Lene Buhl-Mortensen

Matchmaking seminar
BG ENVIRONMENT PROGRAMME
financed through the EEA Grants 2014-2021

SOFIA, MAY 08th – 09th

2019

The Institute of Marine Research

IMR is one of the largest research institutes of its kind in Europe.
Our main activities are monitoring, research and advisory work.

Employees: About 1000
Funding: 1.5 billion NOK

A national research institute

We provide insight and advice from marine life to health –
from the most subtle details of marine ecosystems to the seafood we eat.

Our locations

- Main office in Bergen
- Research Stations with laboratories in Tromsø, Flødevigen, Austevoll and Matre
- Field stations in Porsanger, Rosendal and Etne

Our vessels

Kronprins Haakon


Dr. Fridtjof Nansen

G.O. Sars

Johan Hjort

Kristine Bonnevie


G.M. Dannevig

Experience from 13 years of mapping for the Norwegian government: The Mareano Programme



Biology
Geology
Chemisty

Hydrography
Oceanography

GIS specialists
Electric engineers
Info expertise

Good baseline mapping

- A must for relevant monitoring!

Distribution of:

Environmetal condition

(species-communities, maintenance of ecosystem functions, diversity, etc)

Vulnerable species/communities

Human activities

Knowledge of effects

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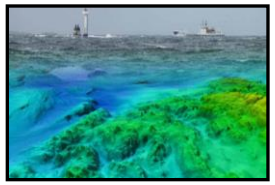
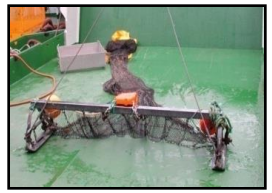
main products:

- Detailed bathymetric maps
- Maps and description of sediment types, habitats, and geological features
- Maps and description of benthic fauna, biodiversity, communities, and production
- Environmental status for sediments
- Areal database for Norwegian coastal- and offshore areas





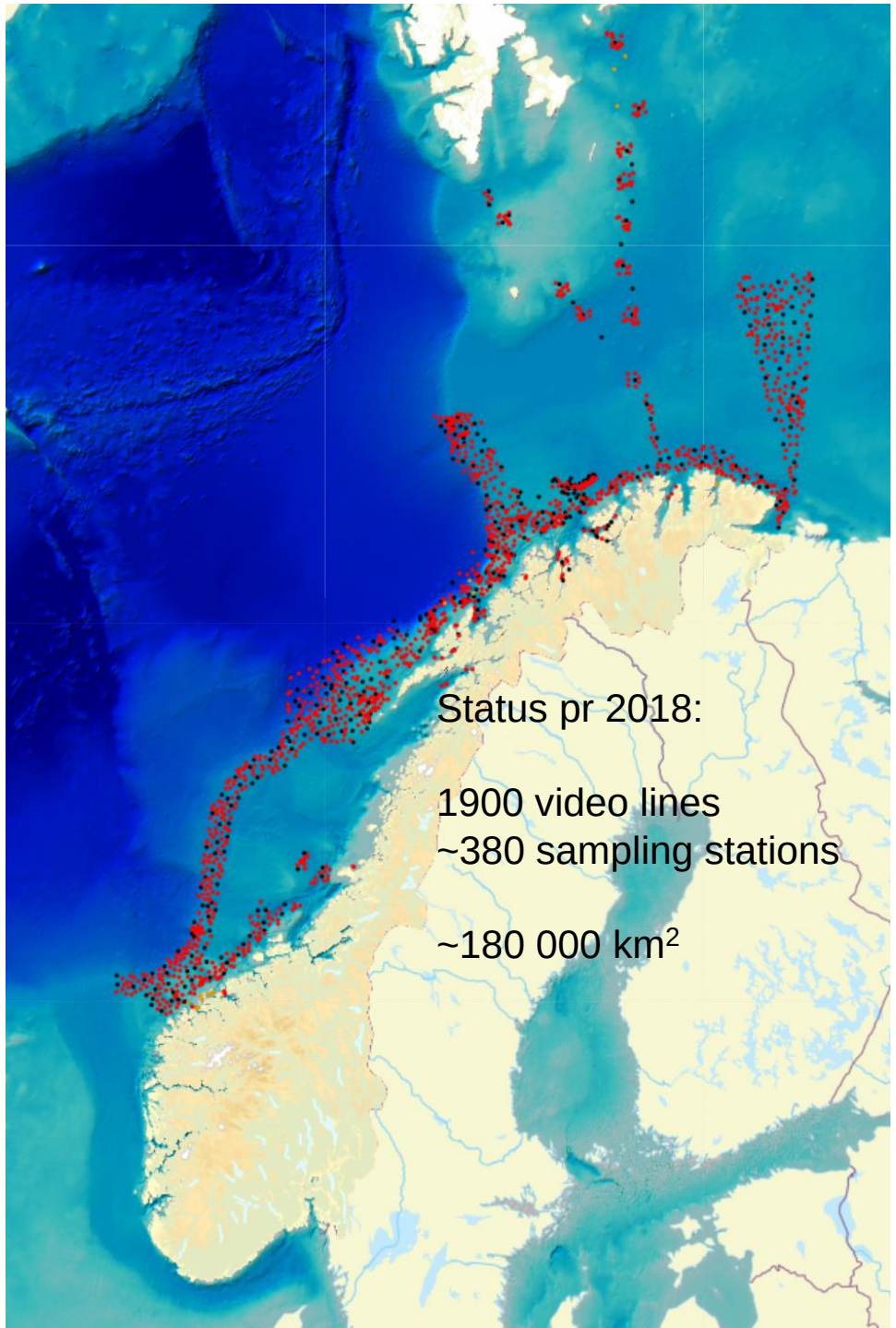

10 video stations and
2 ”sampling-stations” each
1000 km^2

Stratified Random Survey design

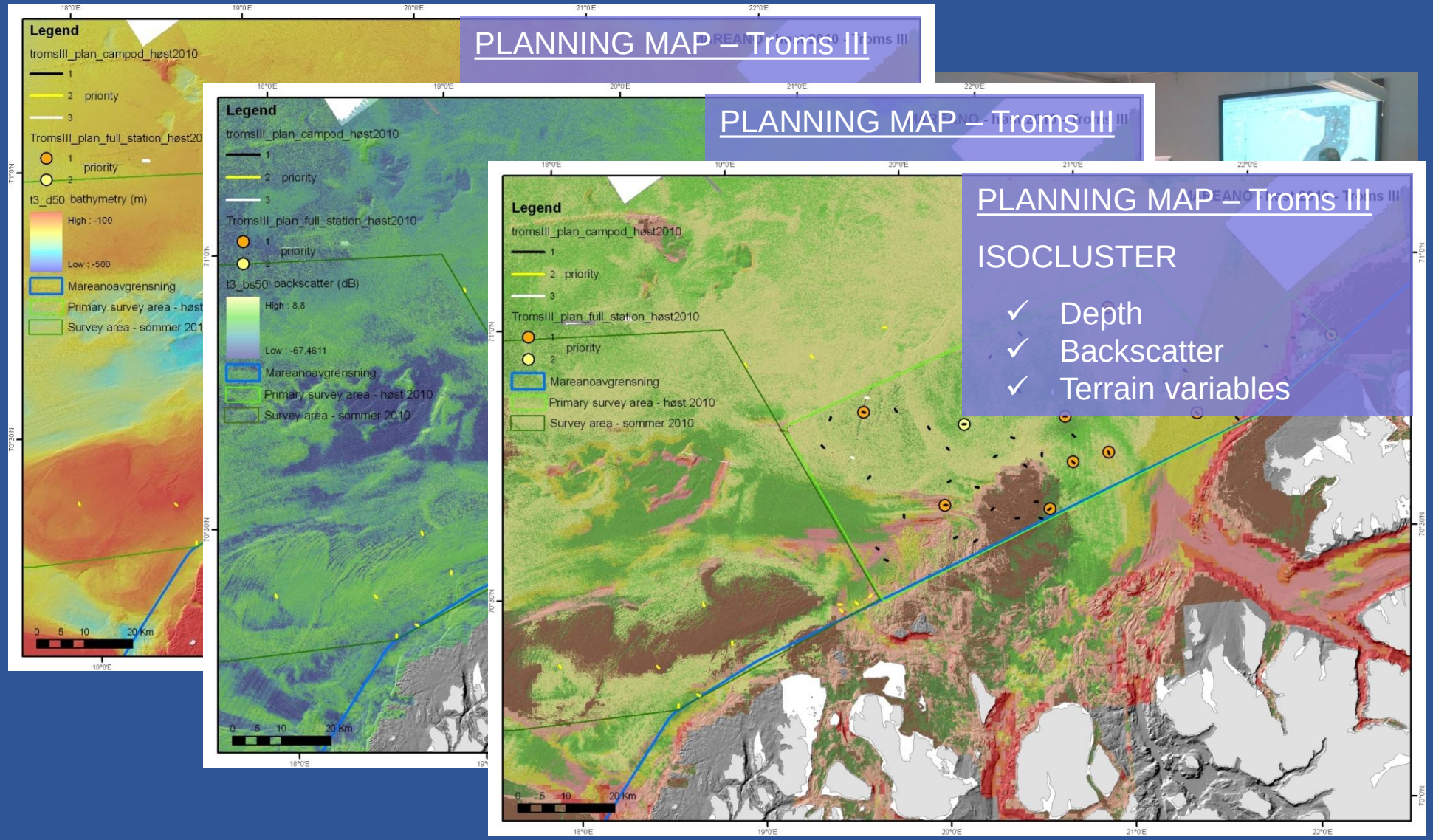
A low proportion of the locations are targeted to ensure coverage of local less common features

✓ Modelling of biotopes between stations

✓ Biologically complementary gears



Selecting sampling localites



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Video platforms
Campod & Chimaera

- Towed /drifted and parked
- 3 video cameras (SD, and HD)
- Hard-disc recording/SSD
- Lights (2x400W HMI, LED)
- Depth sensor, Altimeter
- CTD, Current meter, Turbidity
- Laser scales
- Transponder

Campod

Chimaera

European Standrard EN 16260

Water quality — Visual seabed surveys using remotely operated and/or towed observation gear for collection of environmental data

Table 1 — Recommended minimum quality requirements for the parameters included within pilot surveys, mapping and trend monitoring

Method	Parameter	Pilot survey	Mapping	Trend monitoring
Video transects	Number/distribution	No specific requirements	variable[a]	3 transects
	Total length (per location)	No specific requirements	500 m[b]	500 m[b]
	Average speed over seabed	2 kn	1 kn	1 kn
	Height over seabed (max)	No specific requirements	3 m[c]	3 m[c]
	Image quality[d]			
	Accuracy of positioning ± (m + % of water depth)	20 m + 5 % Start and end	+ 5 %[e] Running positions	+ 5 %[e] Running positions
	Depth recording	Start, end and max., min.	For each position	For each position
Still photo-graphs	Number	1 per 100 m[a]	1 per 30 m[a]	5 per station
	Area	to	to	to
	Image quality[d]			
	Accuracy of positioning ± (m + % of water depth)	+ 5 % For each photo	+ 5 %[e] For each photo	0 (marker on the seabed)
	Depth recording	For each photo	For each photo	For each photo

a Depending on required geographical resolution and the size of the mapping area, see 5.3.

