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Increase of marine litter at two stations of the Arctic deep-sea observatory HAUSGARTEN

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Background

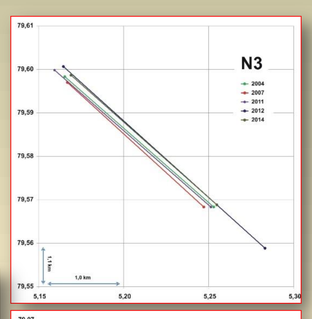
In 1999, the LTER observatory HAUSGARTEN was established in the eastern Fram Strait. HAUSGARTEN (HG) comprises currently 21 sampling stations between 1000 and 5500 m depth. Images from the central HG station (HG IV, 2500 m depth) taken in 2002, 2004, 2007, 2008, 2011 were analysed during a first litter time-series study on the deep Arctic seafloor and reported doubled litter densities between 2002 and 2011.

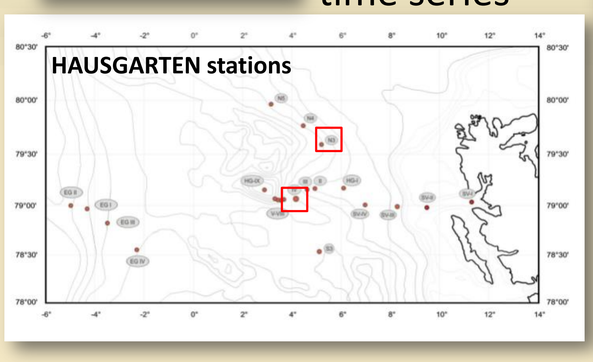
Current Research

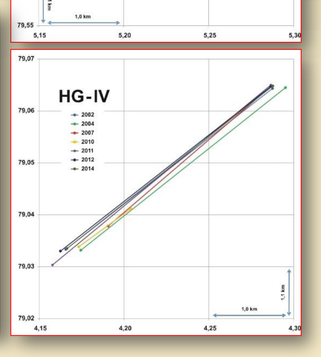
- ❖ Extended HG IV litter time series to 2012 and 2014 to determine if temporal trend persists
- ❖ Assessed temporal trends at northern HAUSGARTEN station (N3, 2500 m depth) in 2004, 2007, 2011, 2012, 2013, 2014
- ❖ Compared litter density, size, type and interaction with megafauna of the two stations
- ❖ Explored possible sources of litter, e.g. rising ship traffic in this remote region as a result of reduced sea ice extent?

Materials & methods

Repeated camera (OFOS) transects for megafaunal time series



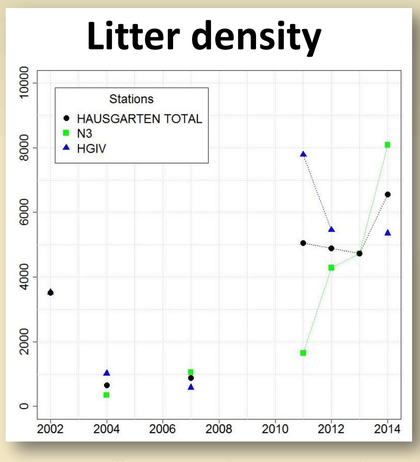




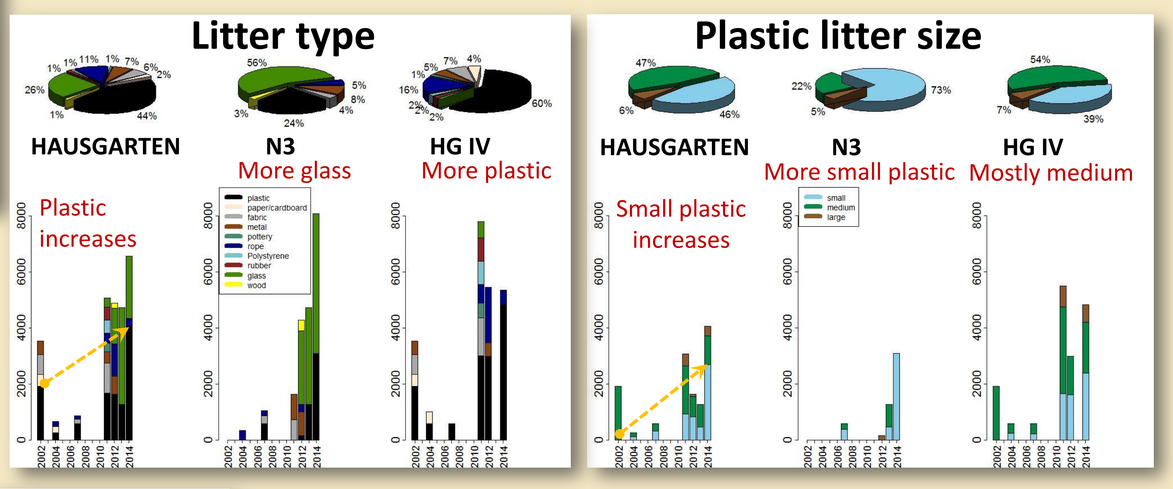
- •Analysis of 5,018 images taken at HG IV and N3 (~2500 m, 1.5 m altitude) in 2002, 2004, 2007, 2008, 2011, 2012, 2013, 2014 by OFOS transects for litter
- •Litter count per image was converted to litter density (litter km^{-2}) based on the area of the image. Mean litter densities were calculated thus: (∑ litter density) / N, where N is the total number of the images of a transect, year or station
- •A total of 7,058 images (incl. data of previous HG IV study) were analysed for temporal and spatial differences using PERMANOVA (PRIMER)

