

4. Deep, dark and cold – Frontiers in polar and deep sea research
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Foraging hotspots of Weddell seals in the southern Weddell Sea



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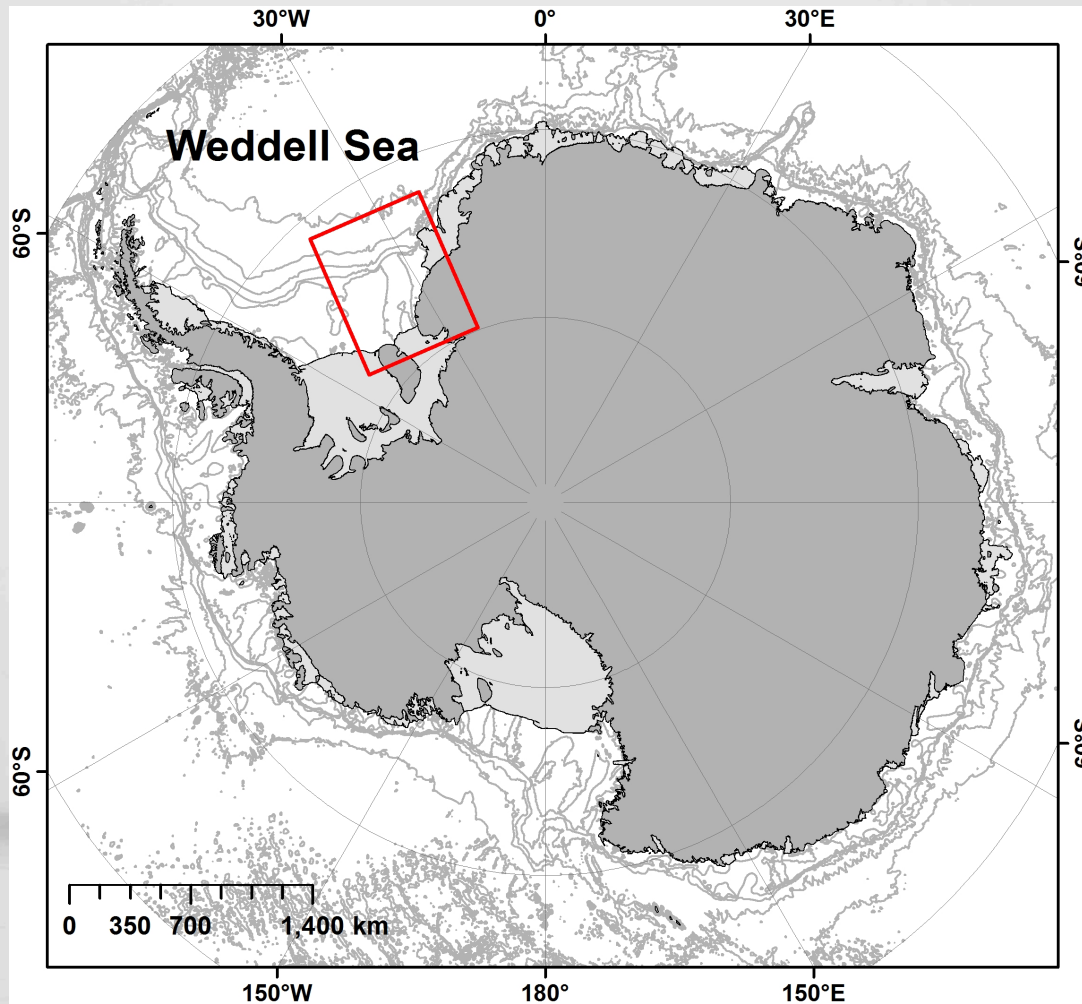


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Background

- Filchner Outflow System in south-eastern Weddell Sea



Background

- Filchner Outflow System in south-eastern Weddell Sea
- Intensive mixing of water masses -> hotspot?