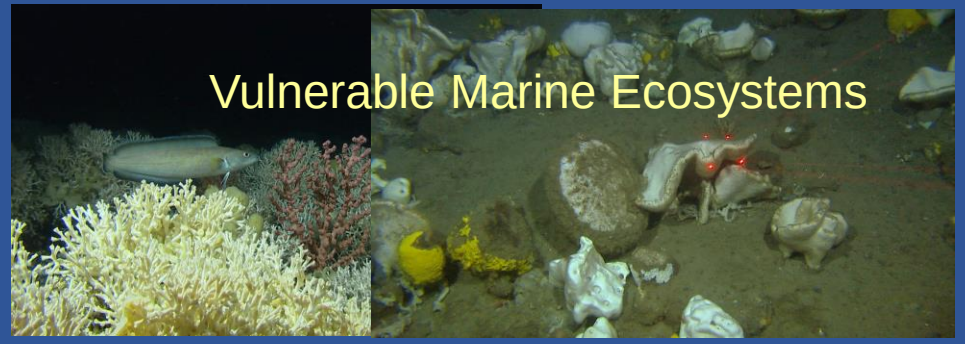
b Only required for investigation of biological diversity.

c For mapping species > 10 cm a greater height from the seabed can be used.

d Image quality is here in the sense of identification of objects/organisms (size of object that can be identified, but not necessarily species determined).

e For depth shallower than 20 m: 3 m + 3 %.

Annotation of video observations in the field



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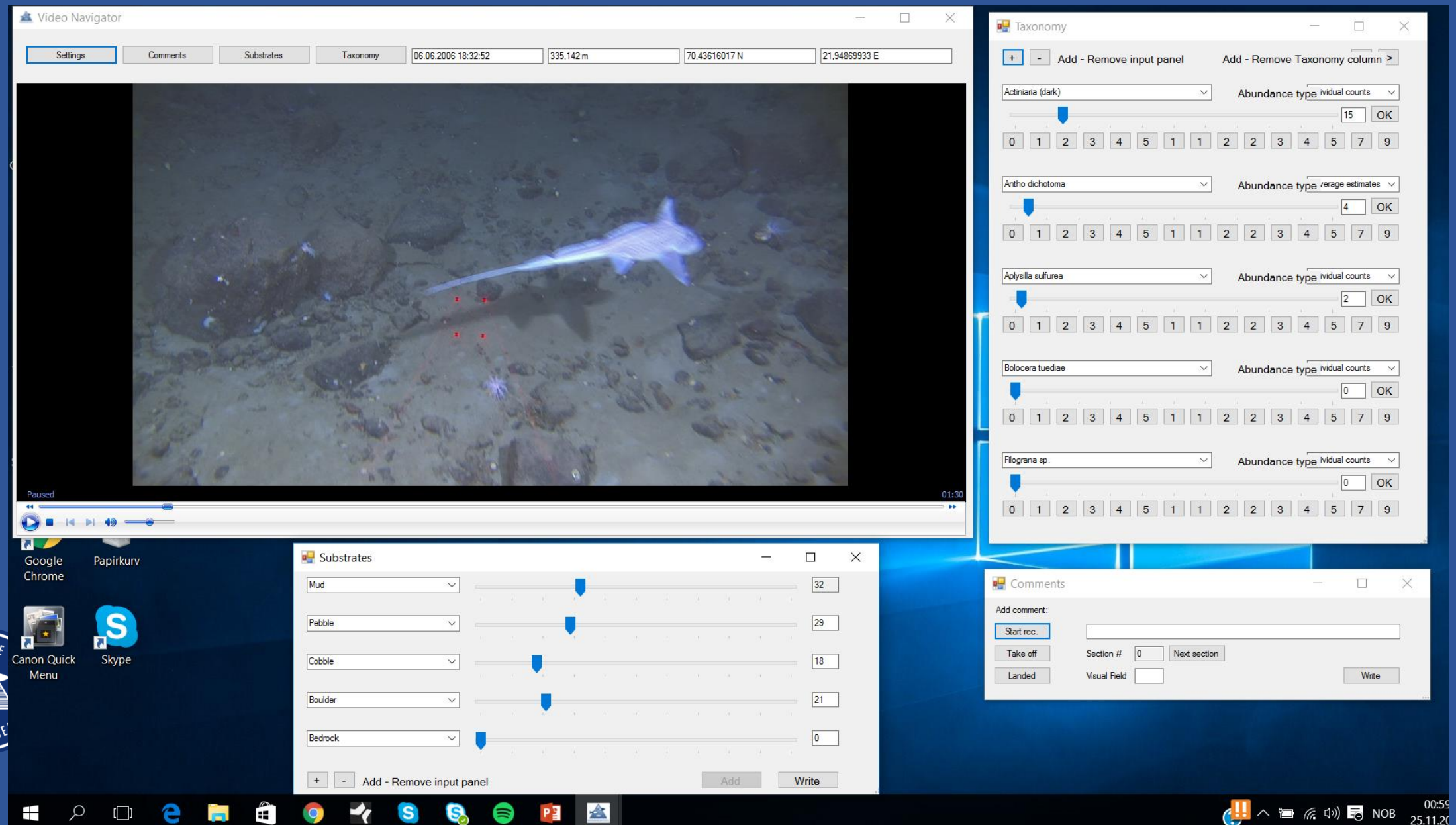
Analysing video-records after cruise

Program: VideoNavigator (HI)



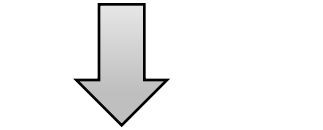
Strategy for characterization and prediction of biotopes

Video-analysis after cruise, registration of all species (taxa) and bottom types

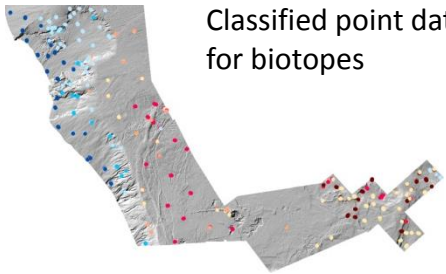
Aggregated video observations (200m)

Multivariate analysis of species composition (DCA) and statistical analysis of biotope-groupings

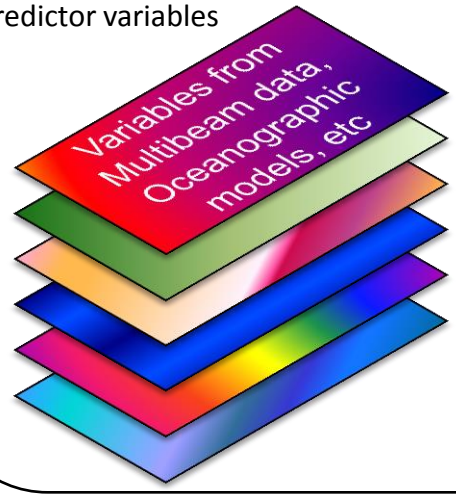
3D analysis and "k-means" clustering



Classified point data for biotopes



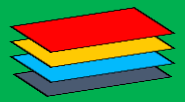
Full-coverage predictor variables



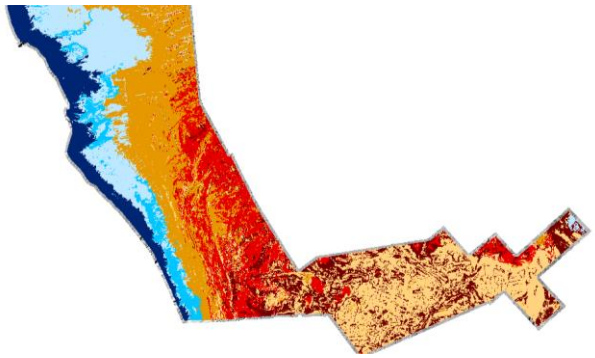
Selection of the strongest and not intercorrelated predictor variables (usin g Forward Selection)

Biotope modeling for each class (MAXENT)

Biotope - models for each class



Construction of maps for each class and description of biotopes



Composit full-coverage biotope-map

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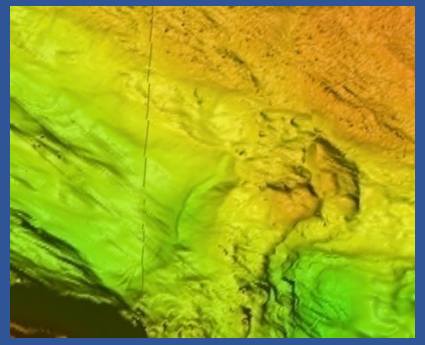
Predictor variables for modeling

