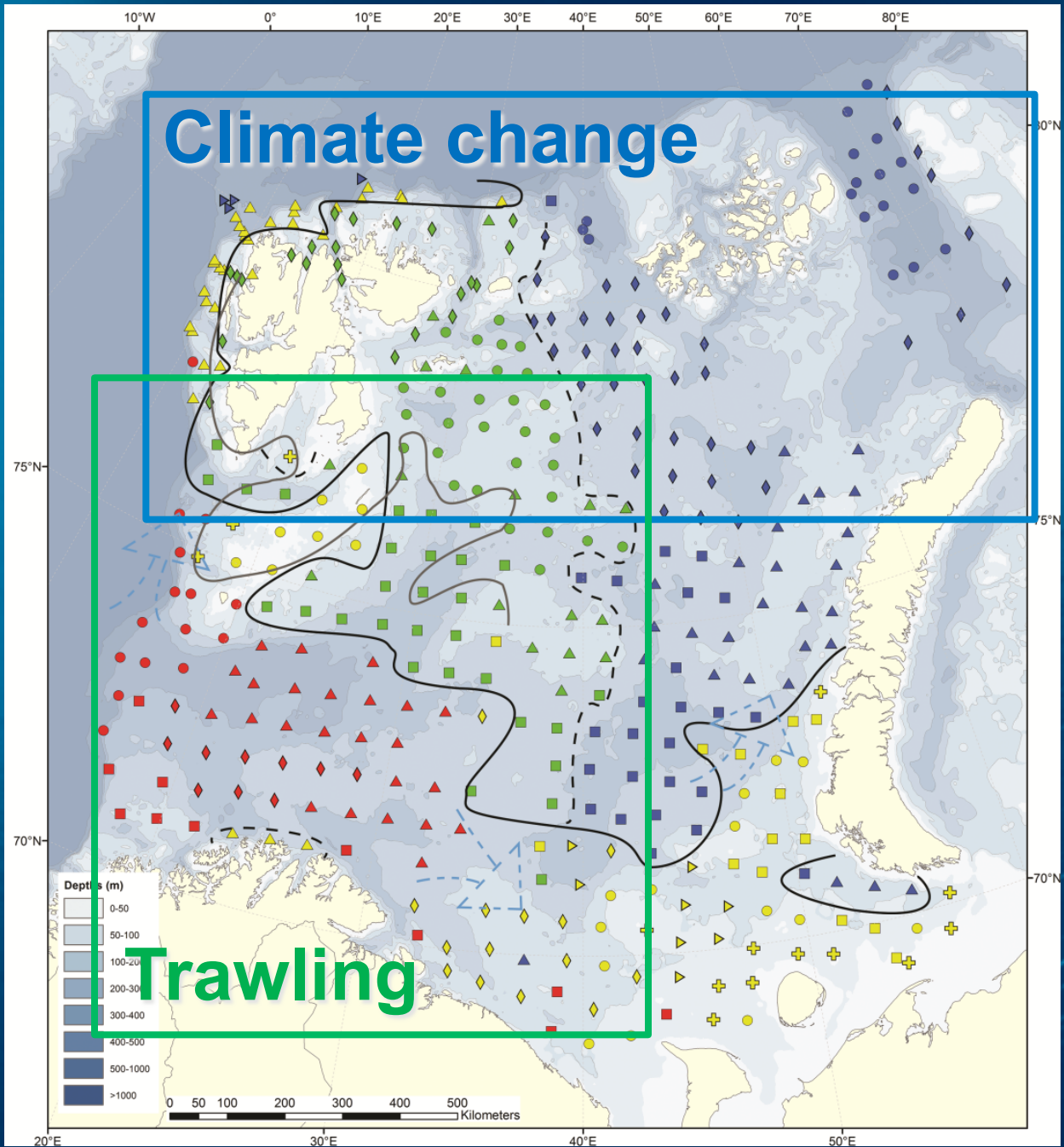


# Climate change



# Climate change

# Trawling



Climate change

Snow crab

Trawling

Depths (m)