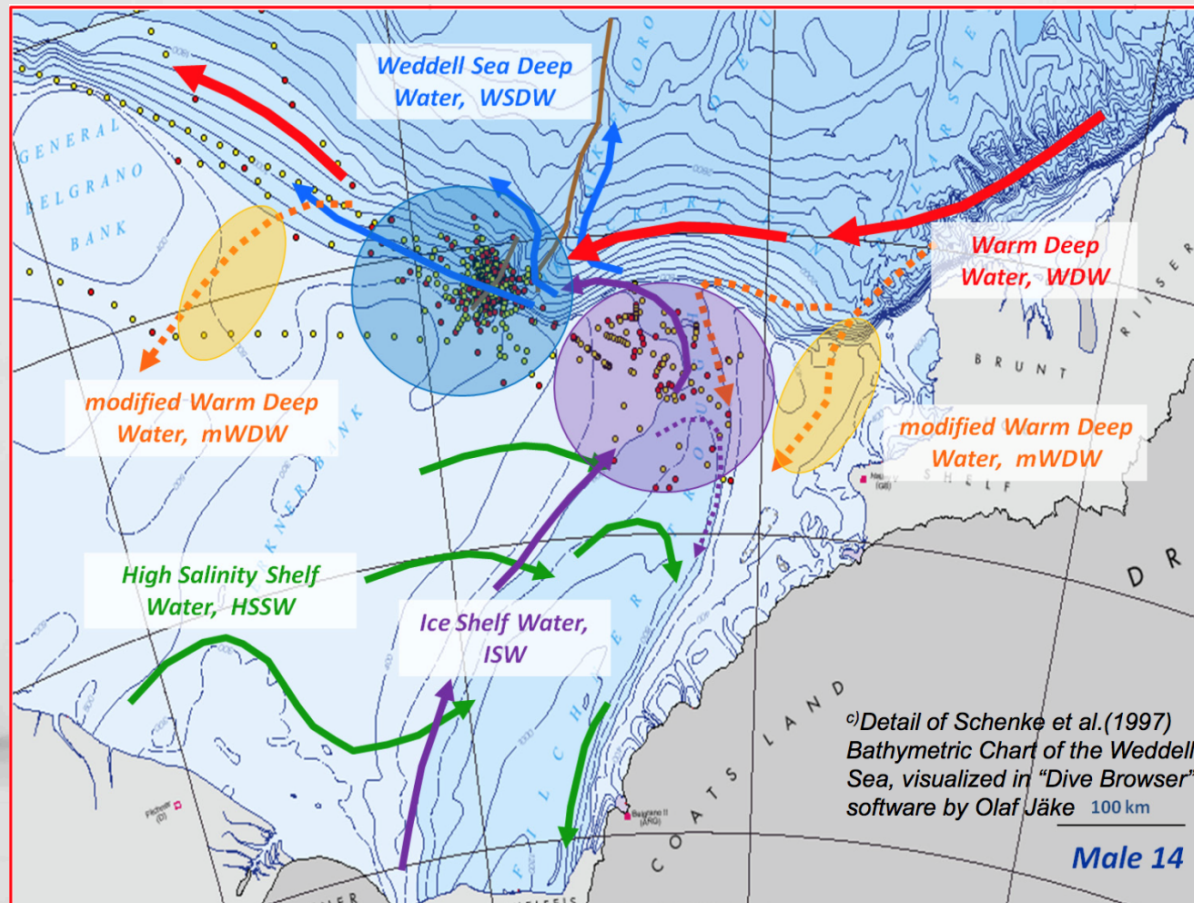
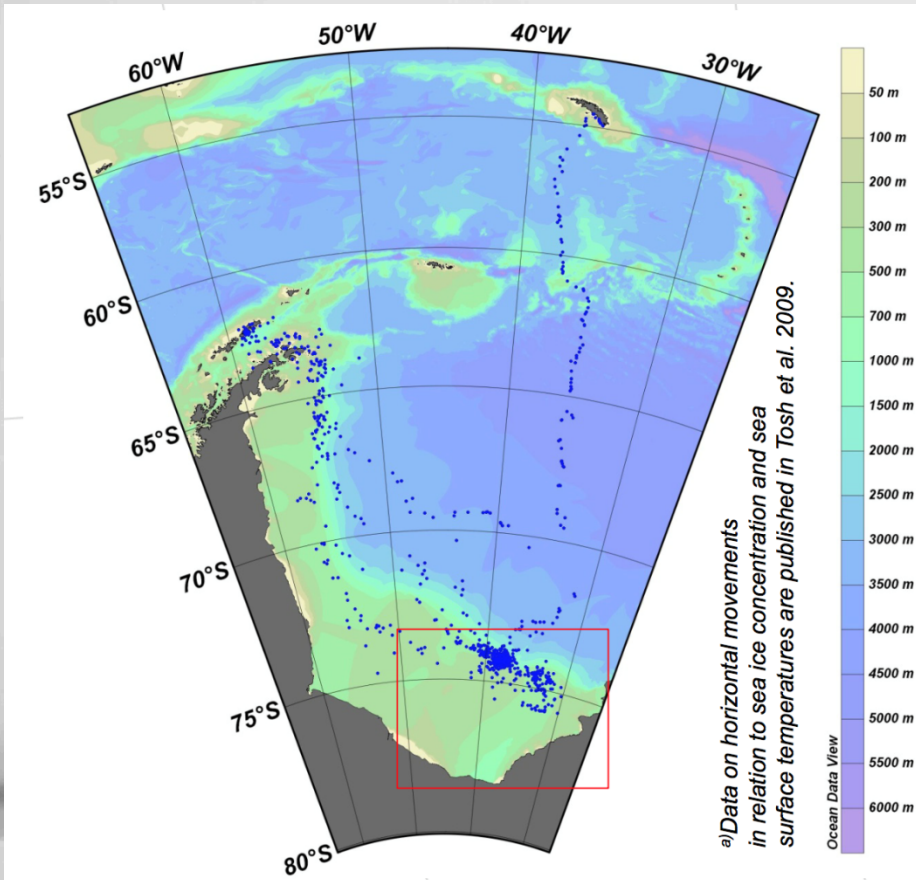