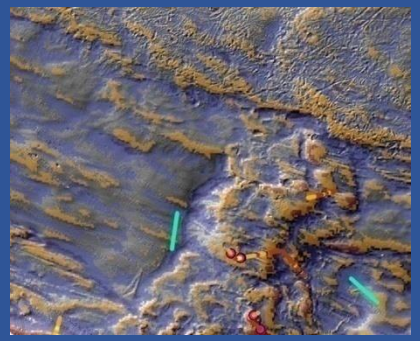
Continuous variables

Variables derived from multibeam echosouder *(fuzzy environmental variables)*

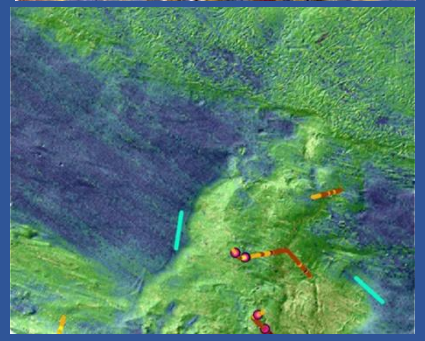
- Depth



- Terrain indexes
(Calculated for different scales):
  - Slope
  - Aspect
  - Curvature
  - Rugosity
  - ++

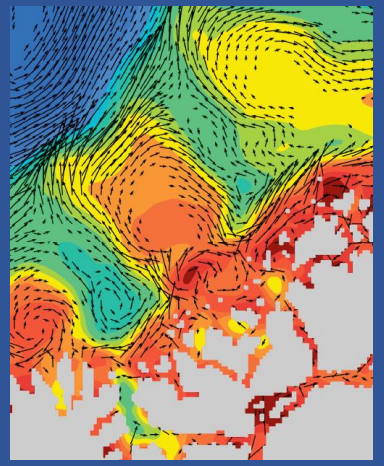


- Backscatter



Modeled oceanography

- Temperature (min, mean, max, std)
- Salinity (min, mean, max, std)
- Currents (mean values for direction and strength)

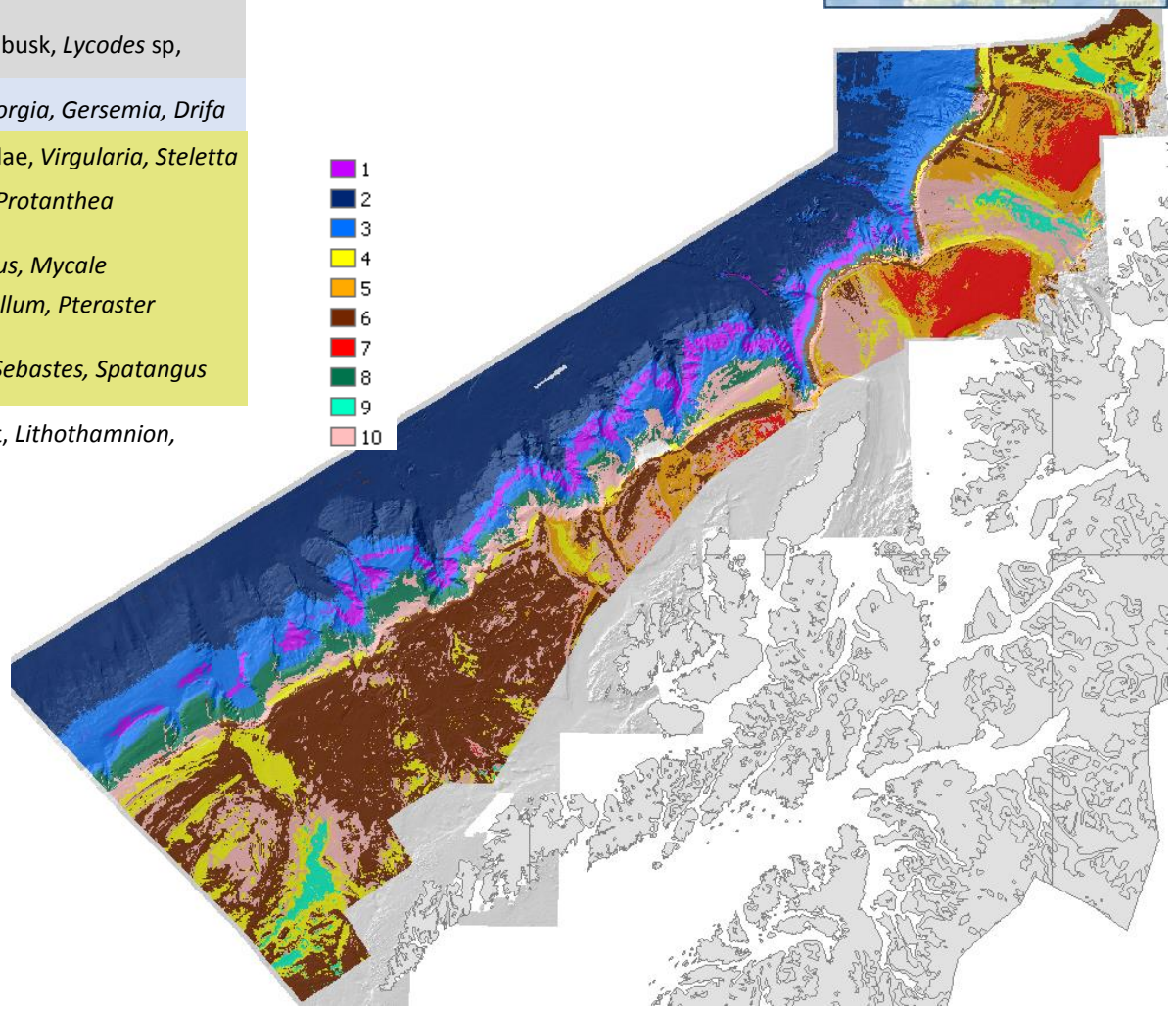


Categorical variables

- Sediment type (interpreted/modeled)
- Marine landscapes (classified terrain)

Characteristics of biotopes off Lofoten:

Biotope	Landscape element	Sediment	Mean depth (m)	Sloping	Typical species
2	Lower slope/Deep-sea plain	Mixed	2114	Moderate	*Bourgueticrinina, Elpidia, Hymenaster, Kolga, Caulophacus*
3	Canyon/steep slope	Mixed	1390	Steep	*Chondrocladia, Lucernaria,* Pycnogonida, *Umbellula, Ophiopleura*
1	Mid slope	Mud	1389	Steep	Nemertini, Actiniaria, Hexactinellida busk, *Lycodes* sp, *Bythocaris*
8	Upper slope	Gravel	747	Steep	*Gorgonocephalus, Crossaster, Paragorgia, Gersemia, Drifa*
9	Marine valley	Mud	290	Flat	*Kophobelemnon, Stichopus,* Pandalidae, *Virgularia, Steletta*
10	Marine valley	Sandy gravel /Coral reef	263	Moderate	*Lophelia, Acesta, Axinella, Primnoa, Protanthea*
6	Shelf plain	Gravel	237	Moderate	*Phakellia, Craniella, Geodia, Stryphnus, Mycale*
4	Shallow marine valley	Sandy mud	221	Moderate	*Asteronyx, Funiculina, Ditrupa, Flabellum, Pteraster*
5	Slope around banks	Sandy gravel	164	Moderate	*Pteraster, Ceramaster, Hippasteria, Sebastes, Spatangus*
7	Shallow banks	Gravel	76	Flat	Gorgonacea, *Filograna,* Tunicata hvit, *Lithothamnion,* Serpulidae



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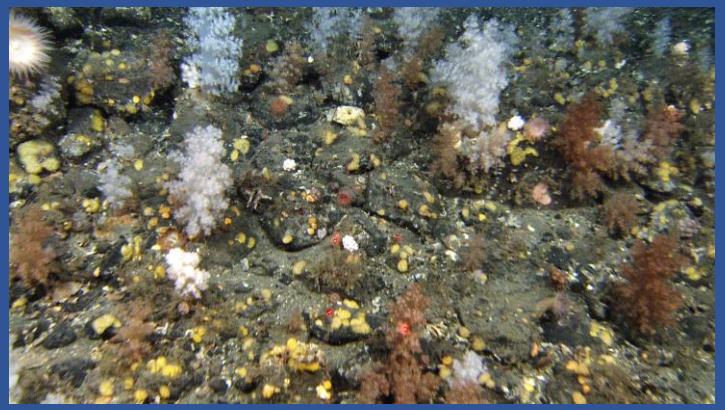
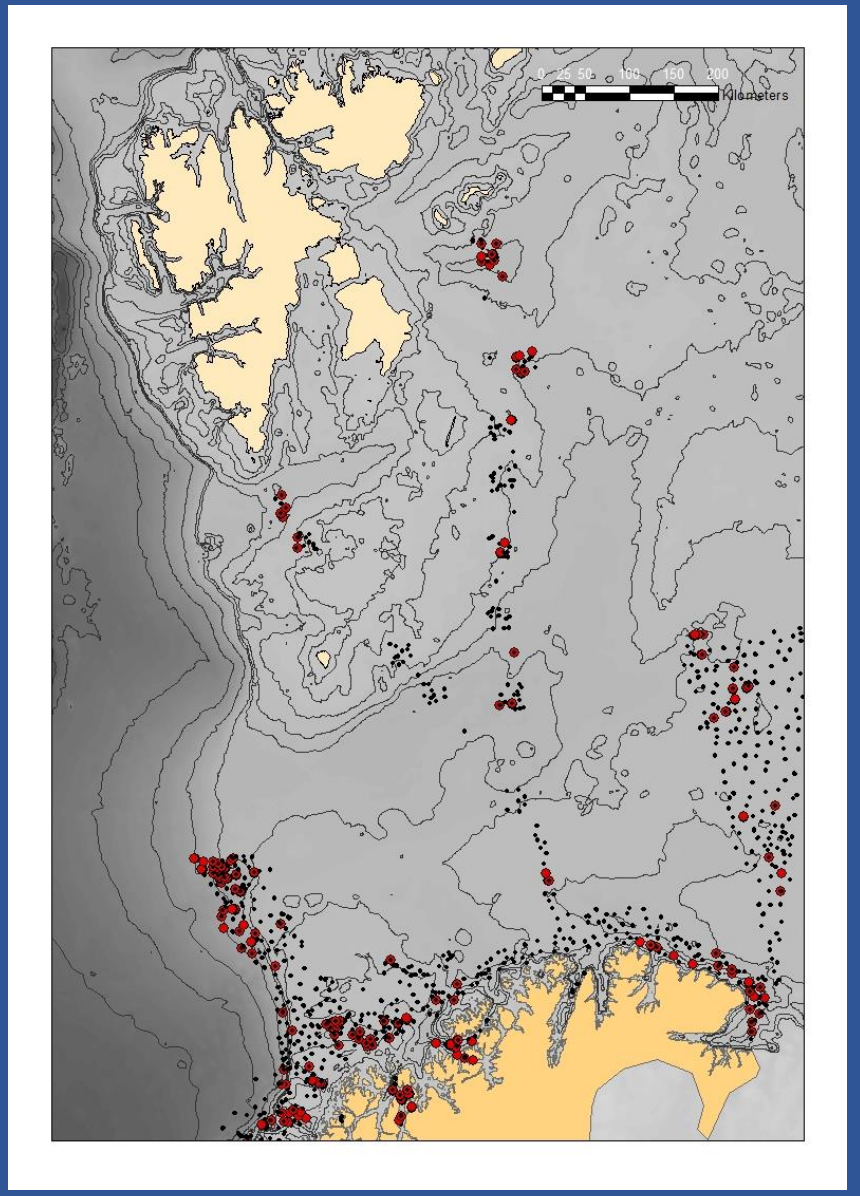
Vulnerable Marine benthic Ecosystems in the Barents Sea