0 50 100 200 300 400 500 Kilometers

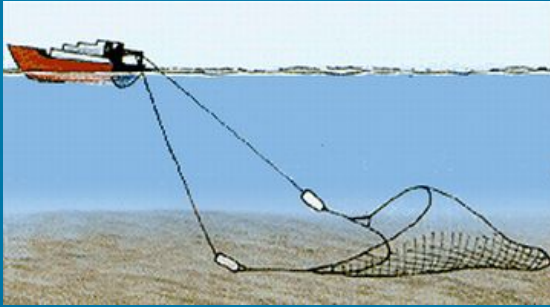


# Multiple stressors and co-sensitive species



Pictures: Vitaliy Syomin

# Combined effect of multiple stressors in the NW

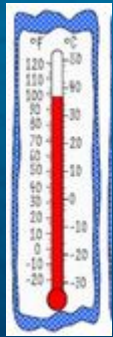
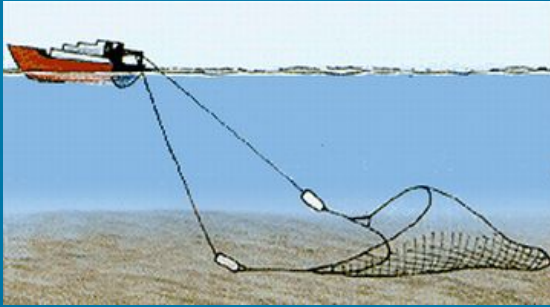


**Large-bodied  
upraised species**





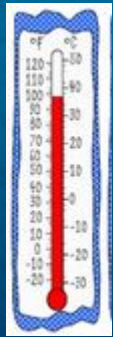
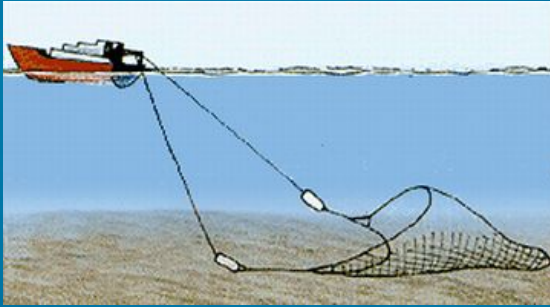
# Combined effect of multiple stressors in the NW