Photo: AWI

Background

- Southern elephant seals foraged at Filchner Trough
- Weddell seals are residents in the area year-round
- Aim: to characterize and describe potential foraging hotspots



Material and Methods



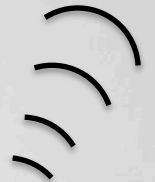
RV Polarstern
research expedition PS82
to Filchner Outflow System
in 2014

6 Weddell seals:
CTD-combined satellite-linked
dive loggers (CTD-SRDLS)



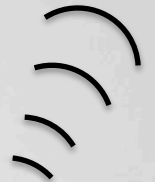
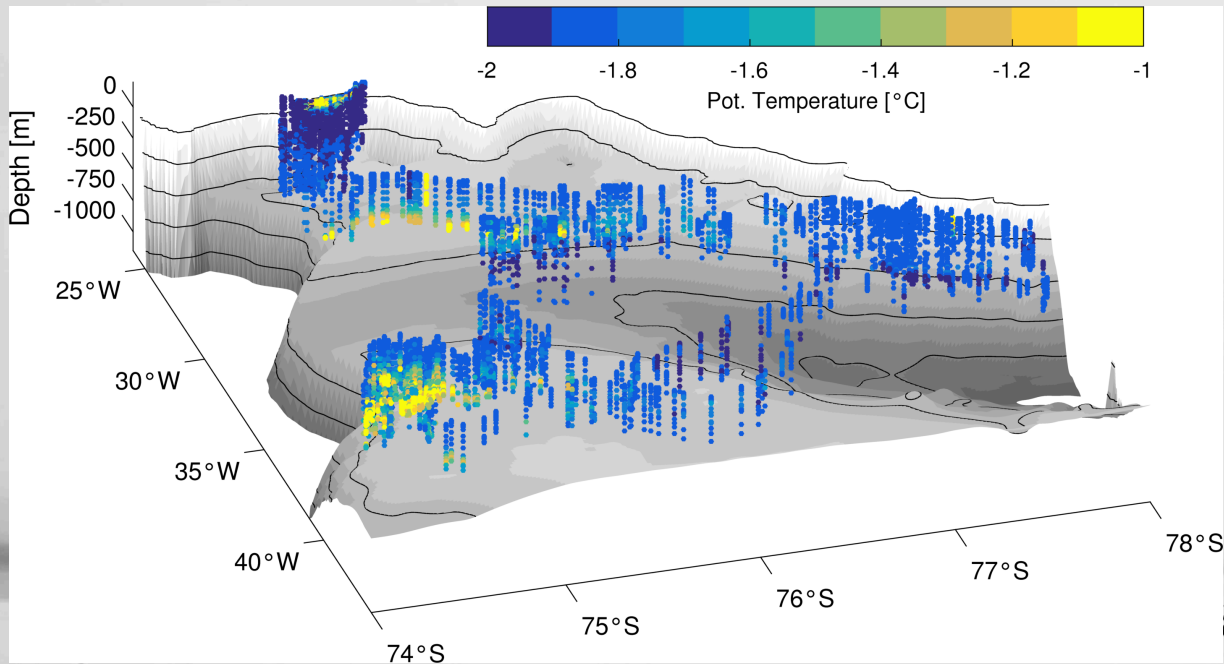
Material and Methods

