

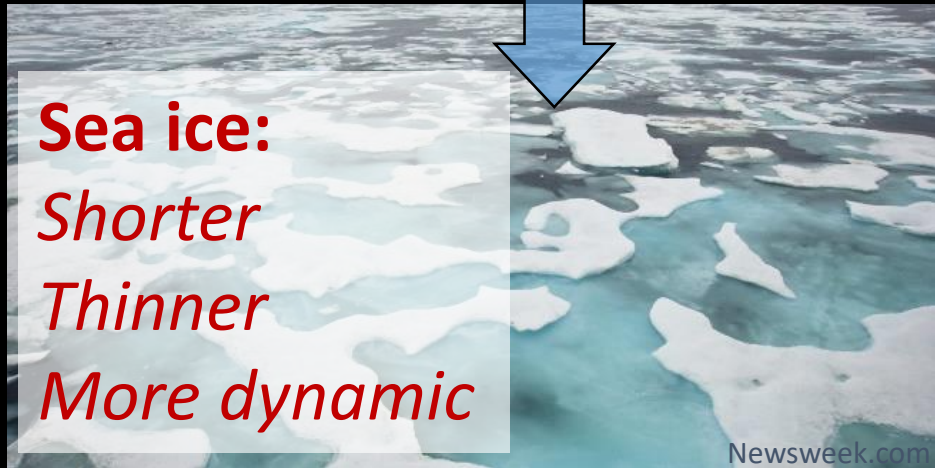
New findings on zooplankton and fish in the Central Arctic Ocean



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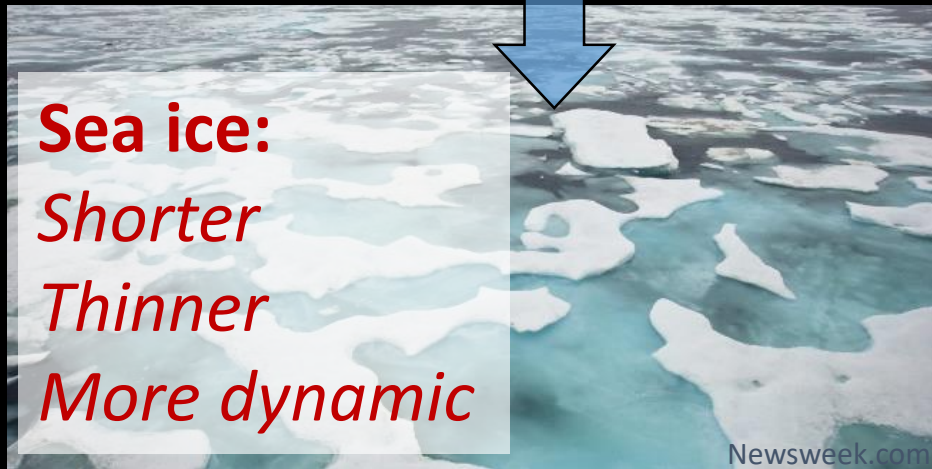
Rapid change of Arctic Ocean and sea ice