Arctic species



# Combined effect of multiple stressors in the NW



Large-bodied  
upraised Arctic  
species



# Combined effect of multiple stressors in the NE



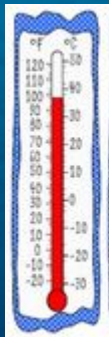
Small prey species



# Combined effect of multiple stressors in the NE

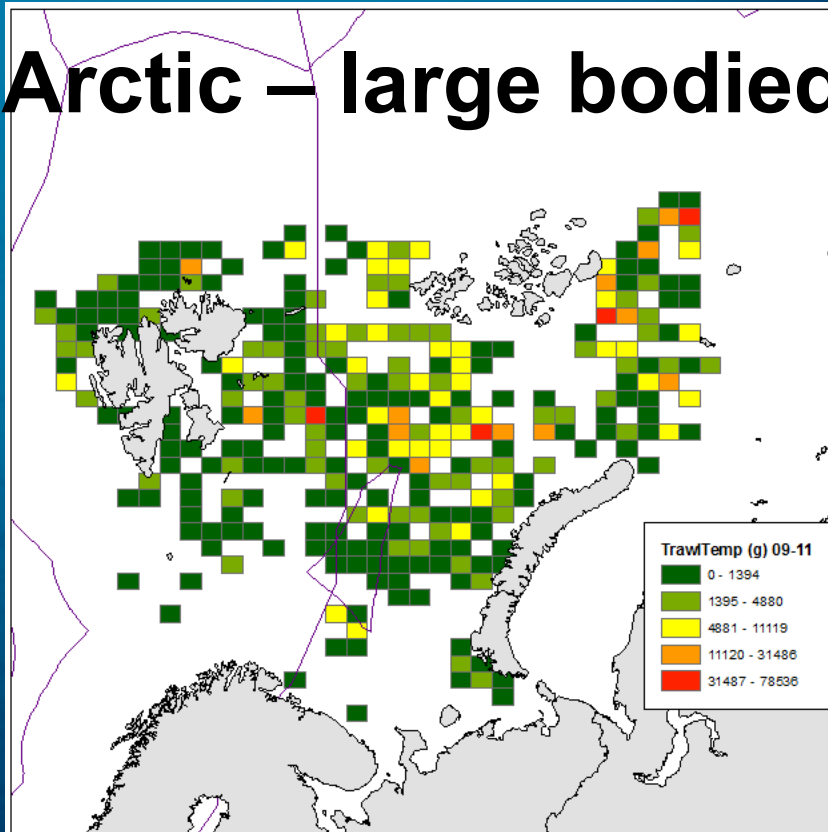