- CTD-SRDs provide...
 - seal locations via Argos satellites



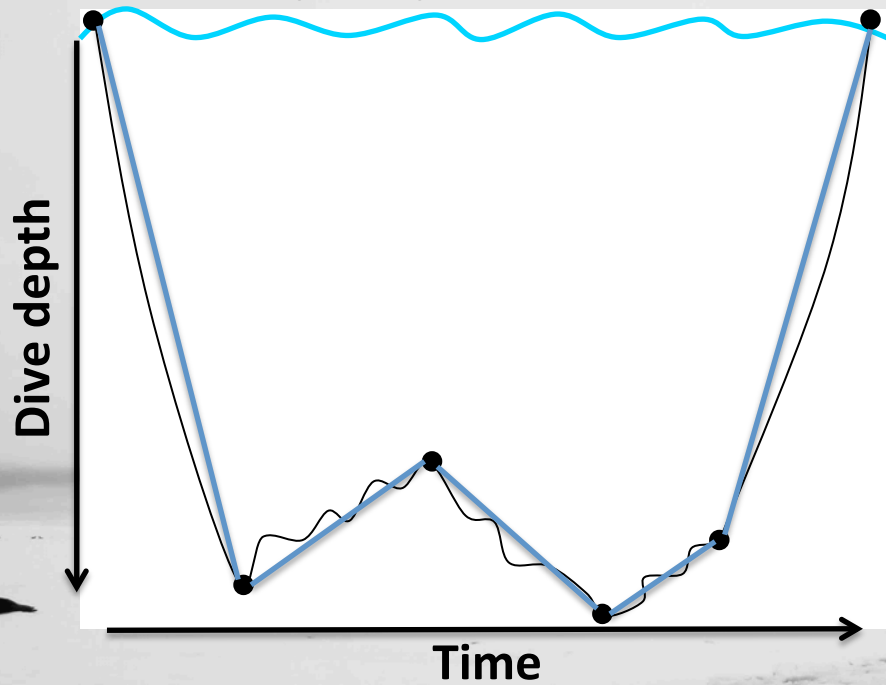
Material and Methods

- CTD-SRDJs provide...
 - seal locations via Argos satellites
 - CTD profiles



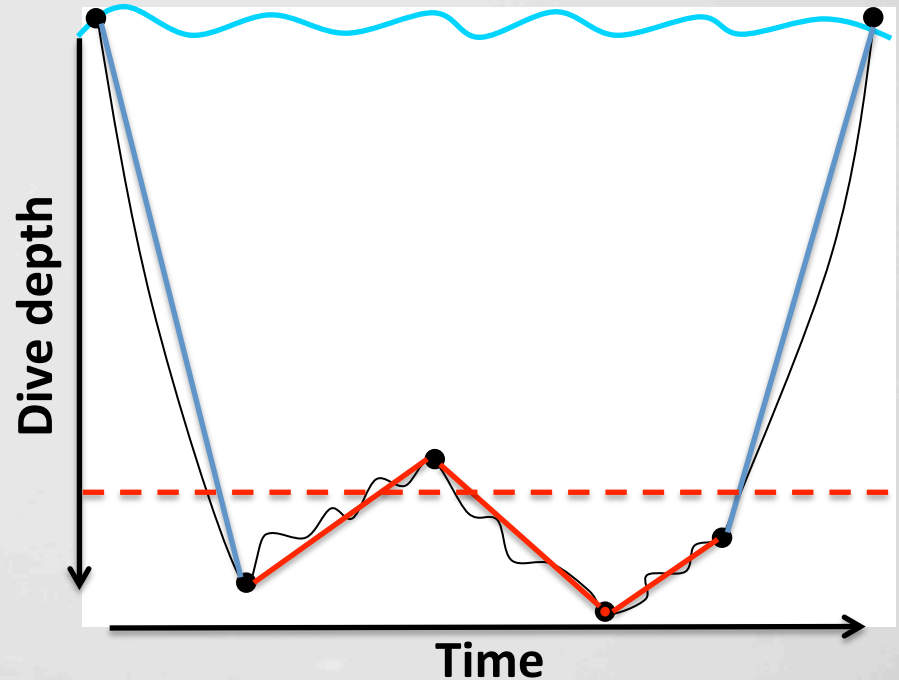
Material and Methods

- CTD-SRDs provide...
 - seal locations via Argos satellites
 - CTD profiles
 - time-depth profiles of each dive



Material and Methods

- from dive profiles, several parameters for foraging behaviour:
 - maximum dive depth (pelagic / demersal)
 - hunting time
 - index for foraging effort in the bottom phase



Material and Methods

- set of environmental covariates, which may influence foraging behaviour:
 - bathymetry
 - water masses
 - sea ice concentration
 - distance to winter polynya
 - light availability (daily / seasonal)



Material and Methods

- hierarchical state-space model (hSSM) to filter seal tracks and infer hidden behavioural states along track (Jonsen 2016)
- statistical analysis: linear mixed effect model (R package *nlme*; Pinheiro *et al.* 2016)