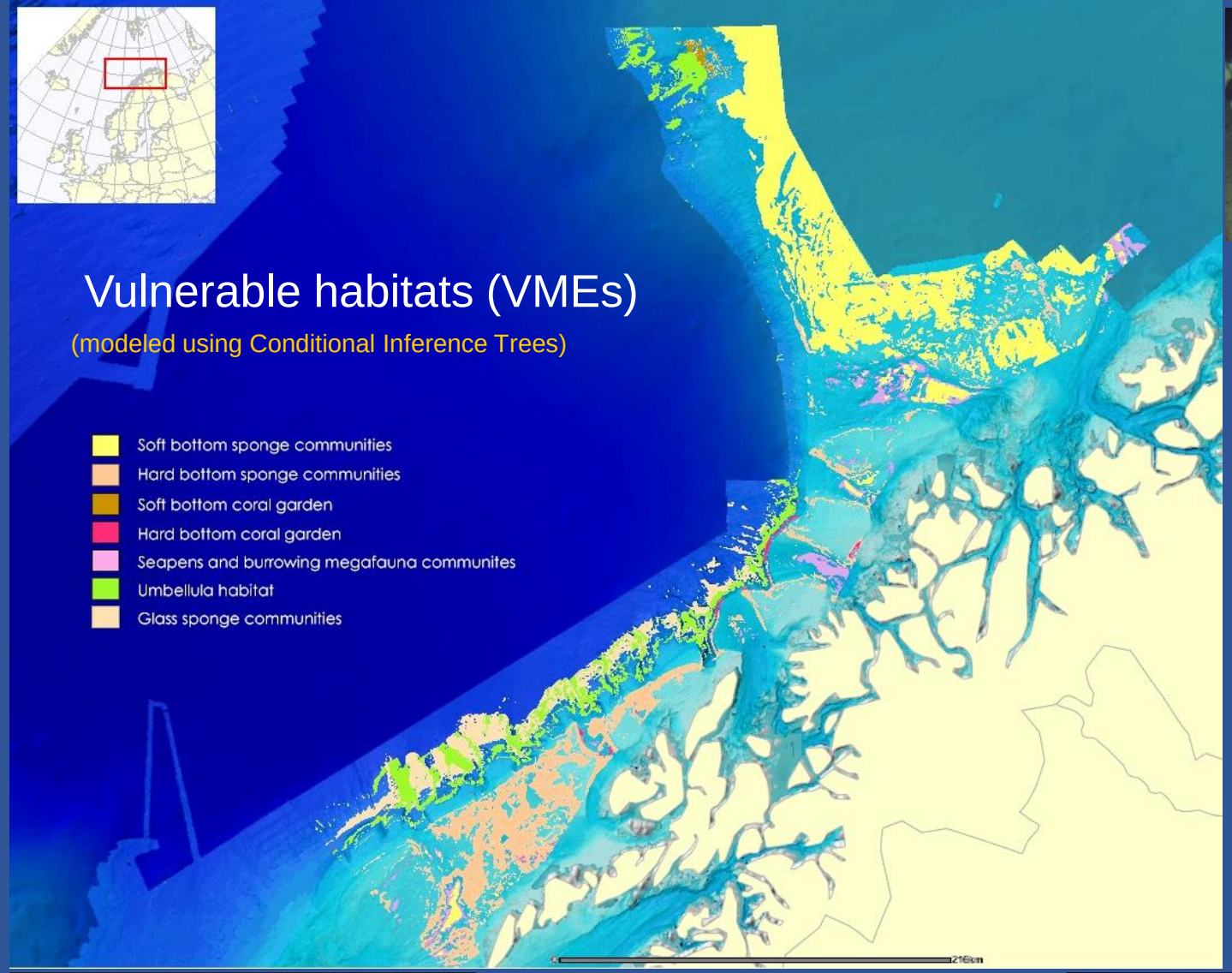


Cauliflower beds
(Unknown sensitivity)

Seapens

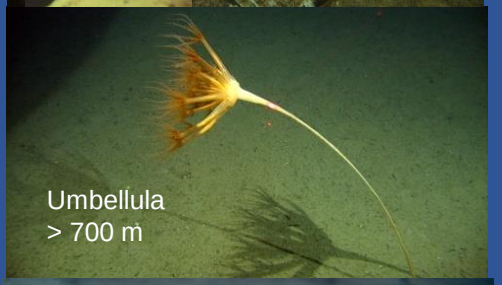


Observed seapens


Vulnerable habitats (VMEs)
(modeled using Conditional Inference Trees)
Soft bottom sponge communities
Hard bottom sponge communities
Soft bottom coral garden
Hard bottom coral garden
Seapens and burrowing megafauna communites
Umbellula habitat
Glass sponge communities


Softbottom sponge communities

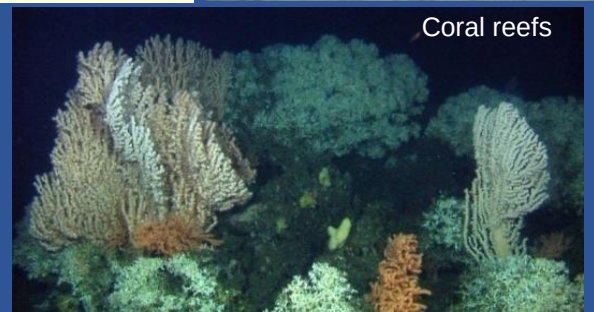

Glass sponge communities


Umbellula
> 700 m


Sea pen


Softbottom coral garden

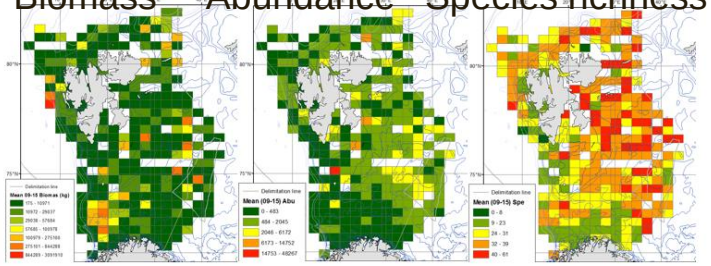

Hardbottom coral gardens


Coral reefs

Existing benthic indicators of health status, climate change effects, and antropogenic impact

