

BENTHIC MEGAFUNA IN THE ARCTIC OCEAN

Dynamics in temporal community composition

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INTRODUCTION & AIM

Benthic megafauna play a pivotal role in the functioning of deep-sea ecosystems and influence the global carbon cycle³. The structure of benthic communities is influenced by food availability and hence by phytodetrital flux from surface layers⁴. Highly productive marginal sea-ice zones therefore provide high food supply for benthic communities⁵. Future climatic change may lead to shifts in such zones⁶ and benthic organisms will be faced with changing phytodetrital fluxes.

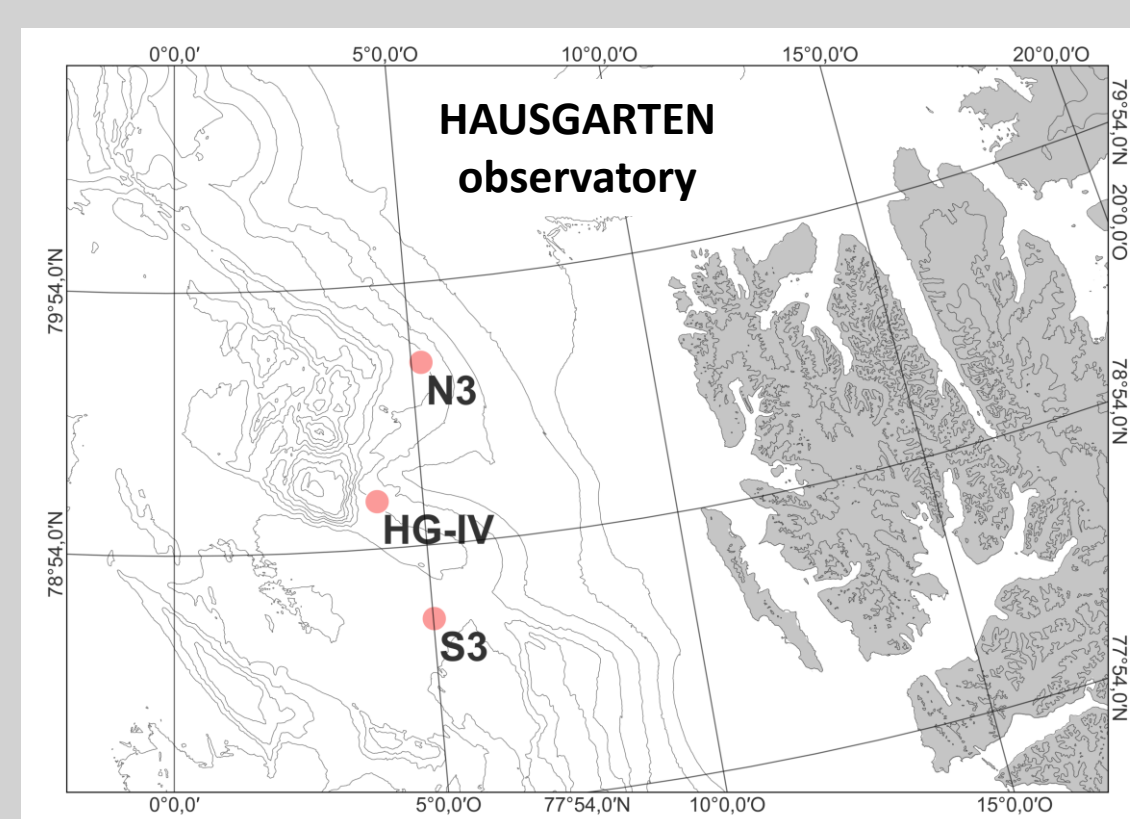
Determination of temporal community composition dynamics in benthic megafauna in the Arctic Ocean and whether those are influenced by sea-ice coverage.

METHODS

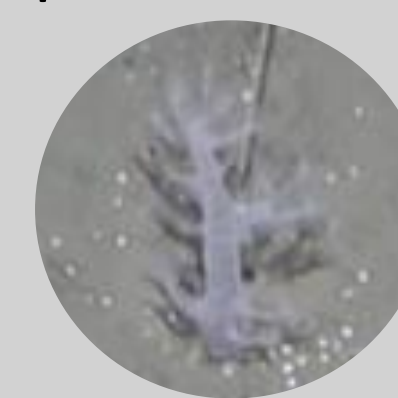
Year 2016 2017 2018 2020 2021

Station N3 HG-IV S3

- 1) Image survey in the HAUSGARTEN observatory
- 2) Image annotation in PAPA(ZZ)I⁷
- 3) Convert abundance data to density (number of ind. per m²)
- 4) Calculate overall megafaunal density
- 5) Group taxa by mobility and feeding types
- 6) Extract mean annual sea-ice coverage
- 7) Statistical analysis