Arctic small  
prey  
species

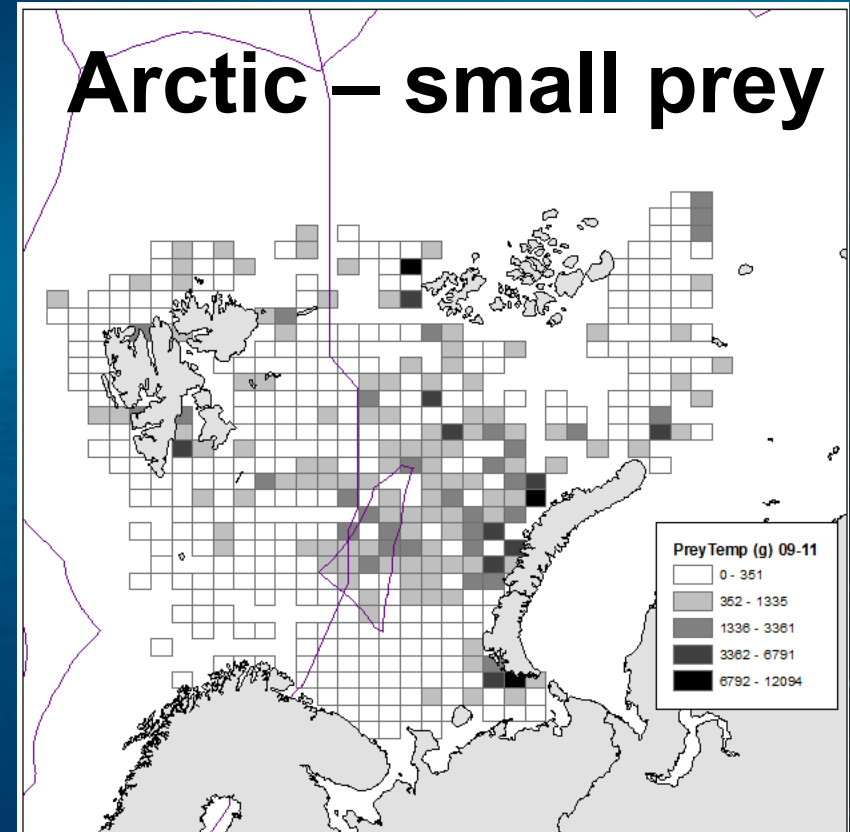


# Co-sensitivity maps

## Arctic – large bodied



## Arctic – small prey

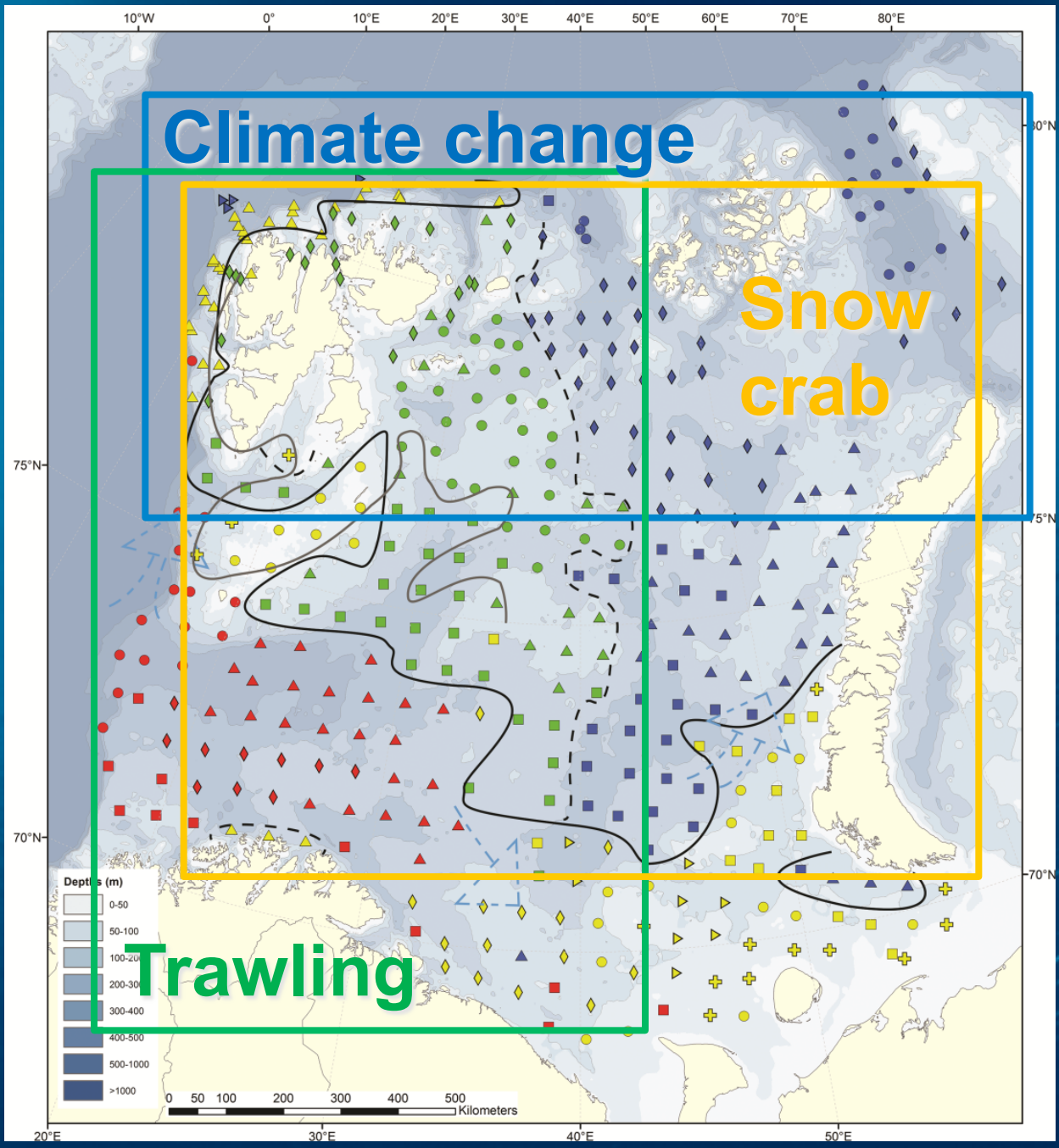


# Future

Climate change

Snow crab

Trawling



# Scenario

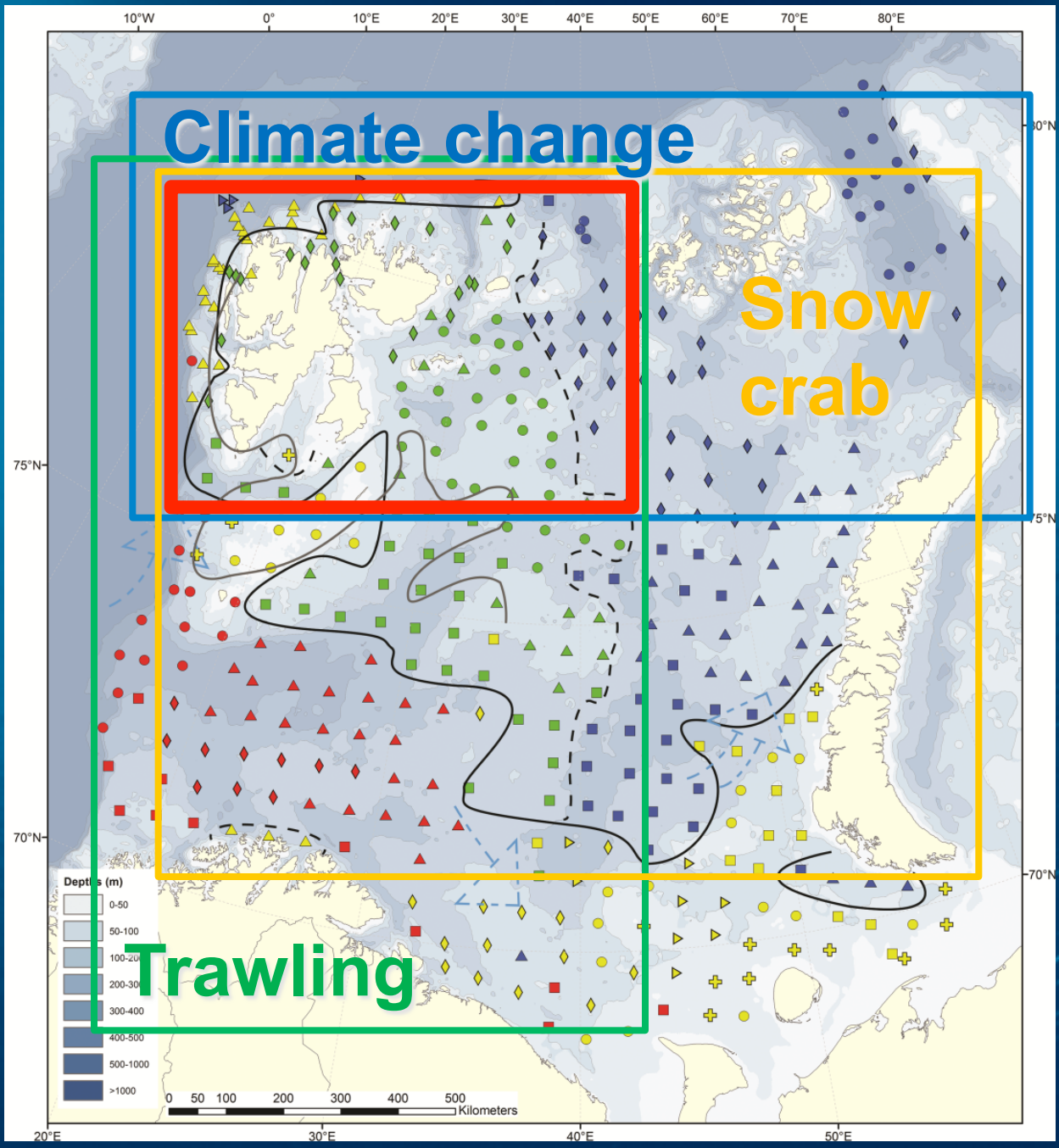