1. Distribution of russian king crab

Biomass Abundance Species richness

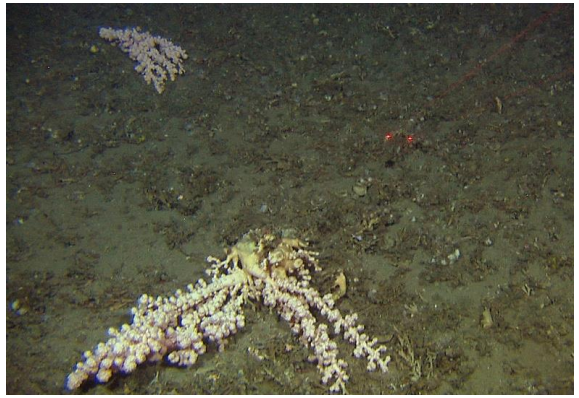


2. Benthos in the Barents Sea

Coral reefs, gorgonians and sponges

3. Coverage of live coral tissue

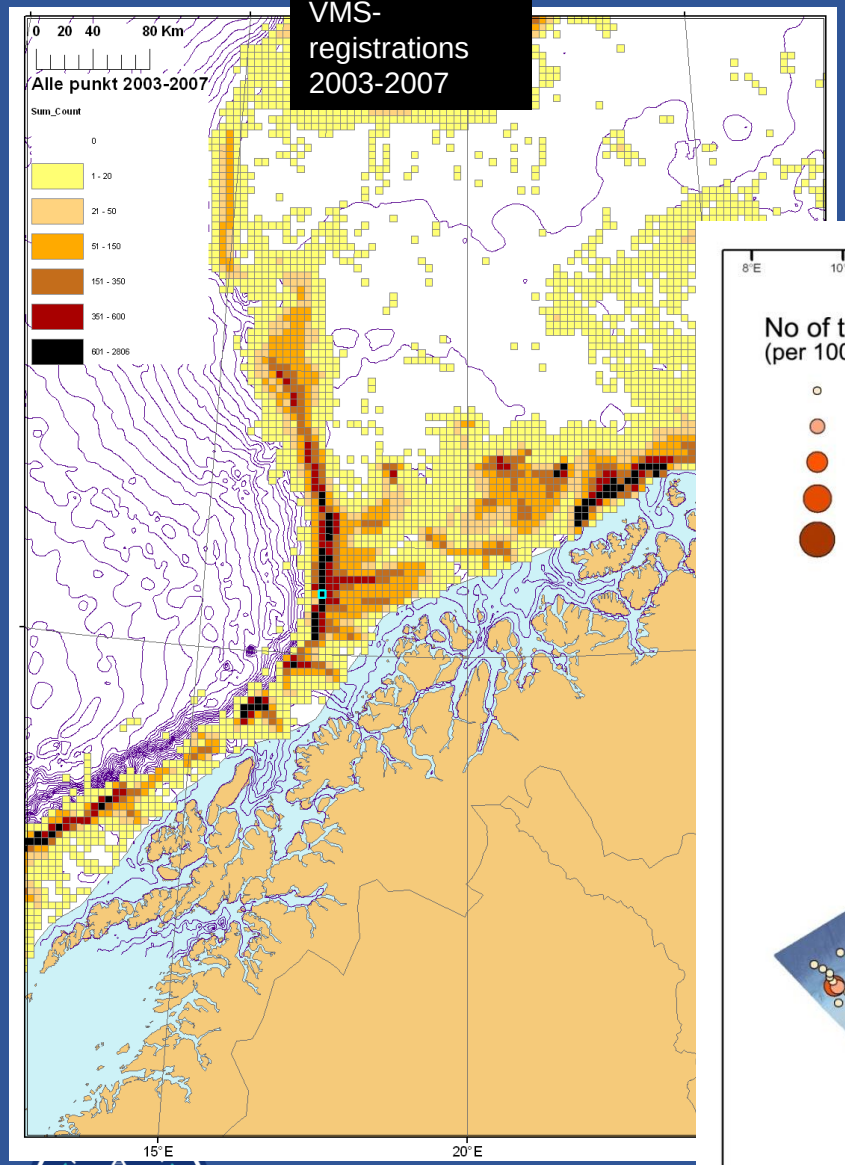
4. Occurrence of damaged corals

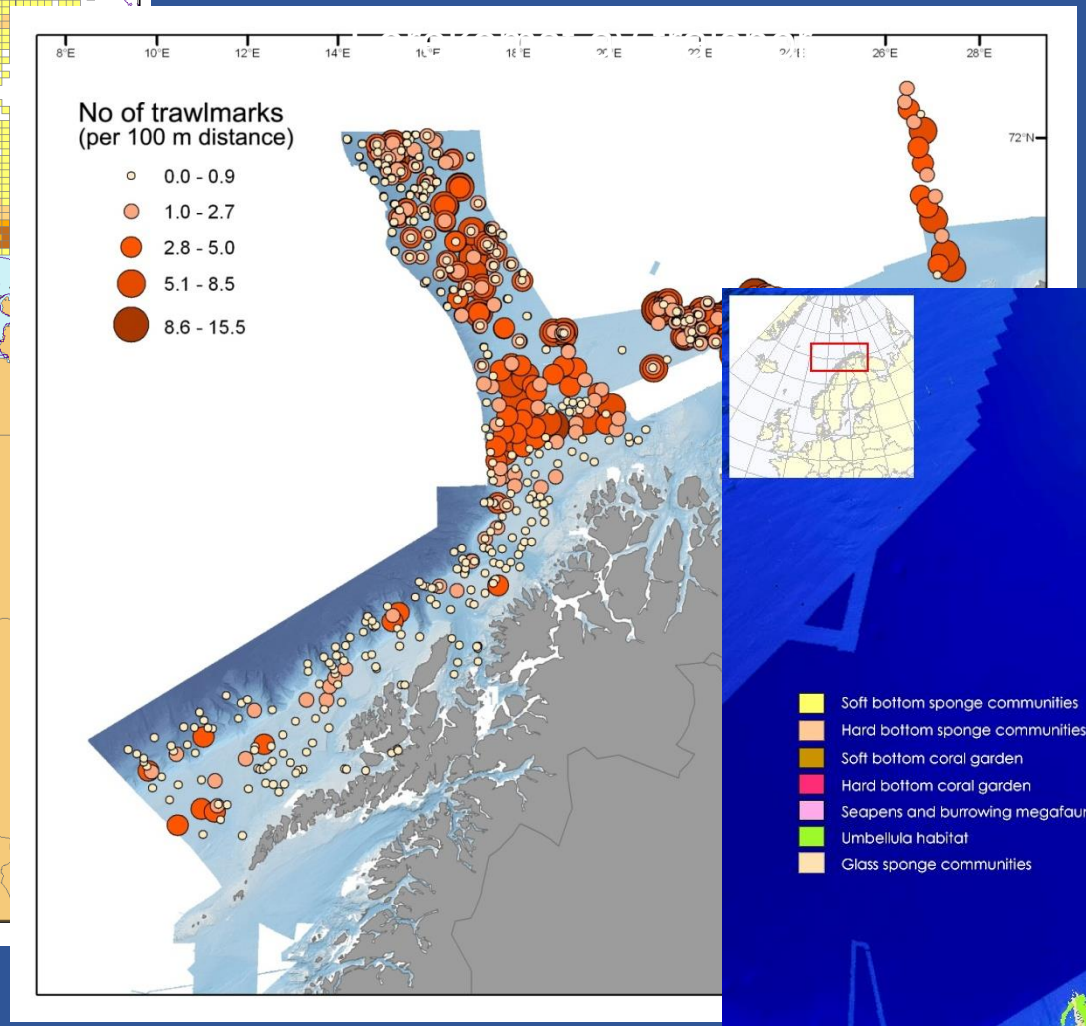


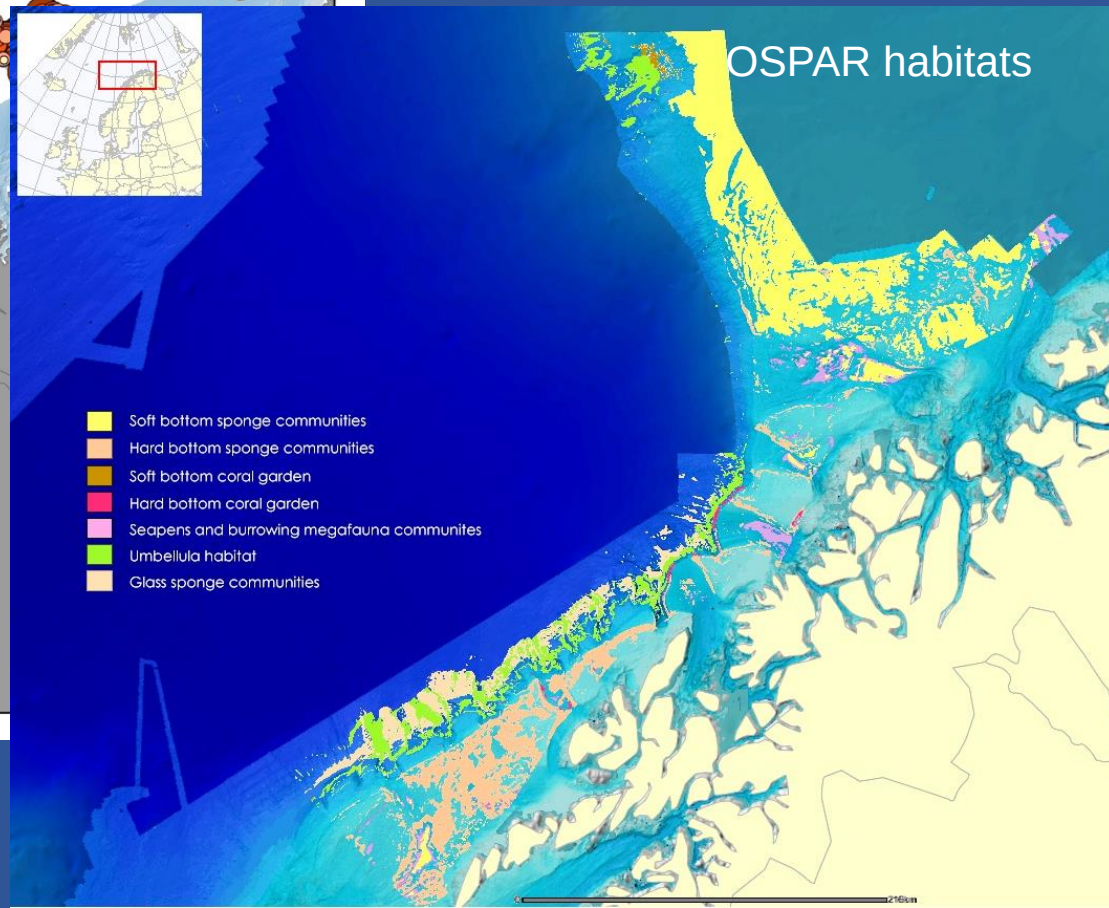
5. Density of colonies (sponges and gorgonians)