Suspension feeders

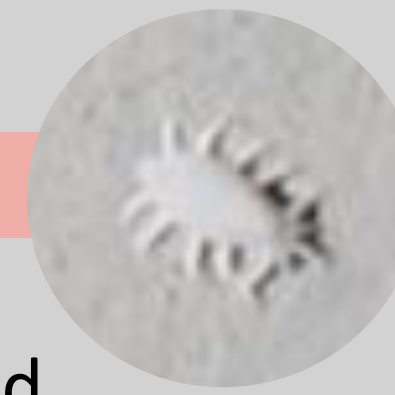


Sessile

Predator/Scavengers

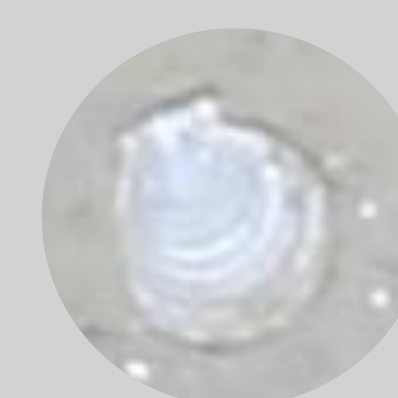


Deposit feeders



Mobile

Not defined



Not defined

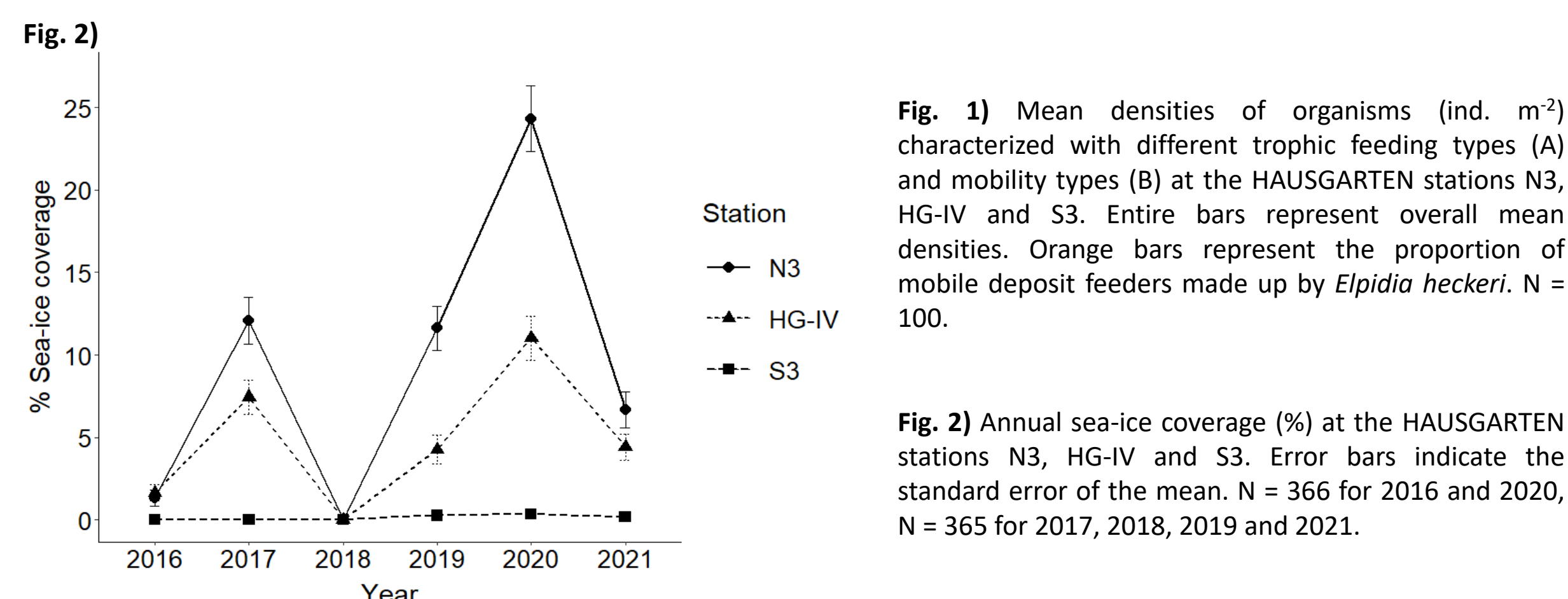
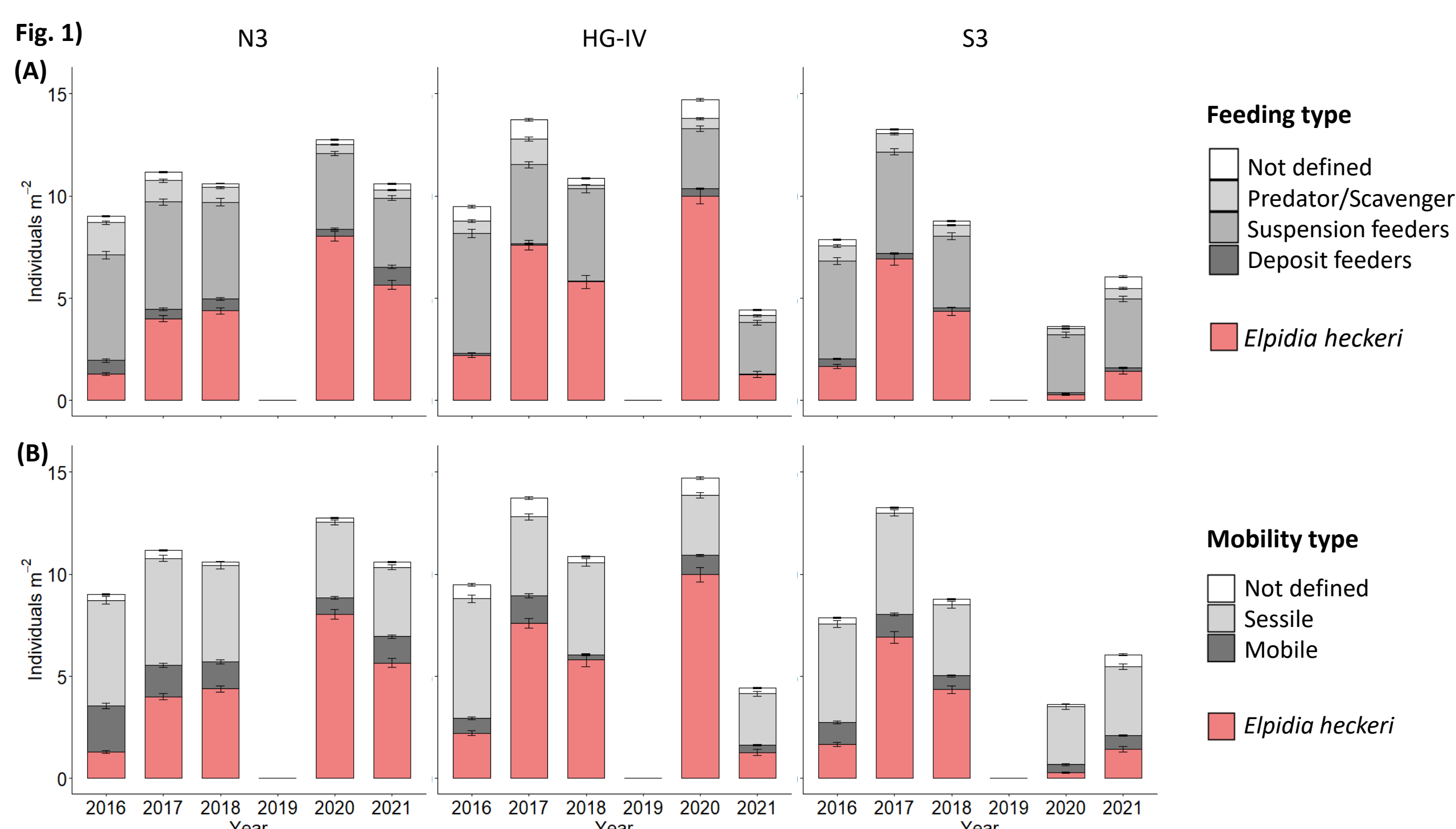