Rapid change of Arctic Ocean and sea ice

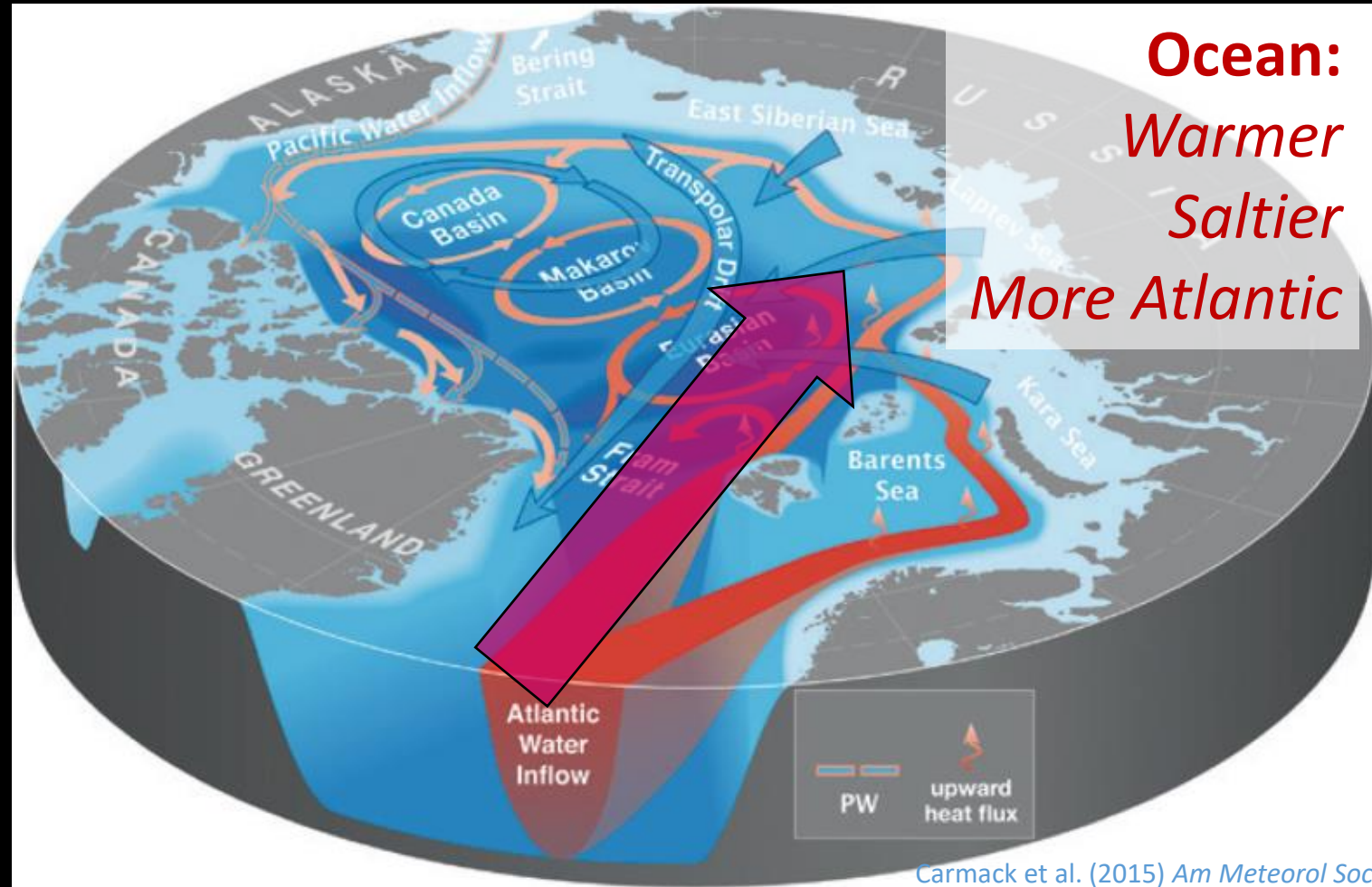


Caspar David Friedrich, 1824



Sea ice:
Shorter
Thinner
More dynamic

Newsweek.com



Ocean:
Warmer
Saltier
More Atlantic

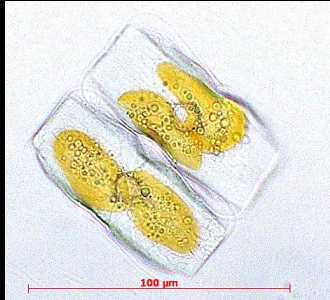
Carmack et al. (2015) *Am Meteorol Soc*

Changing fauna

Less sympagic biota



Nematodes



Ice algae



Ice copepods



Ice amphipods



Polar cod



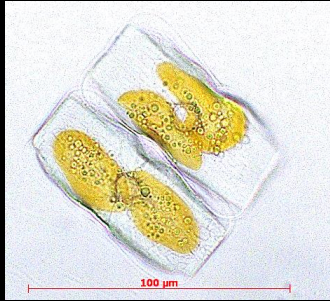
Melnikov (2018) Dokl. Earth Sci.
Ehrlich et al. (2020) Fr. Mar. Sci.
Kiko et al. (2017) Pol. Biol.
Steiner et al. (2019)
Nelson et al. (2014) [pictures]

Changing fauna

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Ice amphipods



Polar cod

Melnikov (2018) Dokl. Earth Sci.
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Nelson et al. (2014)