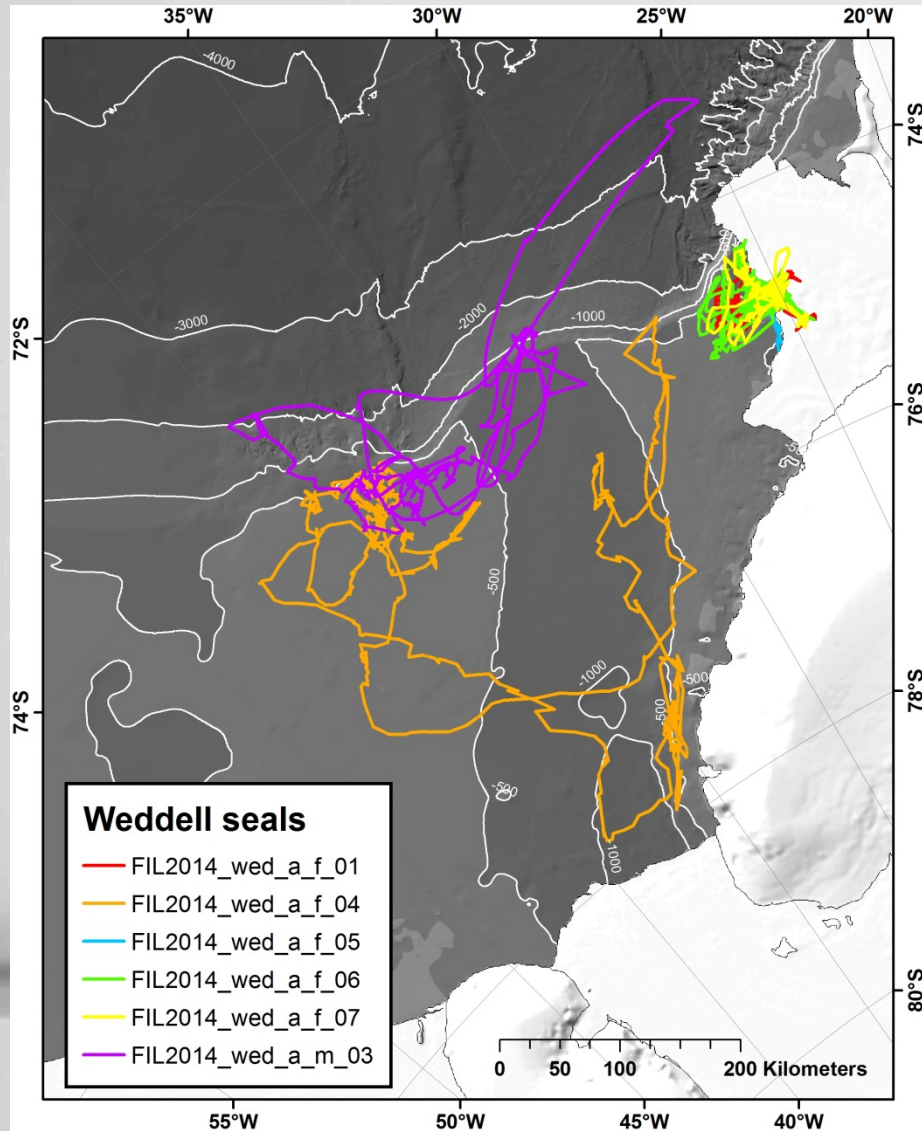


Results & Discussion

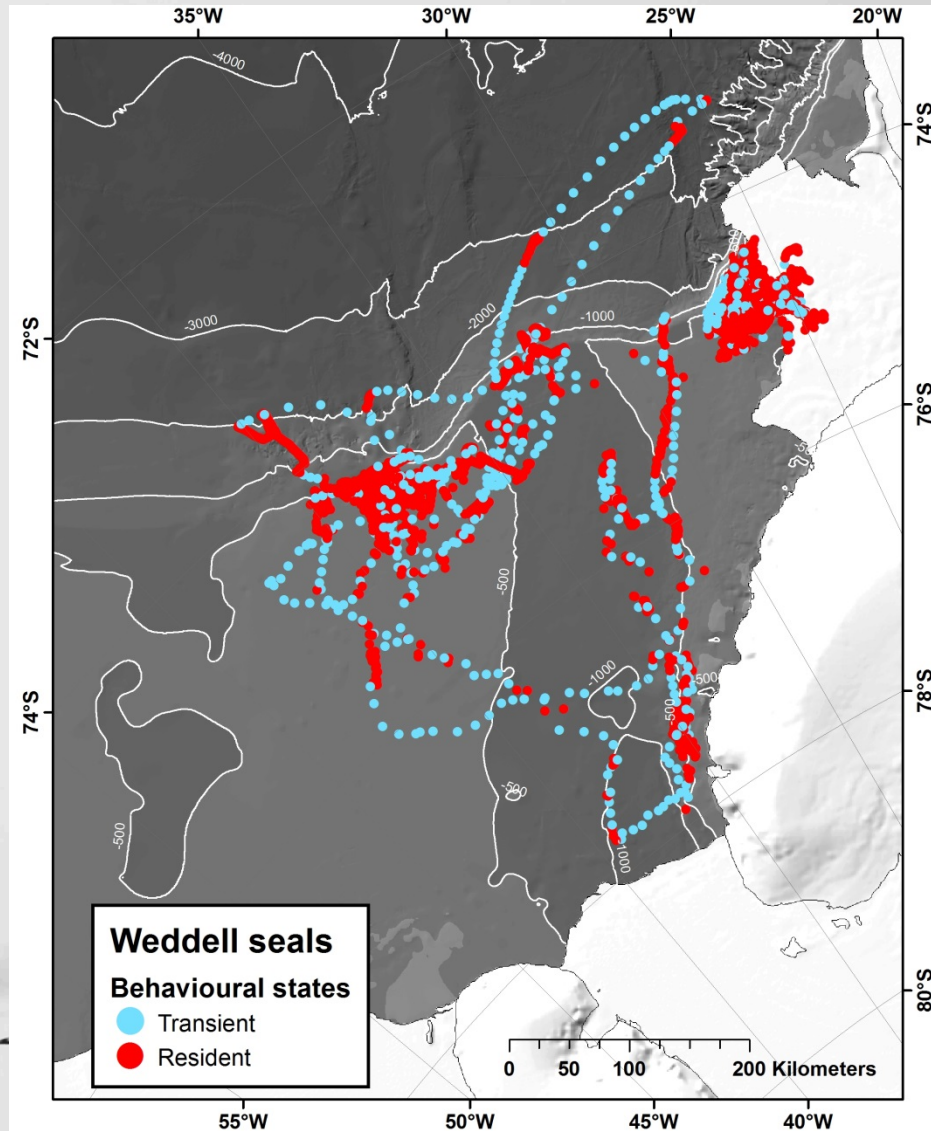
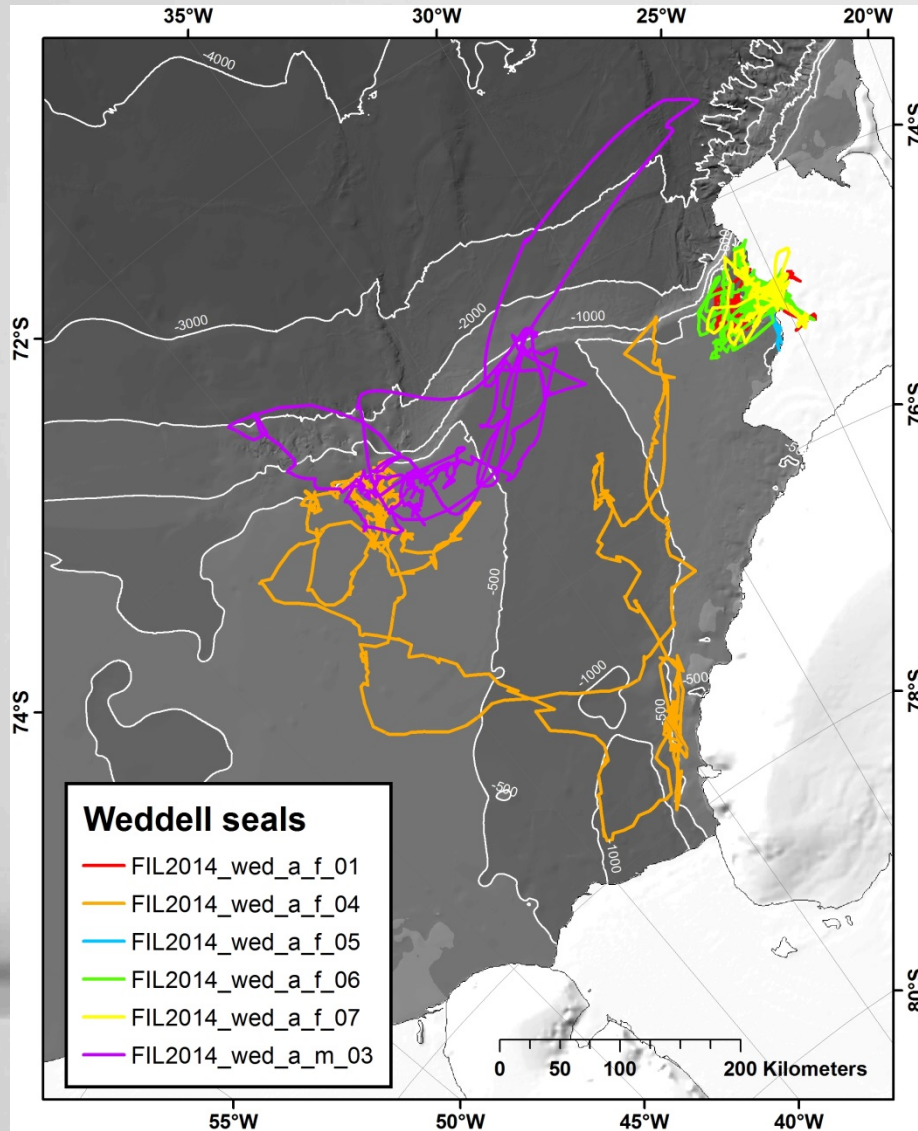
- transmission duration: 174.5 ± 68.9 d
(range: 49-246 d); January – October 2014
- 12,256 dives; 70.7% pelagic, 29.3% demersal
- pelagic dive depth: 143.5 ± 119.0 m
- demersal dive depth: 460.5 ± 115.0 m