Fig. 1) Mean densities of organisms (ind. m⁻²) characterized with different trophic feeding types (A) and mobility types (B) at the HAUSGARTEN stations N3, HG-IV and S3. Entire bars represent overall mean densities. Orange bars represent the proportion of mobile deposit feeders made up by *Elpidia heckeri*. N = 100.

Fig. 2) Annual sea-ice coverage (%) at the HAUSGARTEN stations N3, HG-IV and S3. Error bars indicate the standard error of the mean. N = 366 for 2016 and 2020, N = 365 for 2017, 2018, 2019 and 2021.

RESULTS & DISCUSSION

- Shift in dominant functional traits from sessile suspension feeders to mobile deposit feeders
- The dominance of mobile deposit feeders was attributed to one single species of sea cucumbers: *Elpidia heckeri*
- A positive relation was indicated between benthic megafaunal density, the density of *E. heckeri* and the extent of sea-ice coverage at N3 and HG-IV
- Characteristics of *E. heckeri* potentially leading to its dominance:
 - Opportunistic feeding behaviour⁸
 - Ability to schedule time of spawning incidental to environmental factors⁹
 - ‘Boom and bust’ cycles in response to food availability common in other holothurian species¹⁰

→ Variations in phytodetrital quality and quantity may be responsible for the density variation of *E. heckeri*

→ Variations in phytodetrital flux may be connected to sea-ice coverage and primarily benefitted the sea cucumber

→ Time-series data based on image surveys are valuable data sets in order to detect long-term trends of benthic megafauna in the future Arctic Ocean

SUMMARY

- Benthic megafauna in the Arctic Ocean are influenced by food availability⁴
- Years with high density of the sea cucumber *Elpidia heckeri* coincided with high sea-ice coverage at N3 and HG-IV
- Strong variations in overall megafaunal density and density of *E. heckeri* can be expected for the future Arctic Ocean

OUTLOOK

- For the future stronger ‘boom and bust’ cycles of *E. heckeri* may be expected given their ability to quickly respond to changing environmental conditions
- Benthic megafauna community as a whole may exhibit strong variations in density and diversity

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