Indicators 2-5: still under development
Monitoring not established for 3-5

Maps for conservation and management of human activities







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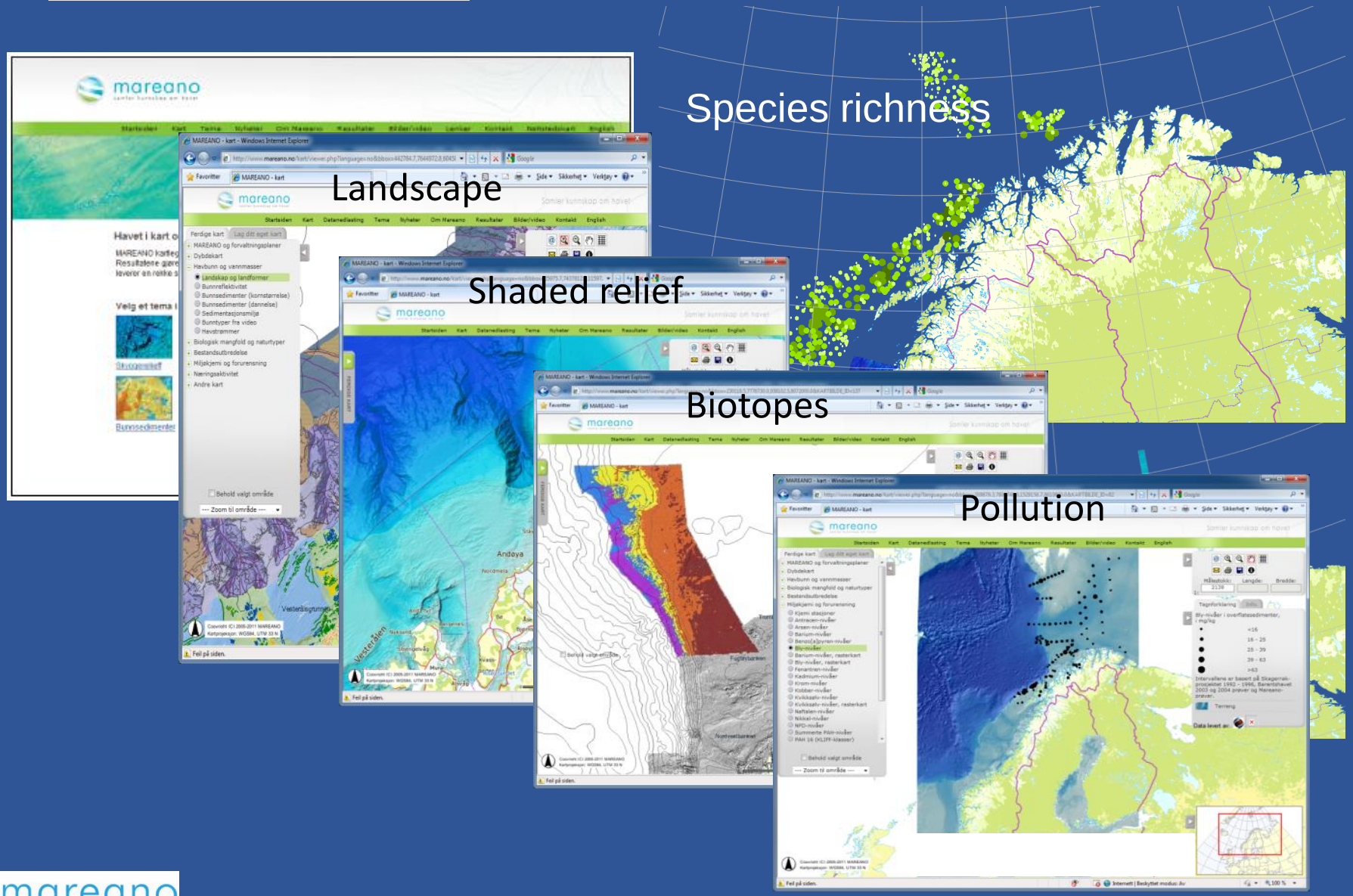

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Trawling impact on megabenthos and sediment in the Barents Sea: use of satellite tracking and video

ICES Journal of Marine Science Advance Access published November 10, 2015

ICES Journal of Marine Science

ICES International Council for the Exploration of the Sea
CIEM Conseil International pour l'Exploration de la Mer

Volume 73 Supplement 1 January 2016, Scientific Symposium: June 16–19, 2014,
“ Effects of Fishing on Benthic Fauna, Habitat and Ecosystem Function”

Trawling disturbance on megabenthos and sediment in the Barents Sea: chronic effects on density, diversity, and composition

Lene Buhl-Mortensen[1]*, Kari E. Ellingsen[2], Pål Buhl-Mortensen[1], Kristian L. Skaar[1,3], and Genoveva Gonzalez-Mirelis[1]

[1]*Institute of Marine Research, PB 1870 Nordnes, N-5817 Bergen, Norway*
[2]*Norwegian Institute for Nature Research—NINA, Fram Centre, PO Box 6606 Langnes, 9296 Tromsø, Norway*
[3]*Directorate of Fisheries, PB 185 Sentrum, N-5804 Bergen, Norway*

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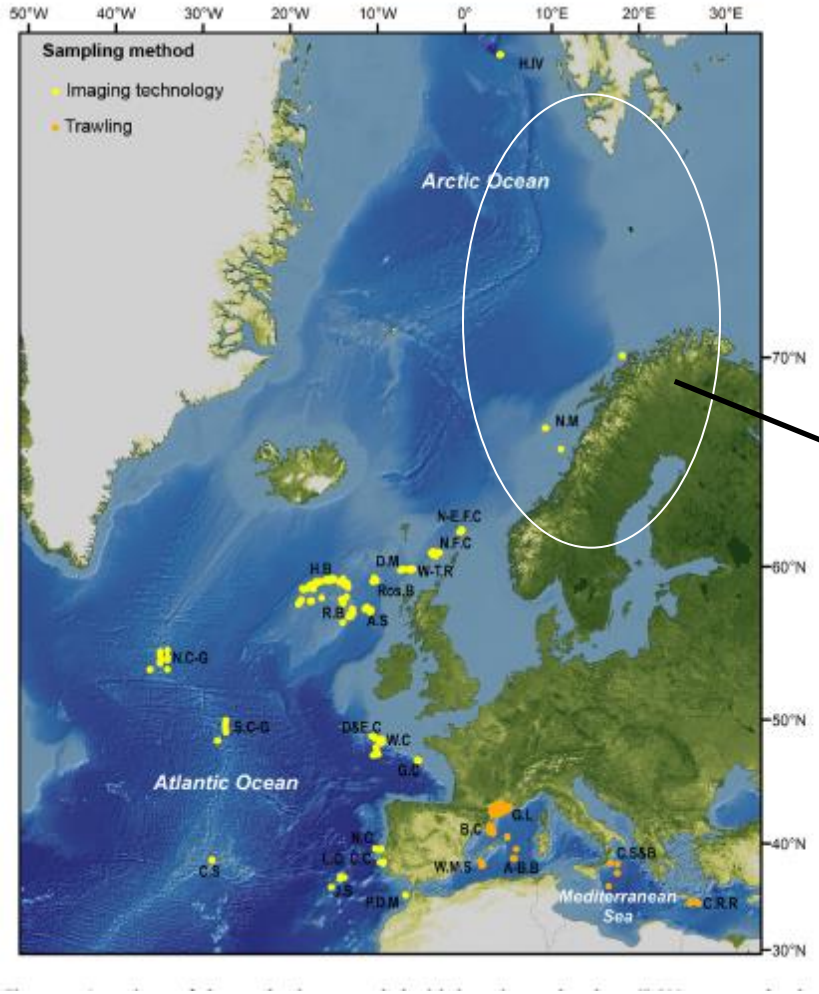


1999-2011, 32 location
374 videos and 214 trawls

Marine Pollution Bulletin xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

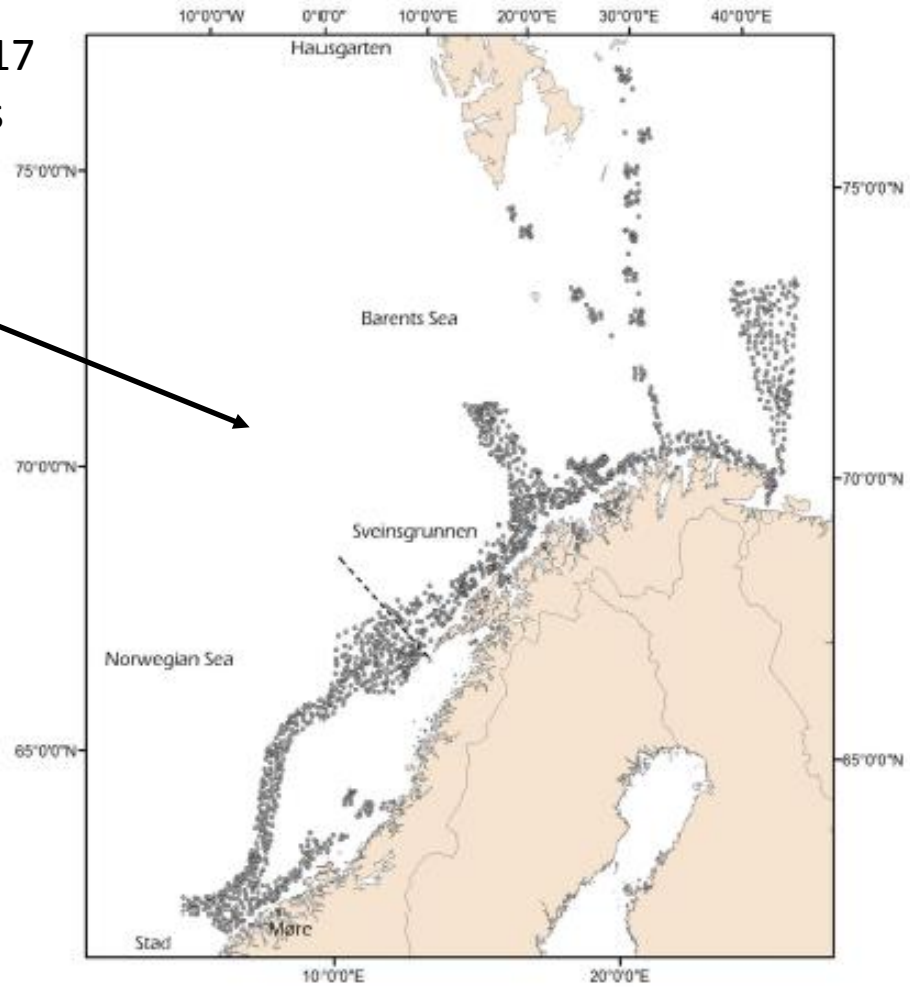
Marine litter in the Nordic Seas: Distribution composition and abundance