# Future

Climate change

Snow crab

Trawling



# Scenario

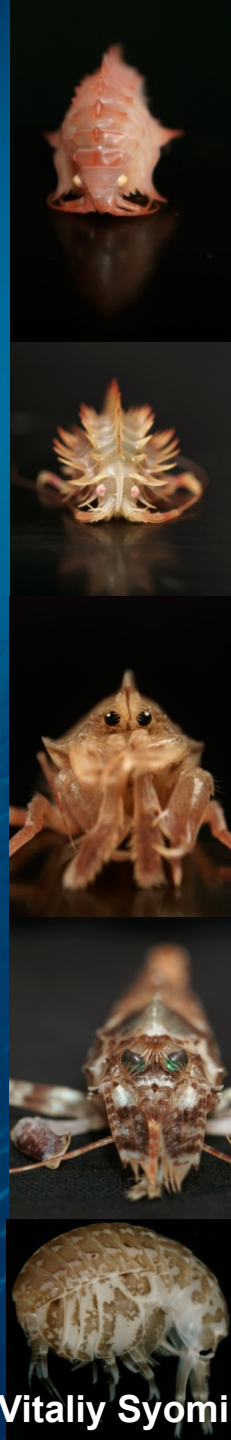


# Conclusion

To sustain a rich and healthy benthic ecosystem.

Reduced bottom-trawling, increase commercial catch of snow crab with *traps* in areas of the Barents Sea affected by multiple stress-factors