Results & Discussion

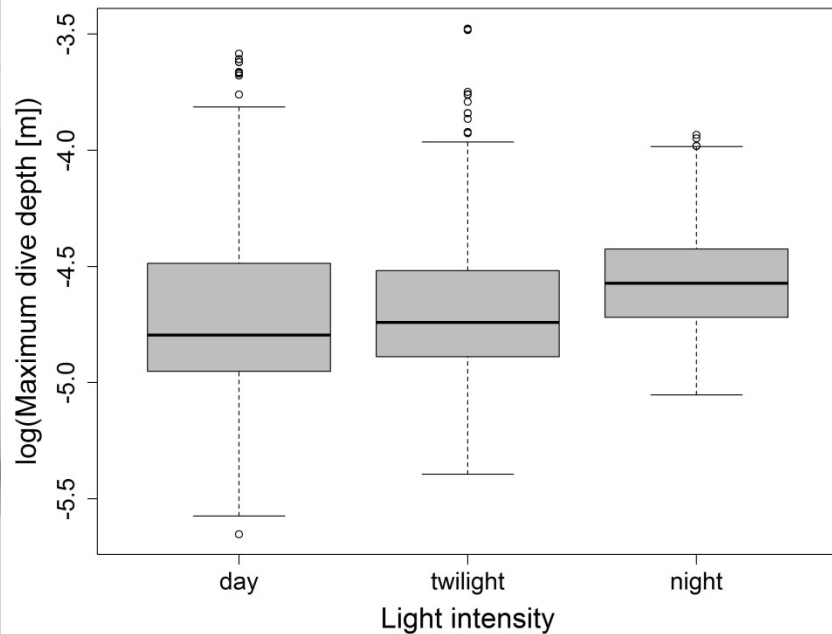


Results & Discussion



Results & Discussion

- maximum dive depth:
 - deeper during day than night (only pelagic)



Results & Discussion

- maximum dive depth:
 - deeper during day than night (only pelagic)
 - no effect of season

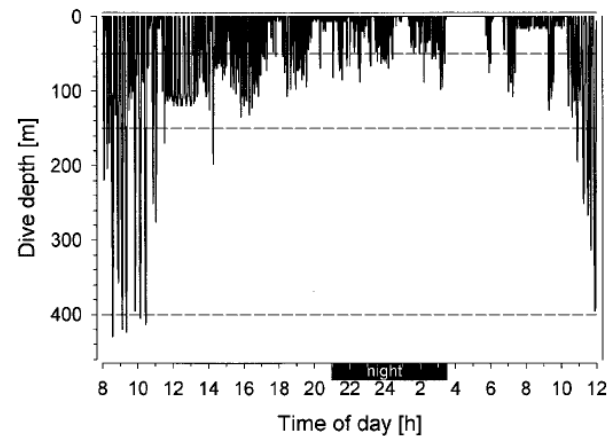
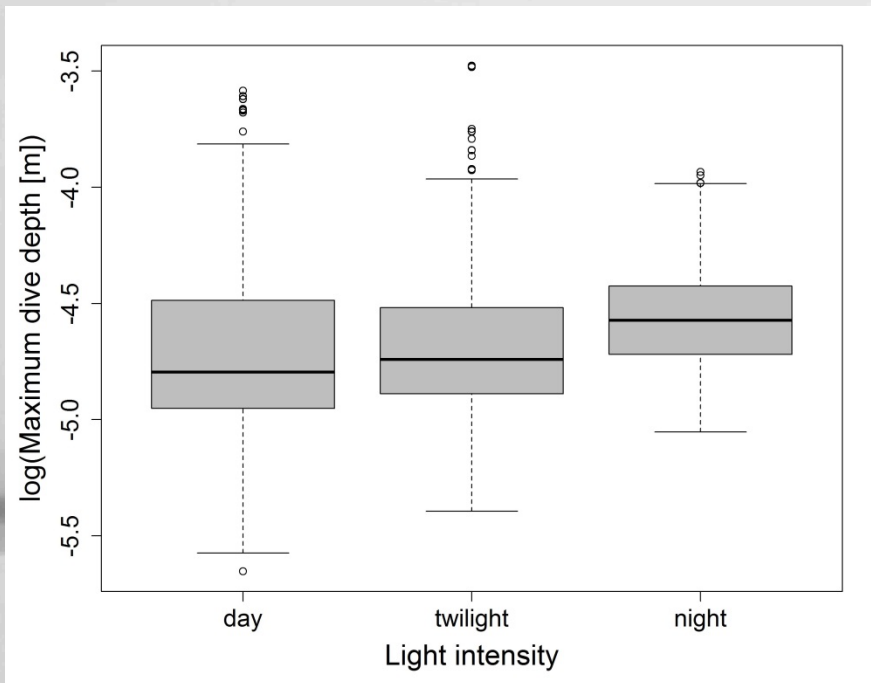
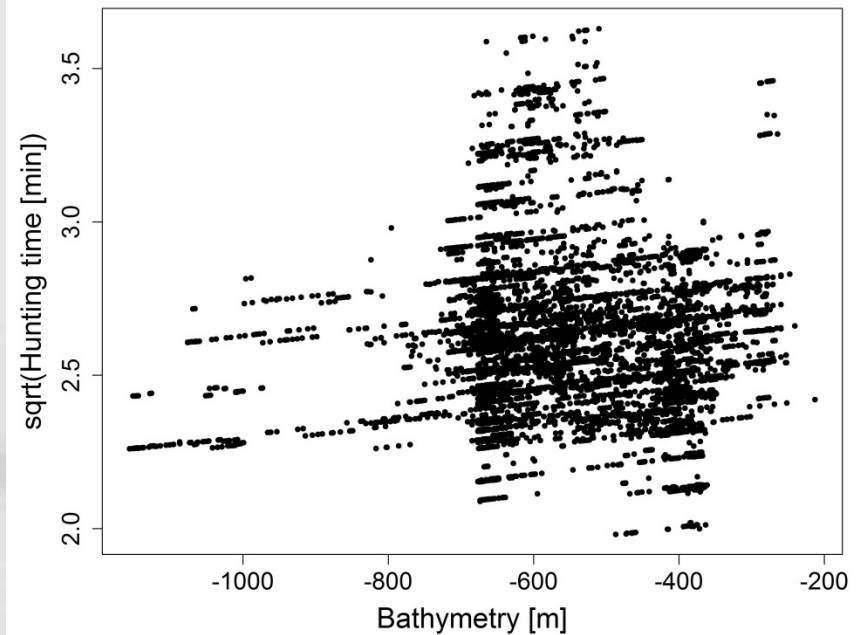
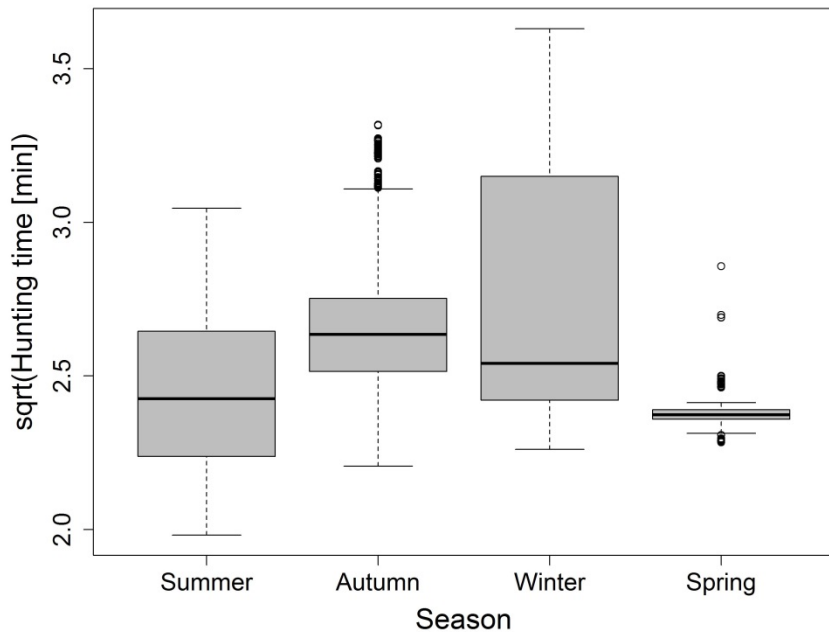


