

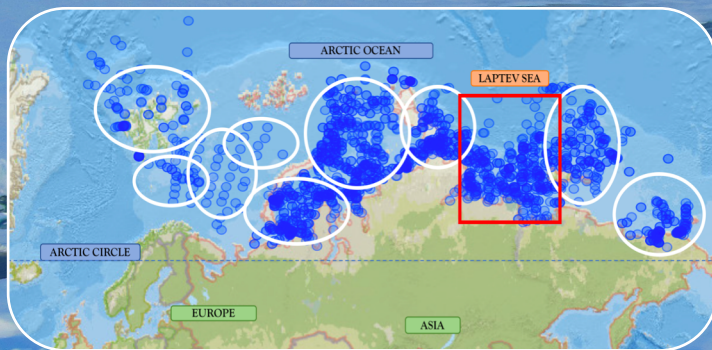
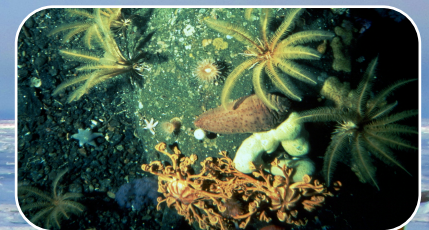
Spatial Variation in Distributional Patterns of Arctic Benthic Biodiversity



Miriam L. S. Hansen (mhansen@ecology.uni-kiel.de)¹, Casper Kraan^{2,3}, Dieter Piepenburg^{1,2,3}

Background

Marine benthic organisms living in shelf seas of the Siberian Arctic are impacted severely by the pronounced consequences of climate change. Polar ecosystems are used to stable conditions and even small changes could influence benthic communities, food webs, and ecosystem functions. Regional patterns in community composition result from the interaction between marine organisms and their local environment. In this study, these relationships are investigated in order to understand how climate change affect Arctic biodiversity in particular.



Data

Biotic

Panarctic Biota "Panabio" Databank

- 1800 – 2014
- 10322 samples
- 49 regions
- 2746 species



- 1992 – 2014
- 228 samples
- 10 regions
- 412 species

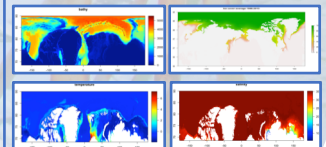
Example species:
Stegophiura nodosa;
Ampelisca macrocephala;
Acanthostepheia malmgrenii;
Cyllichna alba



Abiotic

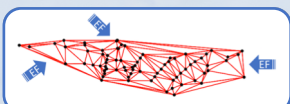
Public Online Databases

- Bathymetry: IBCAO
- Sea ice cover: NSIDC
- Temperature: NOAA WOA 2018
- Salinity: NOAA WOA 2018



Approach

- Modelling the regional distribution and composition of Arctic biota
- Identification of spatial scales and influencing environmental factors (EF)
- Multivariate modelling techniques, e.g. Moran's eigenvector mapping (MEM)



Connectivity matrix „Delaunay triangulation“ of Barents Sea

Limitations

- "Zero-Problem": Siberian Arctic biota display low occurrences
- Data transformations solved nothing
- Result: insignificant data outputs

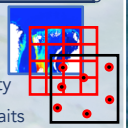
Brandt-Schiff	variables	order	R2	R2Cum	AkaiC2Cum	F	sig
environ.	bat	5	0.14131599	0.141316	0.1375165	38.193443	0.0001
data	sea_ice_mean	1	0.02774553	0.1690615	0.1616754	7.5126	0.005
	sea_ice_max	4	0.03014965	0.1992112	0.1884863	8.493588	0.0001
	sea_ice_sd	2	0.04133085	0.240512	0.2268889	12.126709	0.0001
	sea_ice_min	3	0.0286493	0.2691611	0.2527008	8.702466	0.0002
	bat_squared	6	0.01402276	0.2831839	0.2637228	4.323327	0.0073

Example: significant data output of environmental factors

Alternative

➔ MaxEnt - Maximum Entropy distribution modelling

- Modelling species distribution from presence-only records
- Contrasting species presences against background locations with unknown p/a → absences allow the prediction of presence probability
- Input: presence-only; environmental factors; landscape; ecological traits
- Output: Relative Occurrence Rate; biodiversity hotspots and coldspots; trait relevance important for species composition



¹ Christian Albrecht University of Kiel (CAU)

² Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI)

³ Helmholtz Institute for Functional Marine Biodiversity at the University of Oldenburg (HIFMB)