More Atlantic predators

Fossheim et al. (2015) PNAS
O'Correy-Crowe et al. (2016) Biol Lett



Atlantic cod

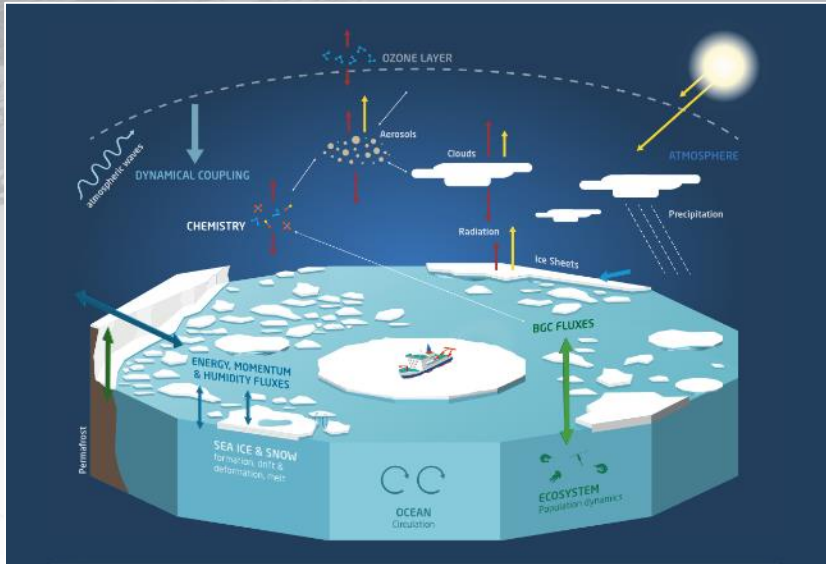


Orca



Jellyfish

MOSAIC



Multi-disciplinary drift study Following the Transpolar Drift from start to end

- 312 days
- 4,300 km
- > 700 Scientists

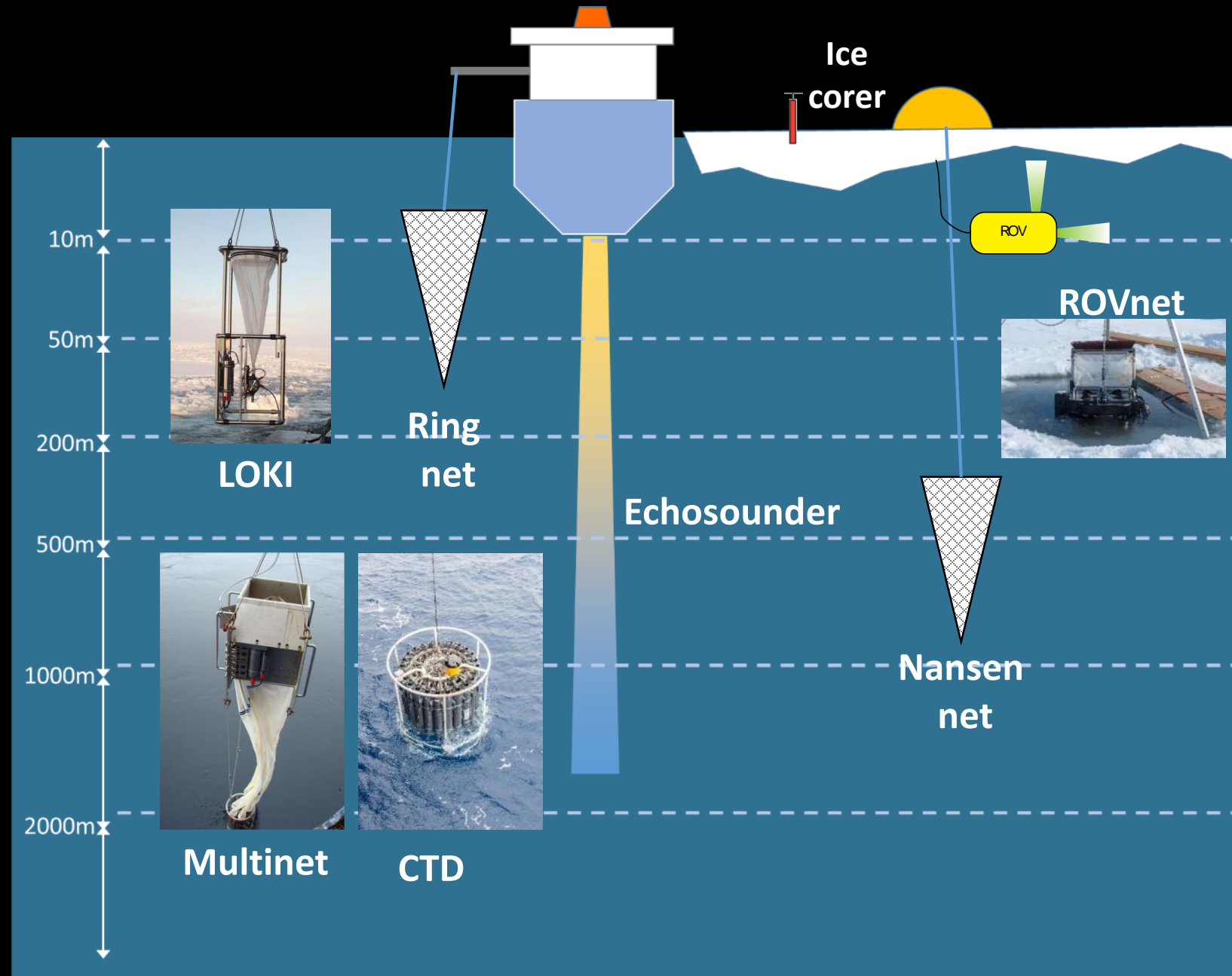
Holistic system approach:

- Atmosphere
- Ocean
- Sea ice
- Ecosystem

Objectives

Investigate the seasonal variability of:

- Animal biodiversity
- Vertical distribution
- Biomass and production
- Their contribution to biogeochemical cycles



Distribution of sampling sites

- Multinet (5 strata, 0-2,000 m)
- Ring nets (50-2,000 m max. depth)
- Nansen net (0-200 m)
- Altogether 207 net deployments

