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Dominik.Nachtsheim@tiho-hannover.de

ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

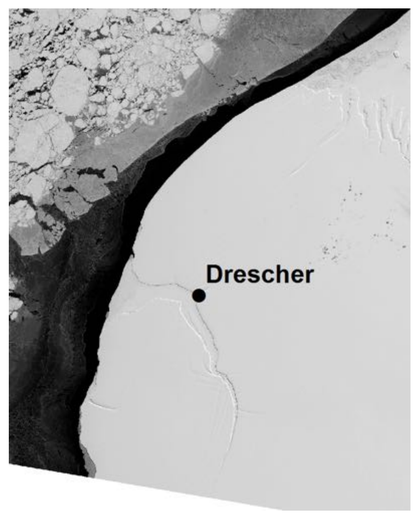
Dominik A. Nachtsheim[1,2,*], Christoph Held[1], Nils Owsianowski[1], Joachim Plötz[1], Richard Steinmetz[1], Yasuhiko Naito[3], Horst Bornemann[1]

Under-shelf ice foraging of Weddell seals

Objectives

The Weddell seal (*Leptonychotes weddellii*) inhabits the Antarctic coastal ecosystem and aggregates in areas characterized by a stable fast ice layer. Due to their extreme diving capabilities, they are able to exploit both pelagic and benthic prey resources. They mainly feed on fishes but occasionally also take cephalopods and crustaceans (Plötz 1986, Green and Burton 1987).

Weddell seals instrumented with still-picture camera loggers detected an unknown cryo-benthic community underneath the floating ice shelf of the Drescher Inlet during an earlier expedition (Watanabe et al. 2006). Images show dense aggregations of invertebrates that likely represent an attractive food horizon for Weddell seals. In this context, we conducted a retrospective analysis of dive profiles collected in the Drescher Inlet. While using a novel approach we aimed to identify favoured hunting depths and correlate those to the local physical and biological environment.



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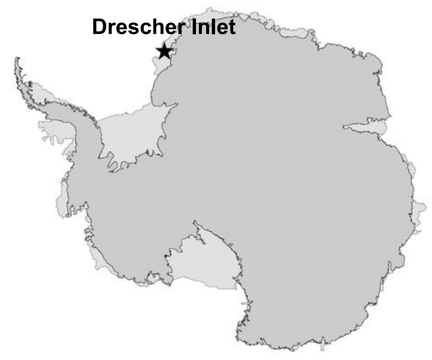
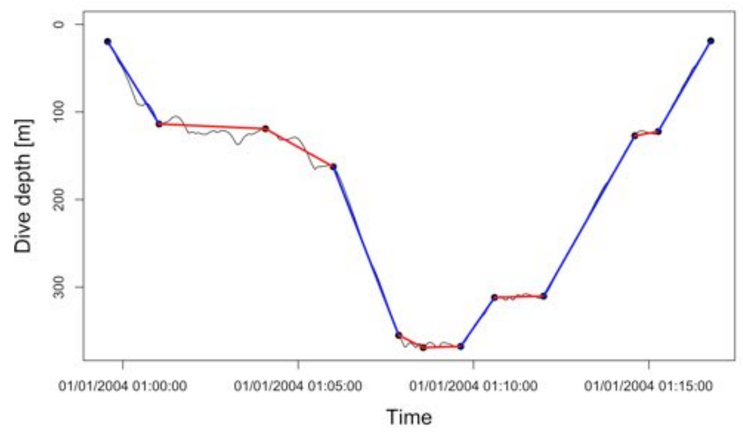


The Drescher Inlet is a 25 km long crack in the Riiser-Larsen Ice Shelf, eastern Weddell Sea, and usually covered with fast ice. Approx. 200 – 300 Weddell seals regularly aggregate along tidal cracks on the fast ice.