Lene Buhl-Mortensen*, Pål Buhl-Mortensen

Institute of Marine Research (IMR), Nordnesgaten 50, 1005 Bergen, Norway

http://dx.doi.org/10.1016/j.marpolbul.2017.08.048

Mareano data 2006-17
1778 video transects



Pham et al. 2014

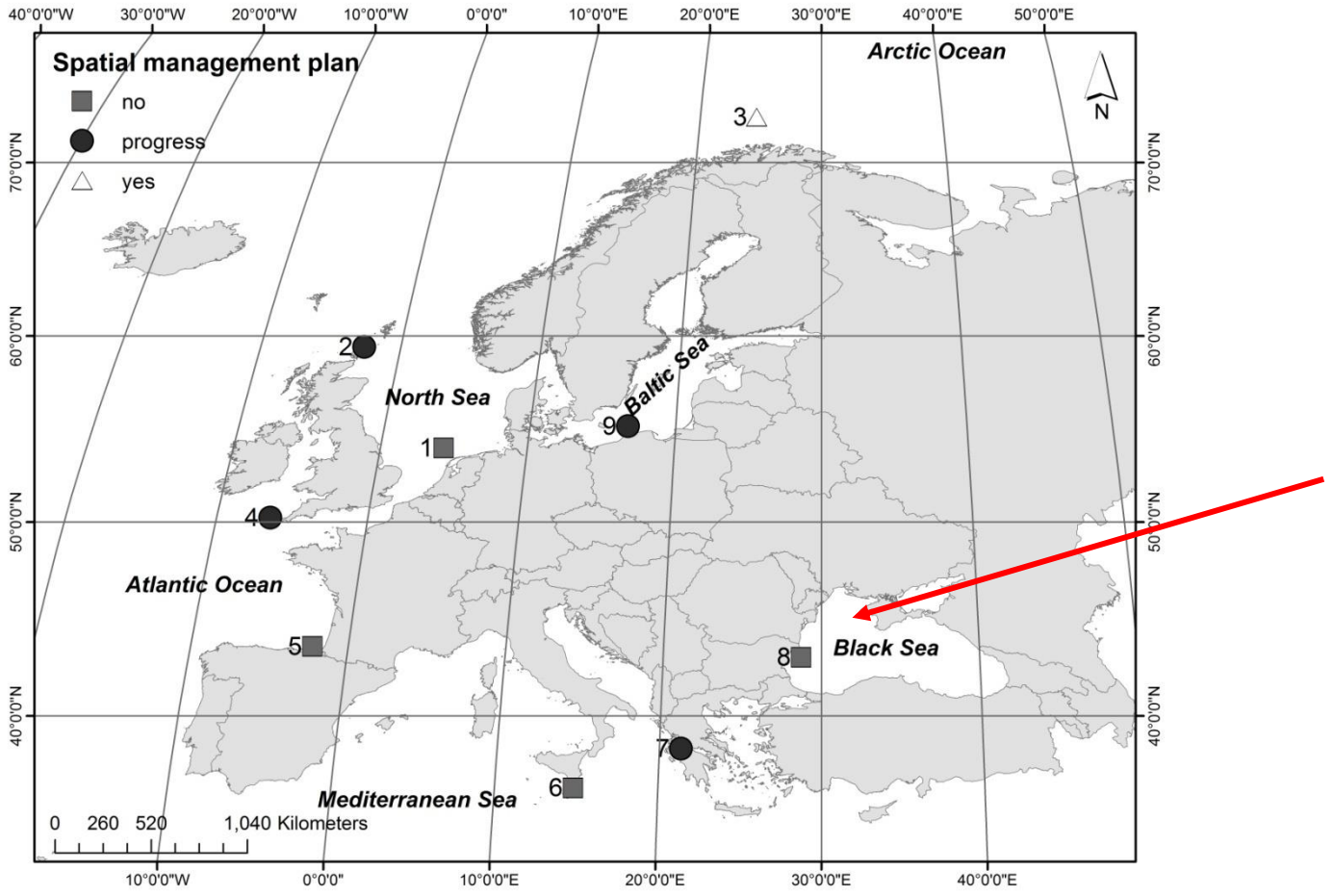
OPEN ACCESS Freely available online

PLOS ONE

Marine Litter Distribution and Density in European Seas, from the Shelves to Deep Basins

Christopher K. Pham[1,2]*, Eva Ramirez-Llodra[3,4], Claudia H. S. Alt[5], Teresa Amaro[6], Melanie Bergmann[7], Miquel Canals[8], Joan B. Company[3], Jaime Davies[9], Gerard Duineveld[10], François Galgani[11], Kerry L. Howell[9], Veerle A. I. Huvenne[12], Eduardo Isidro[1,2], Daniel O. B. Jones[12], Galderic Lastras[8], Telmo Morato[1,2], José Nuno Gomes-Pereira[1,2], Autun Purser[13], Heather Stewart[14], Inês Tojeira[15], Xavier Tubau[8], David Van Rooij[16], Paul A. Tyler[5]

MESMA – EU Project 2009-2013: Developing tools for spatial management



Mapping for spatial planning: Lessons from MESMA EU-project

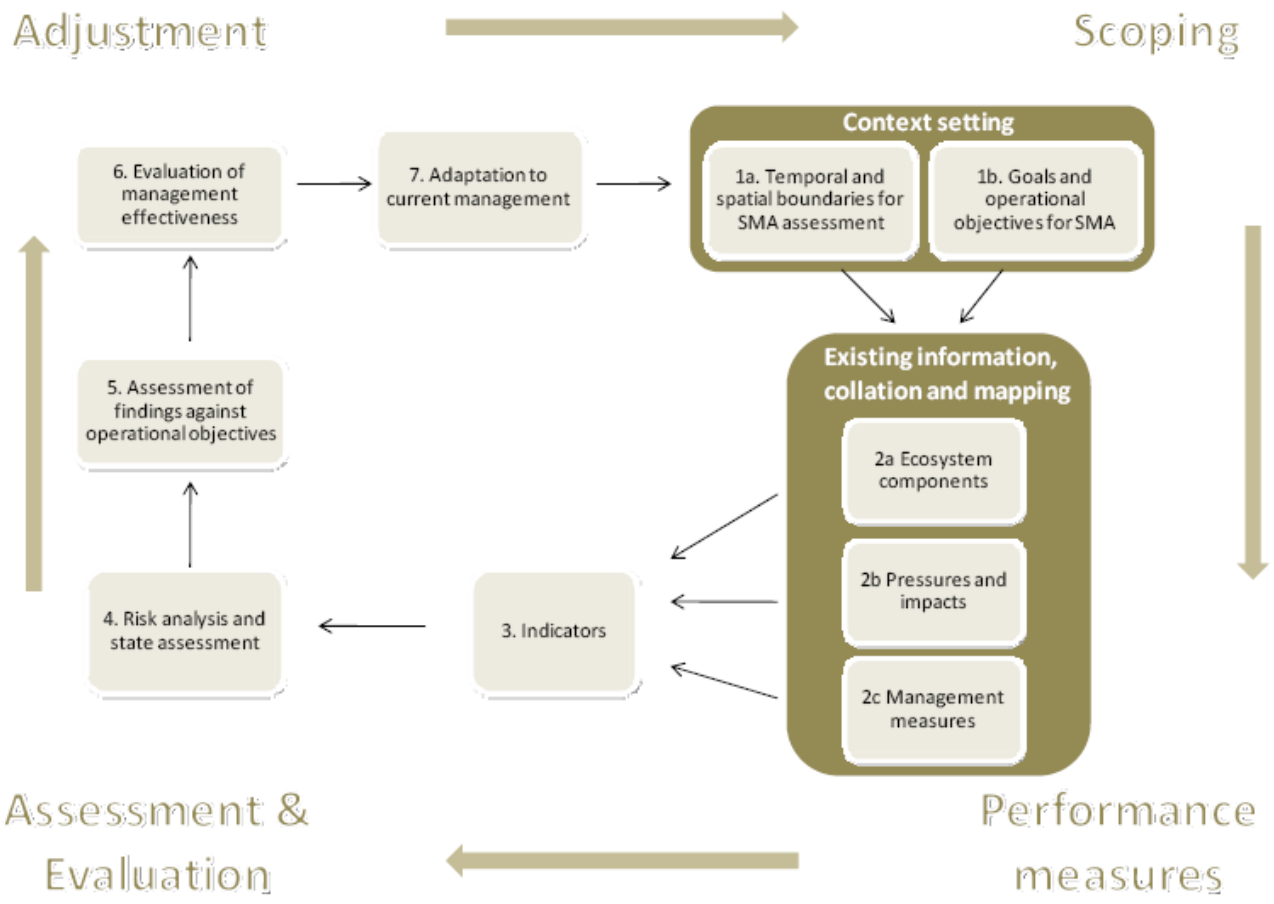


Figure 1: **Proposed MESMA framework outlined in detail in D2.1**

Marine Policy 37 (2013) 149–164

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journal homepage: www.elsevier.com/locate/marpol

Monitoring and evaluation of spatially managed areas: A generic framework for implementation of ecosystem based marine management and its application

Vanessa Stelzenmüller [a,*], Patricia Breen [b], Tammy Stamford [b], Frank Thomsen [b], Fabio Badalamenti [c], Ángel Borja [d], Lene Buhl-Mortensen [e], Julia Carlstöm [f], Giovanni D'Anna [c], Norbert Dankers [g], Steven Degraer [h], Mike Dujin [i], Fabio Fiorentino [c], Ibon Galparsoro [d], Sylvaine Giakoumi [l], Michele Gristina [c], Kate Johnson [j], Peter J.S. Jones [k], Stelios Katsanevakis [l], Leyla Knittweis [m], Zacharoula Kyriazi [n], Carlo Pipitone [c], Joanna Piwowarczyk [o], Marijn Rabaut [n], Thomas K. Sørensen [p], Jan van Dalfsen [q], Vassiliki Vassilopoulou [l], Tomás Vega Fernández [c], Magda Vincx [n], Sandra Vöge [r], Anke Weber [s], Nicklas Wijkmark [f], Robbert Jak [g], Wanfei Qiu [k], Remment ter Hofstede [g]

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Marine Policy ∎ (∎∎∎∎) ∎∎∎–∎∎∎