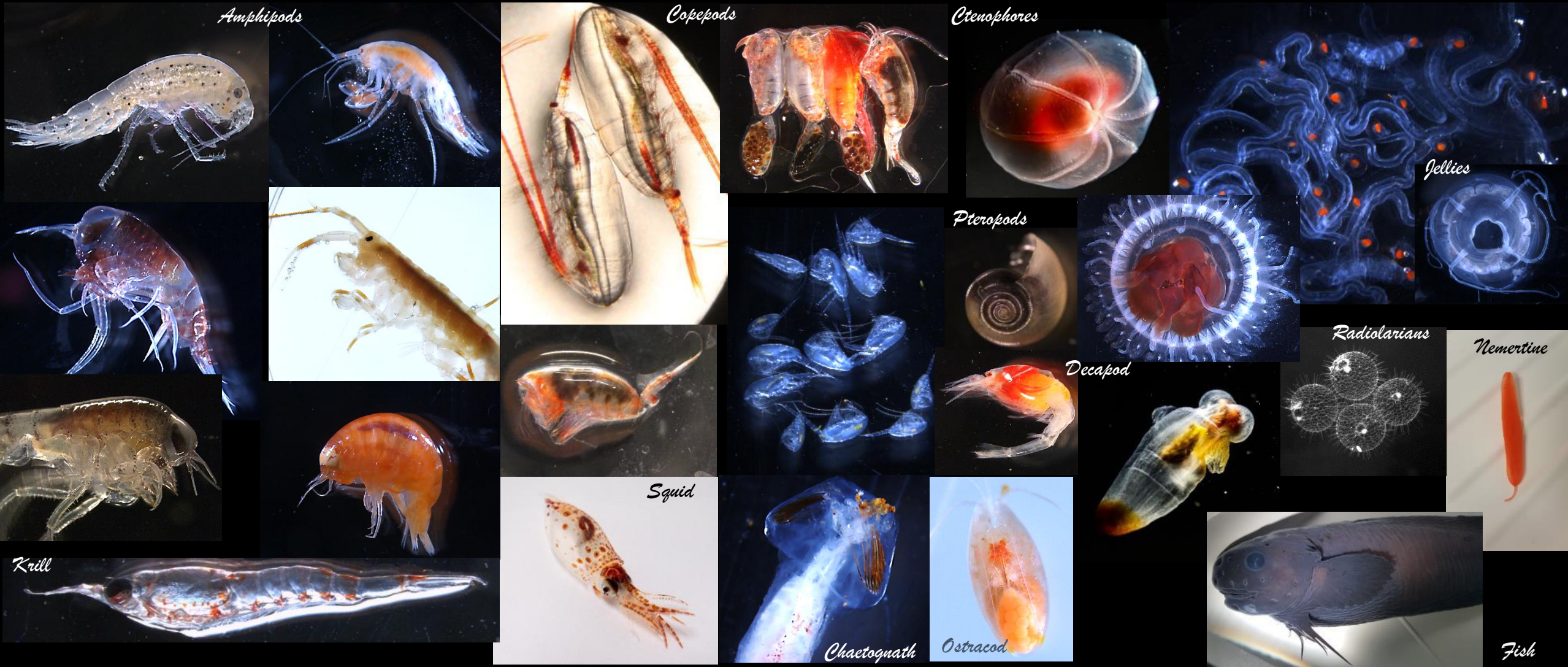


First trans-Arctic hydroacoustic survey

- 9,000 km
- ~ 350 days
- 3 crossings of the Eurasian Basin



Diversity of animals

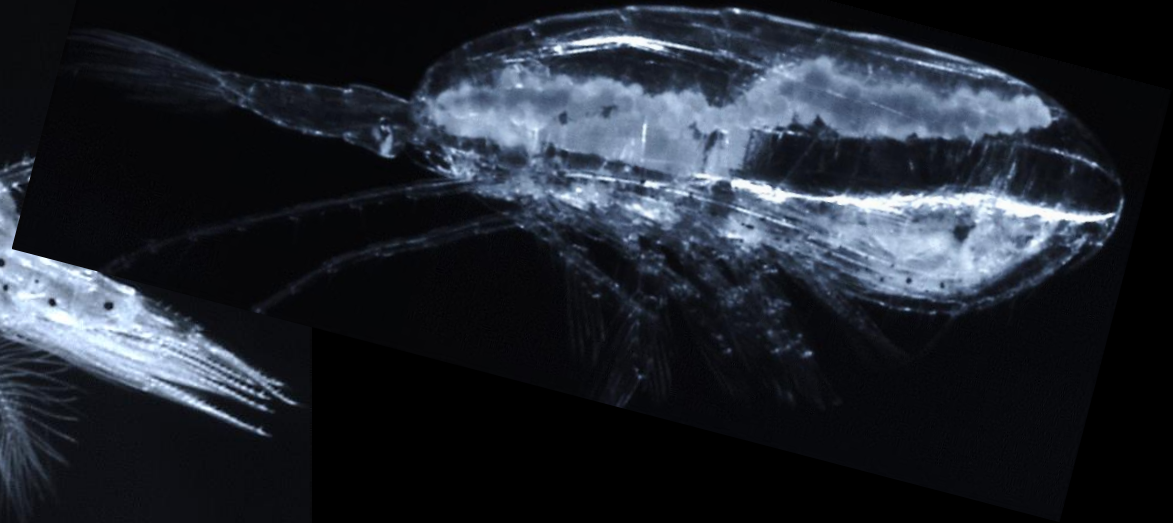


High resolution profiles of zooplankton distribution



LOKI

Indication of reproducing *Calanus hyperboreus* and *Apherusa glacialis* in the Central Arctic Ocean in November/December





Arctic cod in ice crack

Picture: Matt Boyer

Credits: C. Katlein & Team Ice

Could there be „more“ life in the CAO than thought before?

- There appears to be more biomass not seen by traditional sampling (macrofauna)
- Animals are more active all year (feeding and reproduction)
- There are more predators (jellyfish, fish and seals)



M. Hoppman



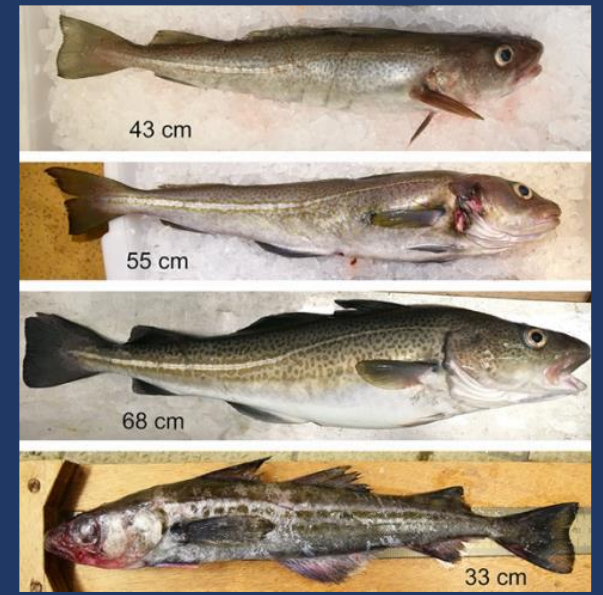
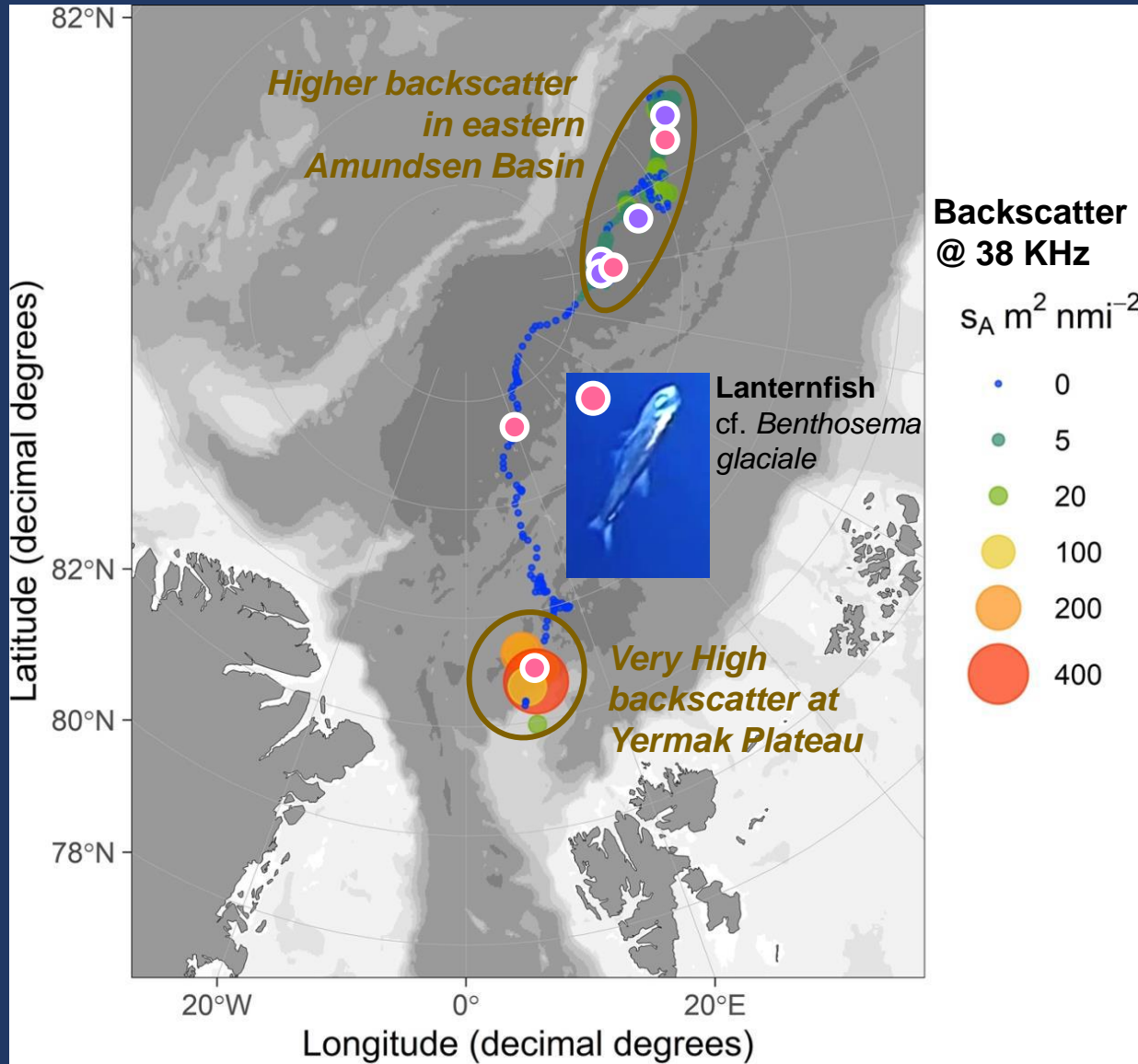
M. Hoppman