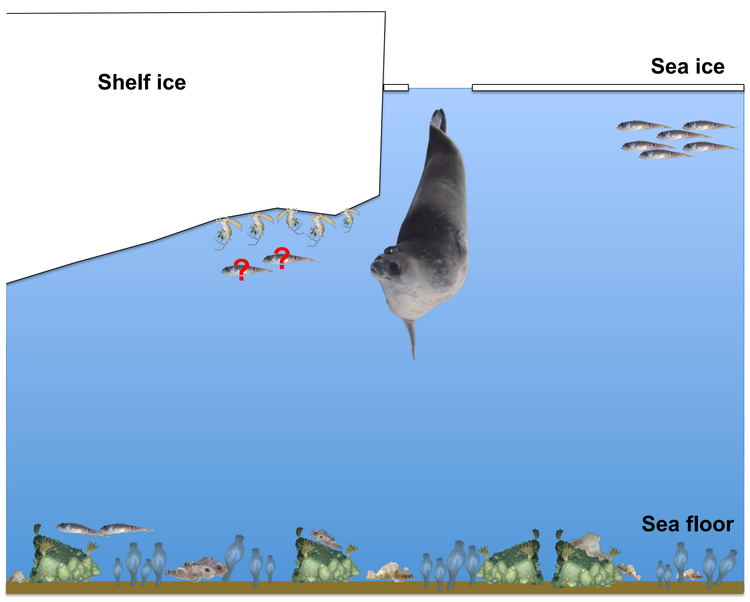


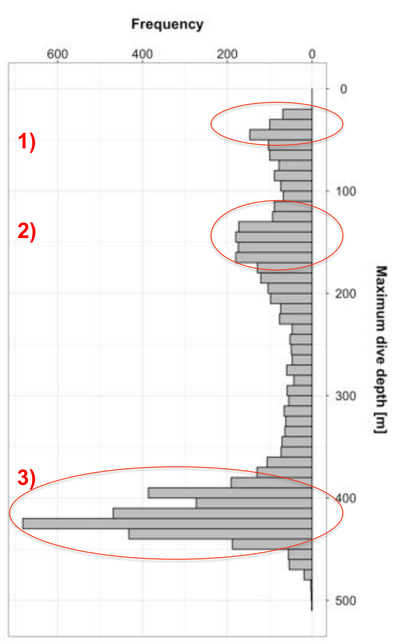
Dive profile of Weddell seal DRE2003_wed_a_f_18. The black line shows the original dive profile. Black dots represent the inflexion points as calculated by the broken stick algorithm, which adequately summarise the dive profile. Highly sinous segments represent hunting phases (red), while segments with straight dive trajctories represent transit phases (blue).

Materials and Methods

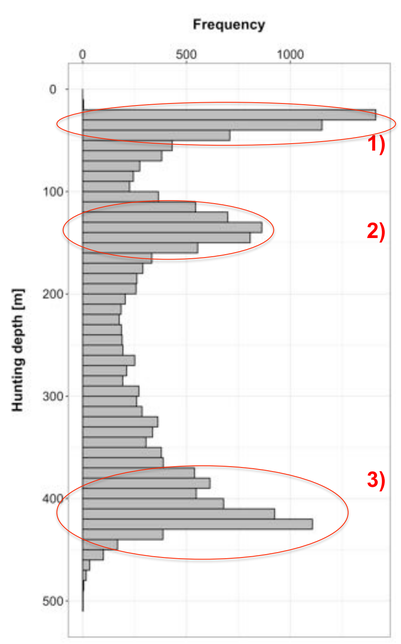
- 34 adult Weddell seals (21 F, 13 M) were instrumented with different dive loggers between 1990 and 2016
- loggers recorded dive depth with different resolutions varying from 1 to 20 s
- dive profiles were zero-offset corrected to account for drift of pressure transducer; only dives deeper than 20 m were regarded for further analysis
- an automated broken stick algorithm was used to identify the optimal number of segments, which describe the shape of each dive profile best (Heerah et al. 2014)
- sinuosity of each dive segment was calculated to distinguish between two behavioural modes: high sinuosity = hunting phase; low sinuosity = transit phase (Heerah et al. 2014)