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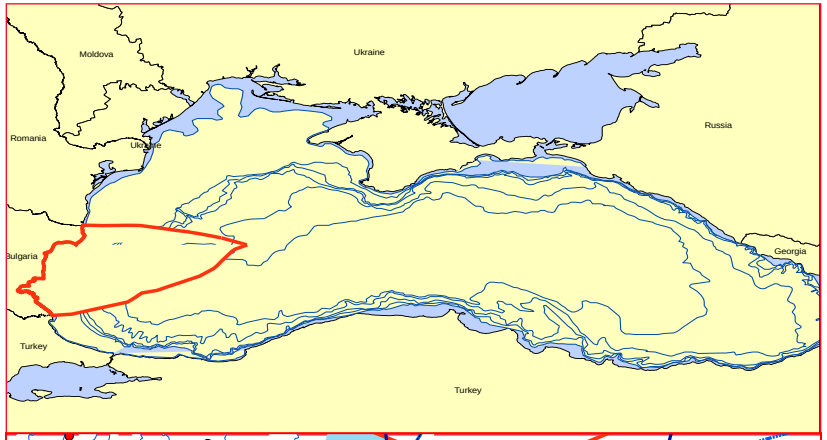
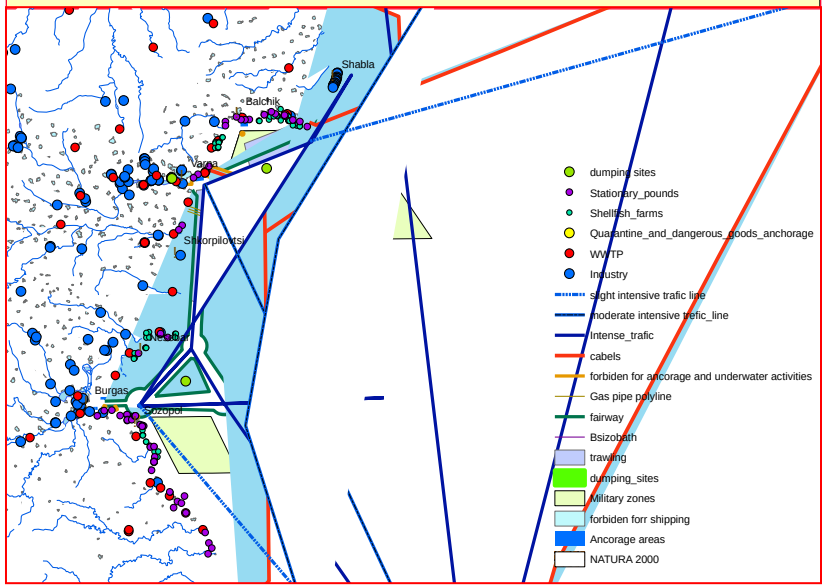
journal homepage: www.elsevier.com/locate/marpol

Maritime ecosystem-based management in practice: Lessons learned from the application of a generic spatial planning framework in Europe

Lene Buhl-Mortensen [a,*], Ibon Galparsoro [b], Tomás Vega Fernández [c,d], Kate Johnson [e], Giovanni D'Anna [c], Fabio Badalamenti [c], Germana Garofalo [d], Julia Carlström [f], Joanna Piwowarczyk [g], Marijn Rabaut [h], Jan Vanaverbeke [h,i], Cor Schipper [j], Jan van Dalfsen [j], Vassiliki Vassilopoulou [k], Yiannis Issaris [k], Luc van Hoof [l], Ellen Pecceu [m], Kris Hostens [m], Marie Louise Pace [n], Leyla Knittweis [o], Vanessa Stelzenmüller [p], Valentina Todorova [q], Valentina Doncheva [q]



The Black Sea with the Bulgarian EEZ.



Pressures identified in the marine coastal area of the Bulgarian Black Sea

The Bulgarian Black Sea River Basin Monitoring Program (BSRBMP) and Black Sea Integrated Monitoring and Assessment Program (BSIMAP):

The Black Sea drains a catchment five times more extensive than the sea area, containing 16 countries, receiving waste water from more than 100 million people, which makes it very sensitive to distant anthropogenic activities.

Valentina Todorova and Valentina Doncheva, Institute of Oceanology – Bulgarian Academy of Sciences.

The BSC aimd to:
recommend the creation of processes that will stimulate the development of maritime activities, focusing on cross-border issues and benefiting strongly from Marine Spatial Planning (MSP) in a way compatible with the good environmental status of the seas as laid down in the Marine Strategy Framework Directive (MSFD).

Within this regional context the Black Sea case study in MESMA is dealing with the Bulgarian marine coastal waters.

The MESMA Framework was used to analyse the effectiveness of the existing Black Sea River Basin Management Plan (BSRBMP) meant to implement mainly the WFD at the national level of Bulgaria.

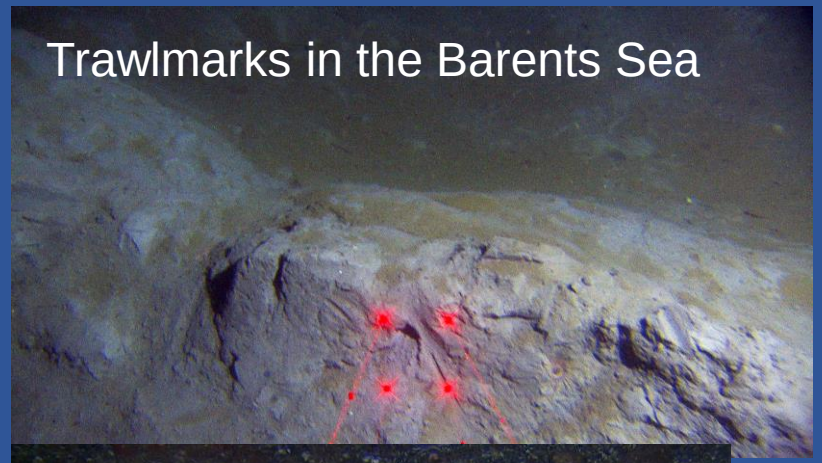
Knowledge on marine habitats and species is lacking in most areas, and abiotic proxies are not sufficient.

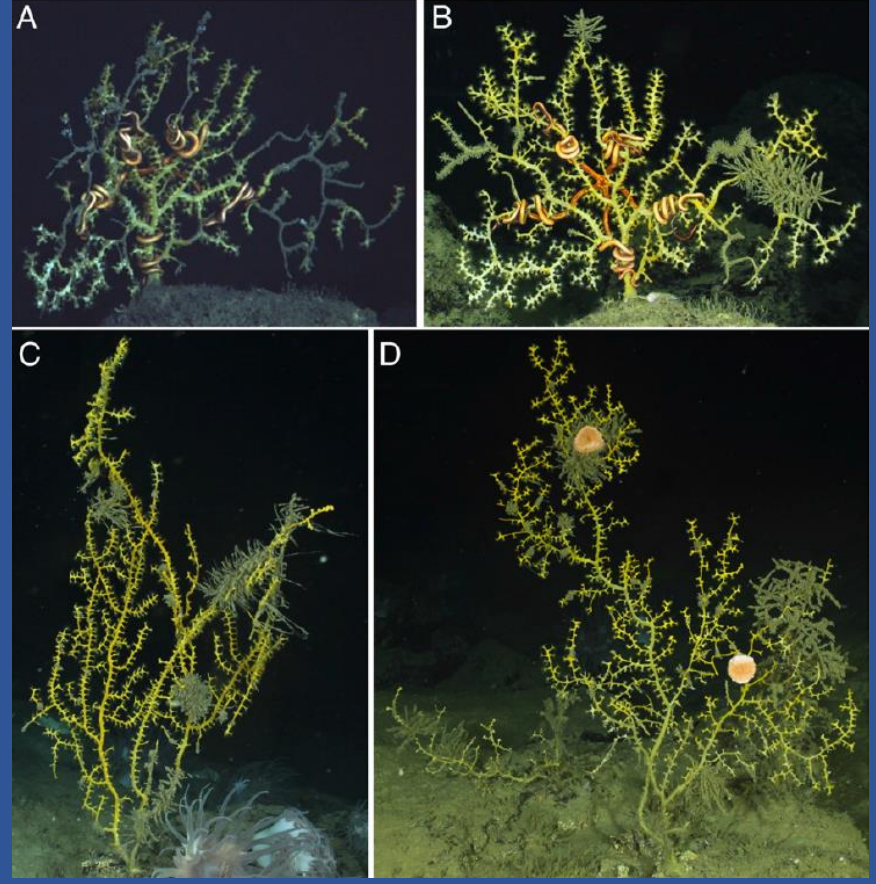
Management entities on all levels need to be identified and there is no correct answer.

Experience from MAREANO shows that megafauna defined biotopes as main management entity is promising. Other fauna groups are documented with relevant gears to cover the full range of diversity, production and functionality within the biotope.

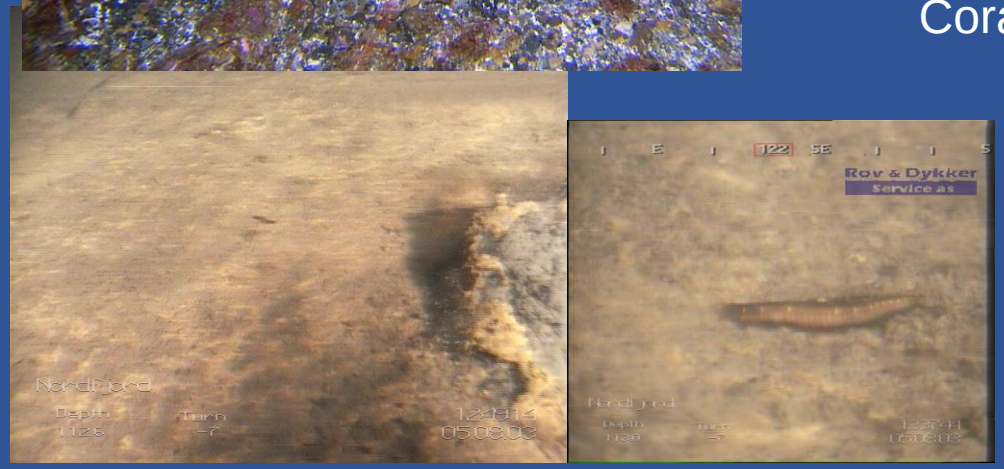
Monitoring health of megafauna by video in biotopes is likely sufficient to indicate if changes has occurred and if further sampling is needed to document changes on all fauna levels.

The focus on easily observed larger fauna is also relevant for increased knowledge of pressure specific response and resilience of the benthos.





Coral health after Deepwater Horizon blowout



Beggiatoa mats in hypoxic fjord basin

Marine snott from plankton bloom