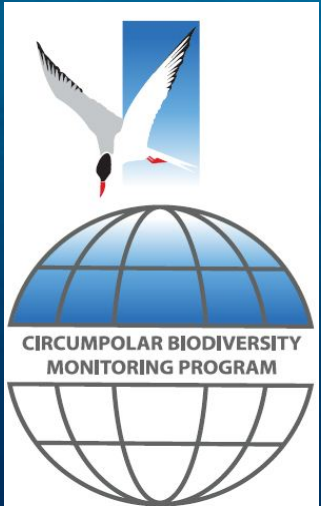
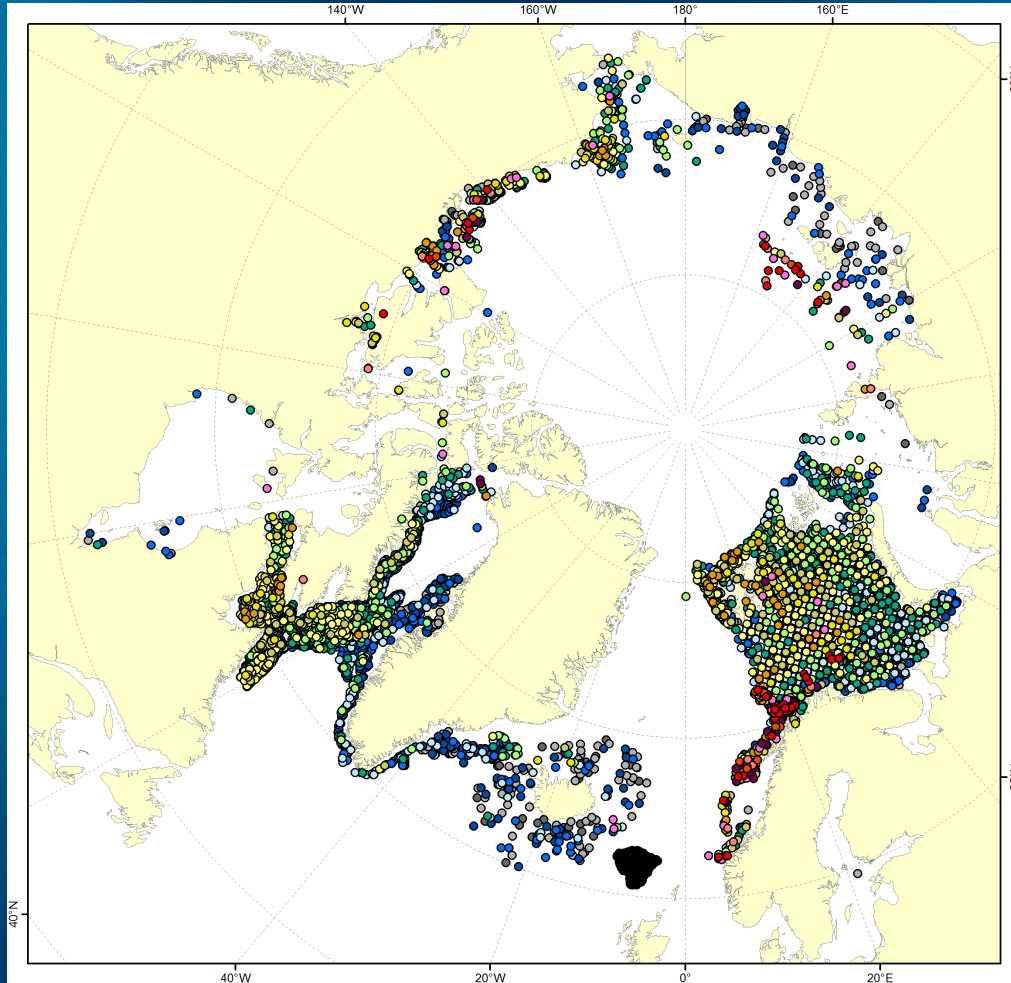
In order to define “critical level”, establish “closed areas” to study the natural fluctuation in a rich and healthy benthic community.





# State of the Arctic Marine Biodiversity Report

- Six **Marine** Expert Networks
  - Sea-Ice Biota
  - Plankton
  - **Benthos**
  - Fish
  - Marine Mammals
  - Cbird



# Timeline SAMBR

- **Sept 6-8:** CAFF Board meeting and # **1 review complete.**
- **October:** Marine group annual meeting, Iceland, Akureyri.
- **Dec:** Circulated for Board review #2.
- **January 7th 2017** CAFF Board deadline to identify any key issues that will need discussion to resolve.
- **Feb 7:** Review #2 complete; approval for SAO **submission.**
- **March 7:** SAO approval.
- **April/May:** **Arctic Council Ministerial.**