ALFRED WEGENER-INSTITUT
FÜR KONTINENTAL- UND MEERESFORSCHUNG



● **Armhook squid**
Gonatus fabricii



● **Atlantic cod** *Gadus morhua*
Ice cod *Arctogadus glacilis*
Paraliparis bathybius (not shown)

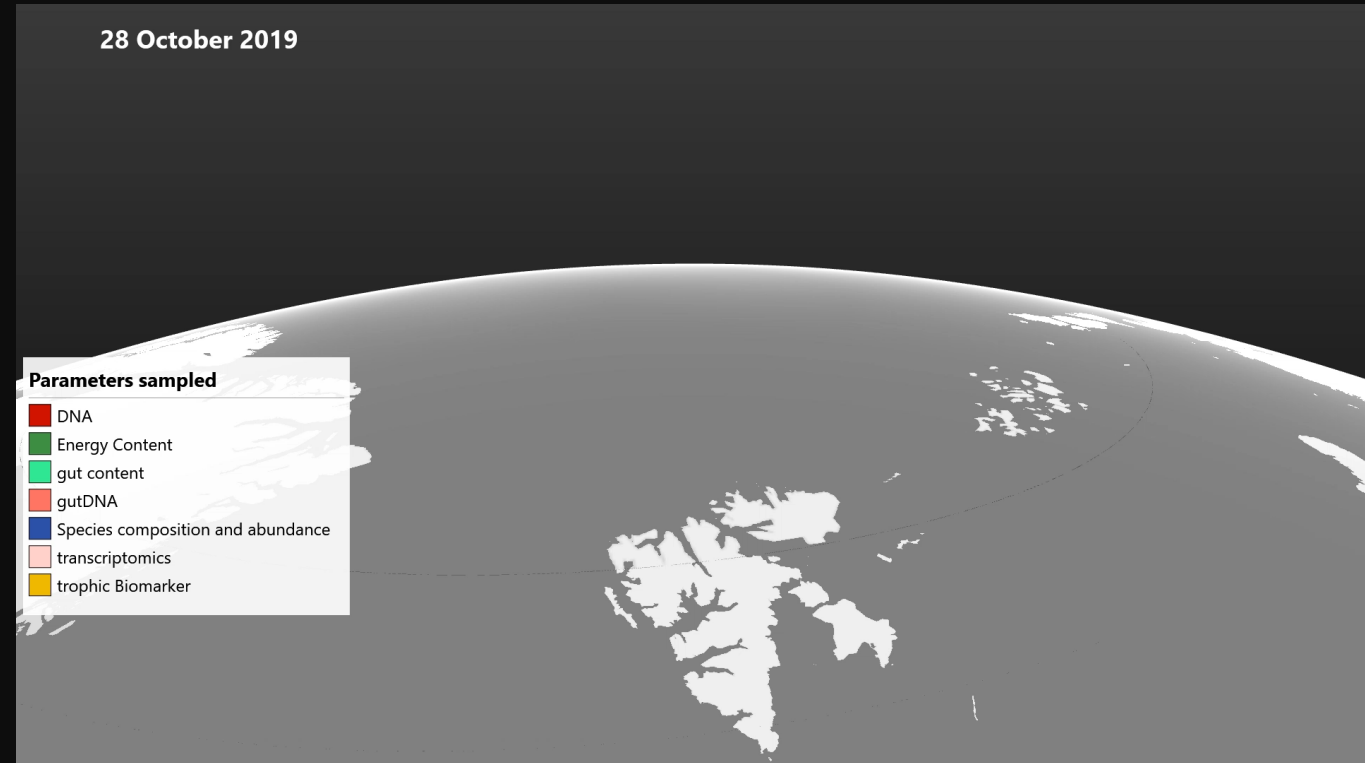


● **Atlantic cod** *Gadus morhua*
Haddock
Melanogrammus aeglefinus
Redfish *Sebastes mentella*
(not shown)

Snoeijs-Leijonmalm, Flores et al.
Unexpected fish and squid in the central Arctic deep scattering layer
Science Advances (acc.)

What we took home

- Year-round observations of zooplankton using net sampling, hydroacoustics, imaging profilers and under-ice video surveys
- ~ 9,000 samples of 20 parameters for analyses including microscopy, trophic biomarkers, genomics,...