Results

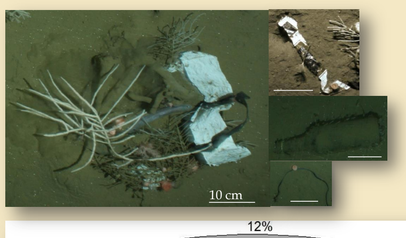
Areas of images were calculated via laser points (total area: 28,161 m^2). 89 litter items were found in 82 images (N3: 41, HG IV: 48). Mean annual litter density was between 660 and 6,566 items km^{-2}.

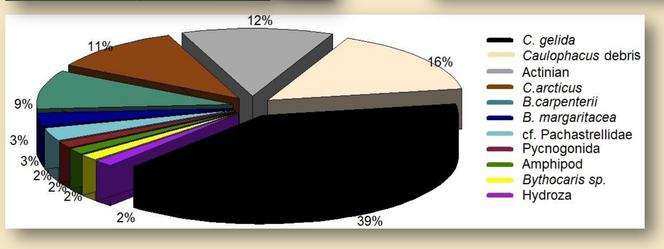


➢Litter densities of two stations were not significantly different (Pseudo-F=0.67, p =0.4)
➢Significant difference between years (Pseudo-F=4.66, p =0.002)
➢Significant difference between N3 transects (Pseudo-F=4.39, p =0.002)
➢No significant difference between HG IV transects



Megafauna interaction





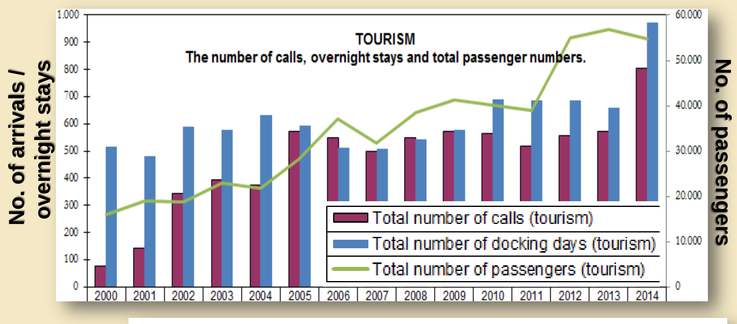
➢54% of all litter encountered megafauna
➢Of these, 75% encountered sponges, *Cladorhiza gelida, Caulophacus arcticus*, *Caulophacus* debris or sea lily *Bathycrinus carpenterii*

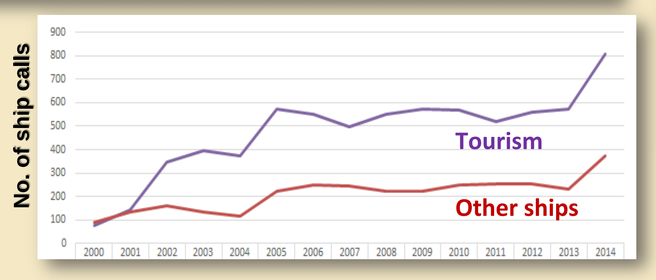
Conclusions

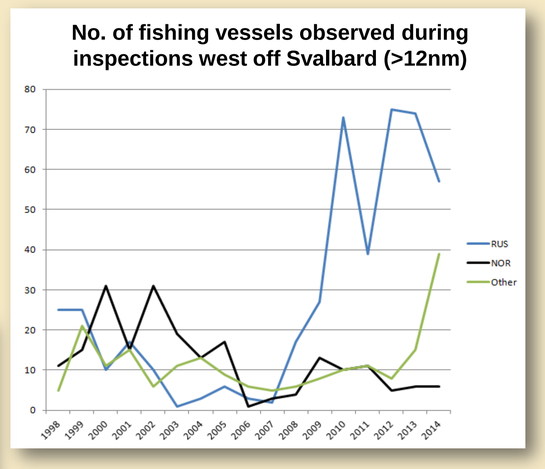
➢Litter densities at HAUSGARTEN increased strongly between 2002 and 2014, exceeding those of Lisbon Canyon (6,600 items km^{-2})
➢Size of plastic litter decreases → fragmentation into microplastic?
➢Litter on seafloor (2.237 - 18.473 items km^{-1}) exceeds floating litter in study area (0 - 0.22 items km^{-1}) → Is deep seafloor a sink for marine litter?
➢Decreasing sea ice cover may encourage anthropogenic activities (tourism, shipping, fishing)

Outlook

❖**FRAM Pollution Observatory**: Surveillance of marine Arctic ecosystem compartments with a particular emphasis on litter and microplastic pollution
❖Development of **LITTERBASE**: Global map of marine litter records and species affected by litter and microplastic







Acknowledgements

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