# **Thank you** to the Joint **Russian-Norwegian** Ecosystem Survey

**Financed by**

**IMR / PINRO**

**FRAM - “VULDER”**

 **NFR Projects – “TIBIA” and “SI\_Arctic”**

# Litterature list

- Nekhaev IO, Zimina OL. 2016. Risen from the Abyss: records of the Atlantic deep-water gastropods on the shelf of the Barents Sea. *Fauna Norvegica*
- Zimina, O. L., Lyubin, P. A., Jørgensen, L. L., Zakharov, D. V., Lyubina, O. S., (2015). Decapod Crustaceans of the Barents Sea and adjacent waters: species composition and peculiarities of distribution. *Arthropoda Selecta* 24(3): 417–428
- Jørgensen, LL, Philippe Archambault, Martin Blicher, Nina Denisenko, Gudmundur Gudmundsson, Katrin Iken, Virginie Roy, Jan Sørensen (in rev) Benthos. In: *The state of the Arctic Marine Biodiversity Report* (SAMBR) within the group "The Conservation of Arctic Flora and Fauna" (CAFF)
- Lacharité M., Jørgensen L.L., Metaxas A., Lien V.S., Skjoldal H.R. (2016) Delimiting oceanographic provinces to determine drivers of spatial mesoscale patterns in offshore shelf benthic megafauna: a case study in the Barents Sea. *Progress in Oceanography* (in print)
- Johannesen E., Jørgensen L.L., Fosshem M., Primicerio R., Greenacre M., Ljubin P.A., Dolgov A.V., Ingvaldsen R.B., Anisimova N.A., Manushin, I.E. (2016) Consistent large-scale patterns in community structure of benthos and fish in the Barents Sea. *Polar Biology* DOI 10.1007/s00300-016-1946-6.
- Degen R., Jørgensen L., Ljubin P., Ellingsen I., Pehlke H., Brey T (2016). Patterns and drivers of megabenthic secondary production on the Barents Sea shelf, *Marine Ecology Progress Series*, 546 , pp. 1-16 . doi: 10.3354/meps11662
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- Jørgensen L.L, Planque B, Thangstad TH, Certain G (2015b). Vulnerability of megabenthic species to trawling in the Barents Sea. *ICES Journal of Marine Science*. DOI: 10.1093/icesjms/fsv107.
- Certain, G., Jørgensen, L.L., Christel, I., Planque, B., Vinceny, B. (2015). Mapping the vulnerability of animal community to pressure in marine systems: Disentangling impact types and integrating their effect from the individual to the community level. *ICES Journal of Marine Science*. Doi:10.1093/icesjms/fsv003.
- Jørgensen L.L, Ljubin P, Skjoldal HR, Ingvaldsen RB, Anisimova N, Manushin I. (2015a). Distribution of benthic megafauna in the Barents Sea: baseline for an ecosystem approach to management. *ICES Journal of Marine Science*; 72 (2): 595-613
- Michalsen K, Dalpadado P, Eriksen E, Gjørseter H, Ingvaldsen R.B., Johannesen E, Jørgensen L.L, Knutsen T, Prozorkevich D, Skern-Mauritzen M (2013). Marine living resources of the Barents Sea – Ecosystem understanding and monitoring in a climate change perspective, *Marine Biology Research*, 9:9, 932-947
- Bluhm BA, J.M. Grebmeier, P. Archambault, M. Blicher, G. Guðmundsson, K. Iken, L. Lindal Jørgensen, V. Mokievsky (2012). Benthos. In: Jeffries, M. O., J. A. Richter-Menge and J. E. Overland, Eds., 2012: *Arctic Report Card 2012*, <http://www.arctic.noaa.gov/reportcard>.
- Golikov AV, Sabirov RM, Lubin PA, Jørgensen LL (2012). Changes in distribution and range structure of Arctic cephalopods due to climatic changes of the last decades. *Biodiversity*1:1-8
- Anisimova NA, Jørgensen LL, Lubin P., Manushin I. (2011). Benthos. In: T. Jakobsen, V. Ozhigin (Edt.) *The Barents Sea Ecosystem: Russian-Norwegian Cooperation in research and management*, Chapter 4.1.2.
- Jørgensen LL, Renaud P, Cochrane S. (2011). Improving benthic monitoring by combining trawl and grab surveys. *Marine Pollution Bulletin* 62 1183-1190.