Implications and impact

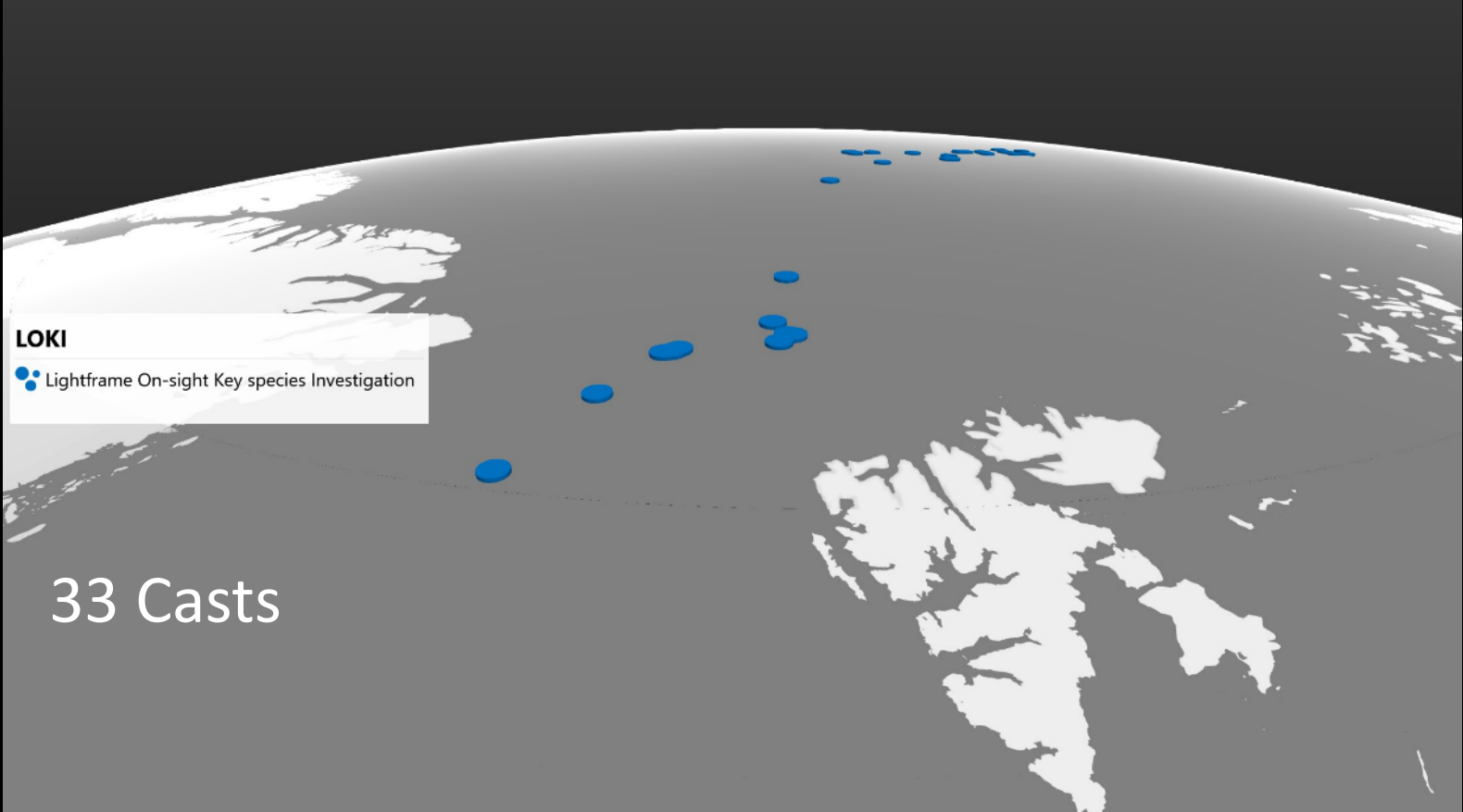
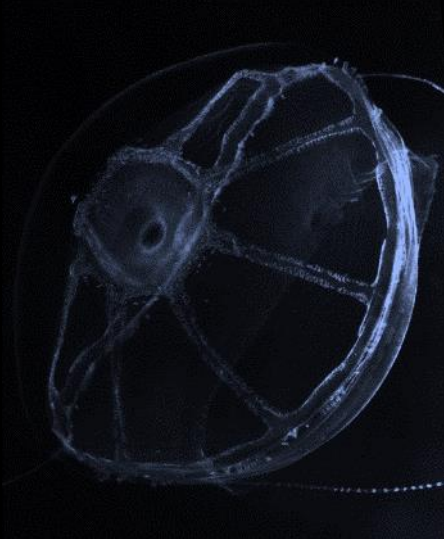
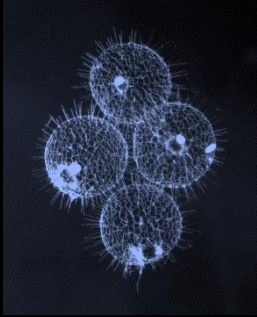
- New sampling technology enabled a more comprehensive view on diversity, life-cycles and biogeochemical functions of pelagic fauna

Guiding questions for future work:

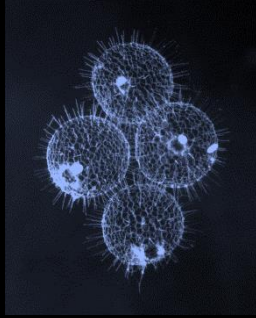


- Do high metabolic and reproductive activity during winter imply highly efficient heterotrophic resource utilisation, independent of primary production?
- Does this high activity and the year-round presence of predators suggest that the food web in the CAO may be more productive than previously assumed?