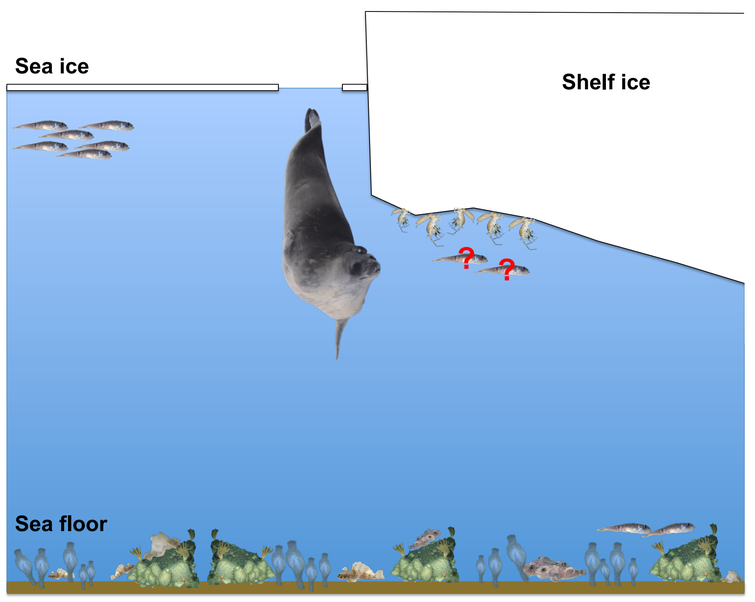
Maximum dive depths





Hunting depths





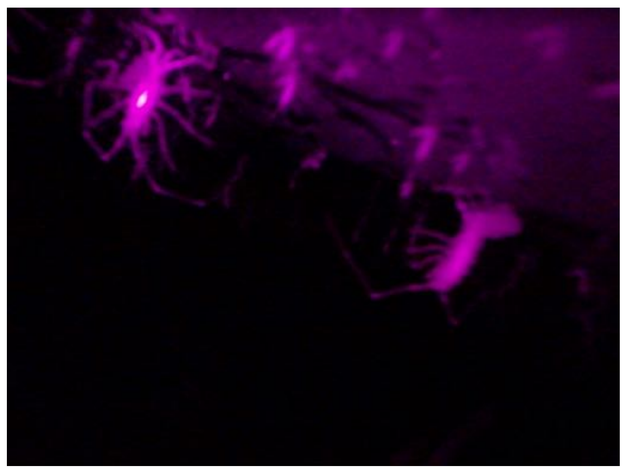


Image taken by a seal-borne, infrared camera logger at 85.4 m water depth. The picture shows an aggregation of isopods, attached to the underside of the floating ice shelf, in immediate vicinity to the seal‘s head.

Results and Discussion

The analysis of high-resolution dive data revealed a trimodal frequency distribution of both maximum dive depths and hunting depths. However, the maximum dive depth did not adequately represent the actual depths of hunting activities. Generally, hunting took place in three different depth ranges in similar frequencies:

1) 20 – 50 m ⟶ foraging in the pelagic zone, most likely on Antarctic silverfish *Pleuragramma antarctica*
2) 110 – 160 m ⟶ foraging on the shelf ice underside, possibly on isopods or shelf ice-associated fishes?
3) > 370 m ⟶ foraging at or close to sea floor, mainly on *P. antarctica*, other bentho-pelagic fish and cephalopods

Our investigation highlights the importance of the shelf ice underside as an attractive food horizon for Weddell seals. However, the contribution to their diet as well as the exact spectrum of prey organisms remain unexplored.

References

[1] Plötz J 1986. Polar Biol 6:97-102
[2] Green K and Burton HR 1987. Aust Wildl Res 14:475-489
[3] Watanabe et al. 2006. Mar Ecol Prog Ser 309:297-300
[4] Heerah et al. 2014. PLoS ONE 9: e99329

Acknowledgements

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Poster to go?

Affiliations

[1] Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung, Am Handelshafen 12, 27570 Bremerhaven, Germany
[2] BreMarE - Bremen Marine Ecology, Marine Zoology, University of Bremen, P.O. Box 330440, 28334 Bremen, Germany
[3] National Institute of Polar Research, 10-3, Midori-cho, Tachikawa-shi, Tokyo 190-8518, Japan
[*] present adress: Institute for Terrestrial and Aquatic Wildlife Research (ITAW), University of Veterinary Medicine Hannover, Foundation, Werftstr. 6, 25761 Büsum, Germany

ALFRED-WEGENER-INSTITUT HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG
HELMHOLTZ GEMEINSCHAFT
Universität Bremen
NiPR National Institute of Polar Research
STIFTUNG TIERÄRZTLICHE HOCHSCHULE HANNOVER