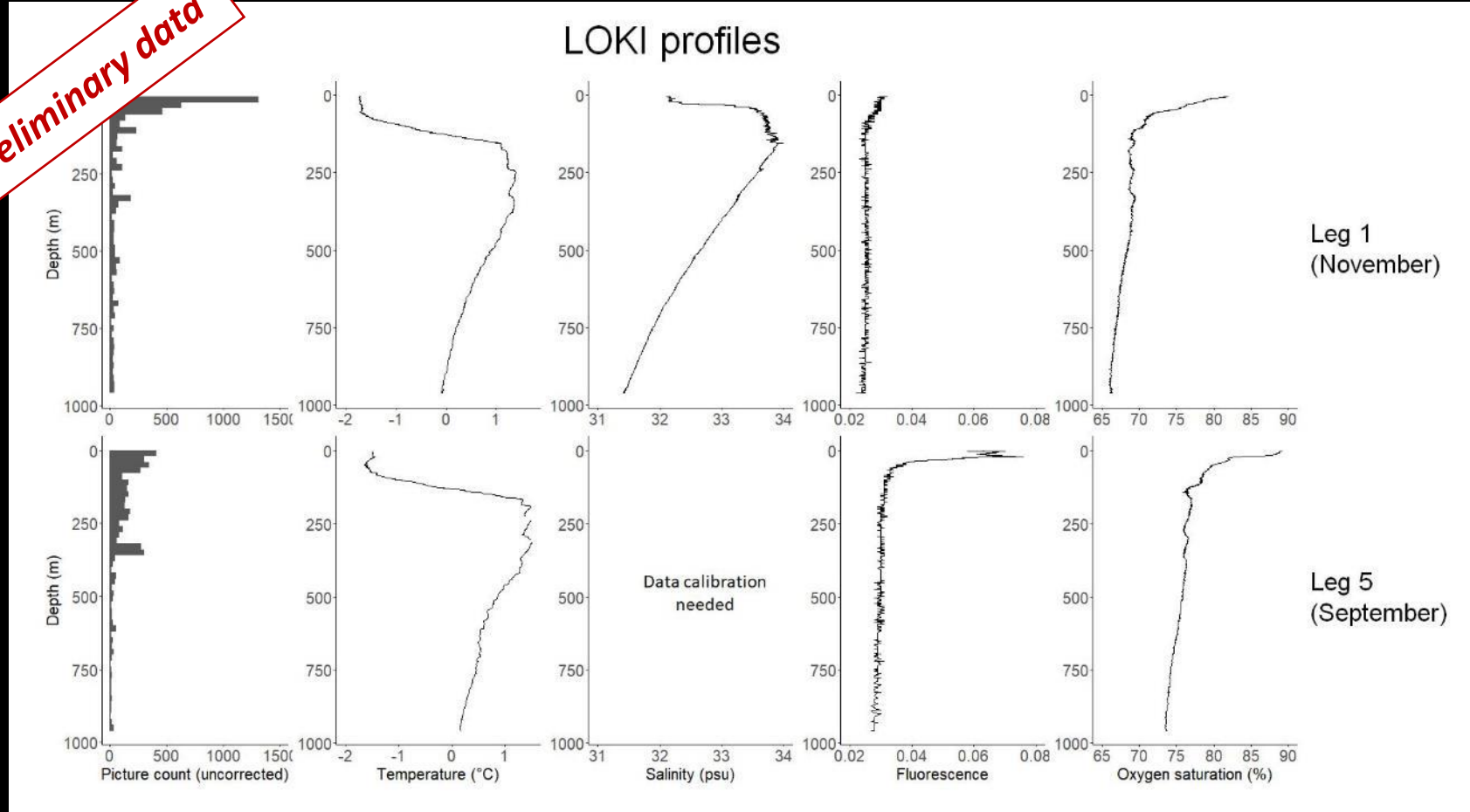
High resolution profiles of zooplankton distribution



High resolution profiles of zooplankton distribution



Preliminary data

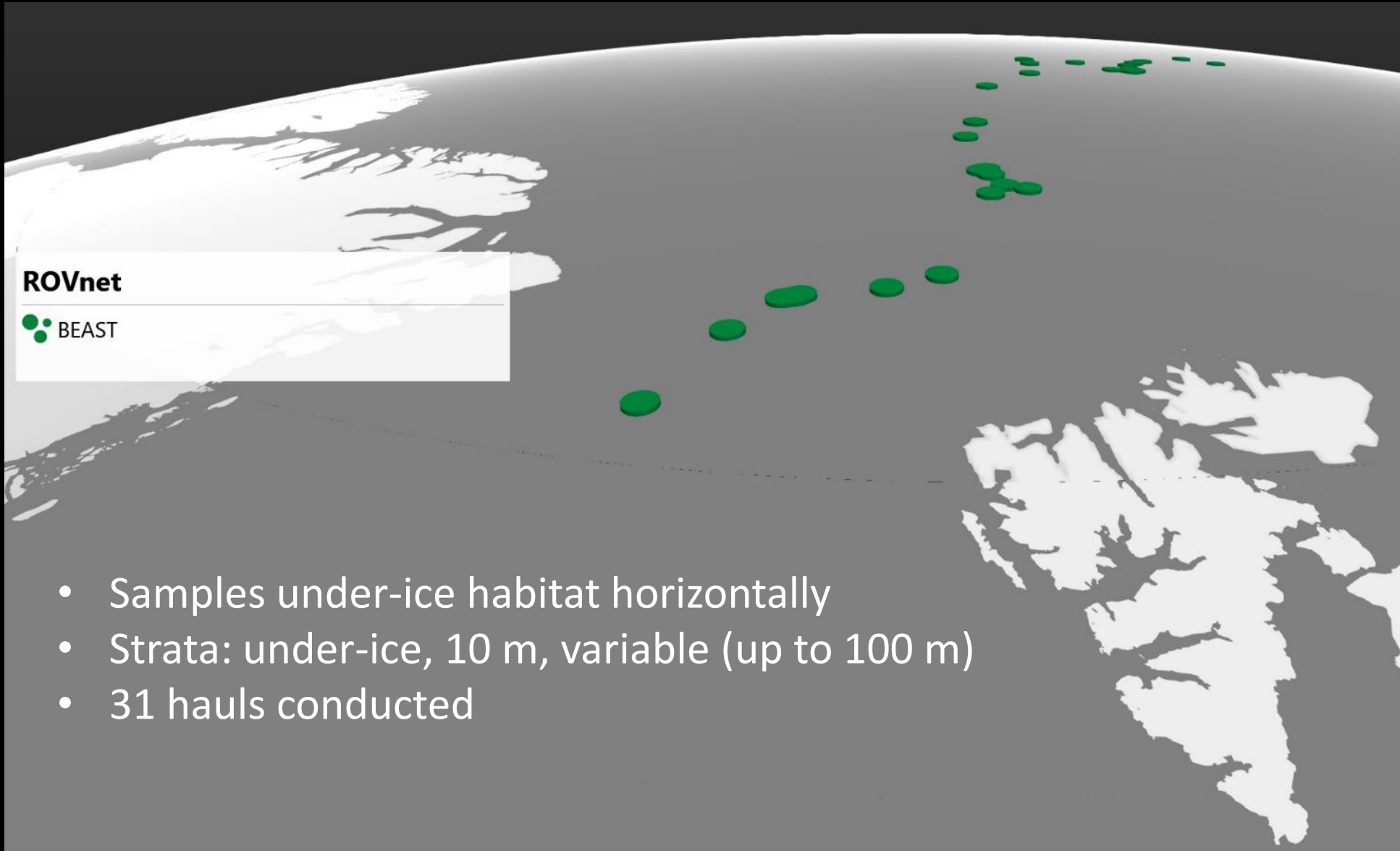


Sampling the sea-ice habitat

- Ice coring (meiofauna, trophic biomarkers)
- ROVnet
- Creative methods



Sampling the sea-ice habitat



Sampling the sea-ice habitat

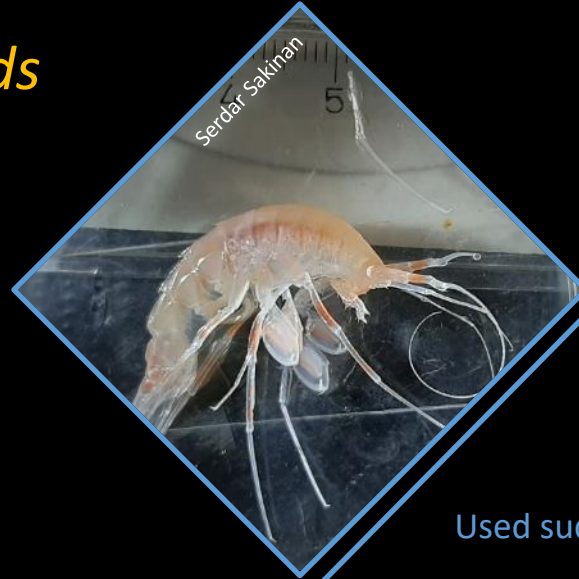
unusual but successful sampling methods

Castellani
stick-and-scoop
method



Hauke Flores

Used successfully to sample
15 polar cod
from holes in the ice



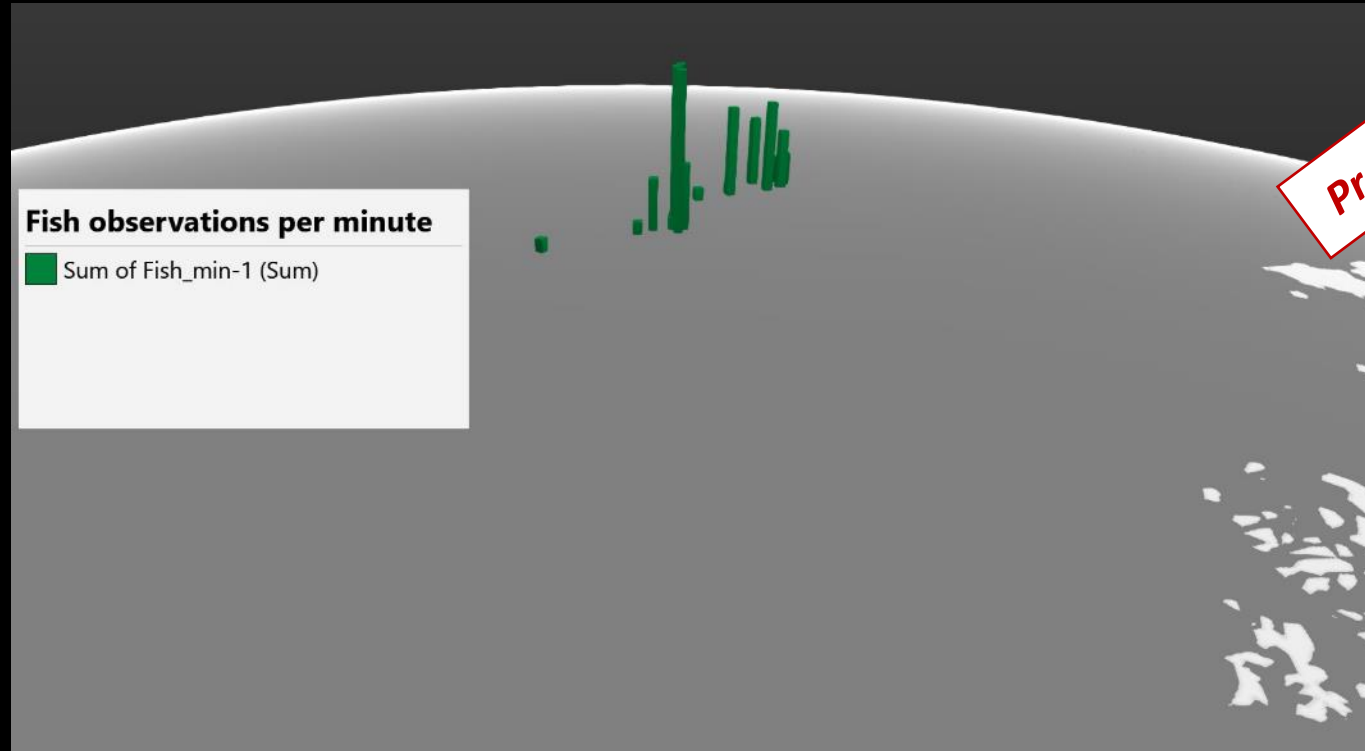
Serdar Sakinan

Used successfully to
collect large amphipods
from underneath
the sea ice

Opportunistic
collection by
hand

134 individuals were
collected, mainly of the
species *Eusirus holmii*

Video observations of predators under sea ice (Leg 1&2)



Preliminary data