Fig. 3 Diurnal dive pattern of a Weddell seal (Seal 15) during 15/16 Feb. 1998
Plötz *et. al.* 2001



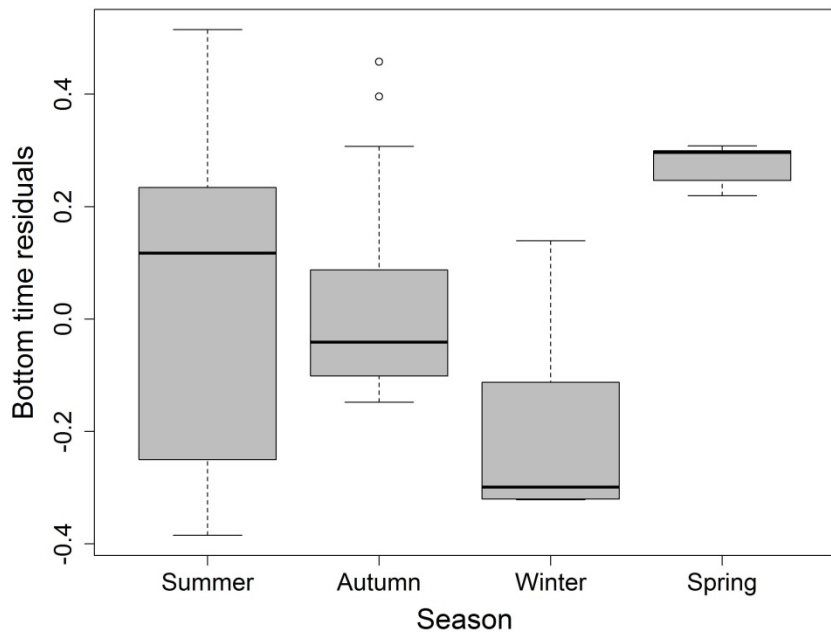
Results & Discussion

- hunting time:
 - higher in winter than in summer
 - higher in shallower waters



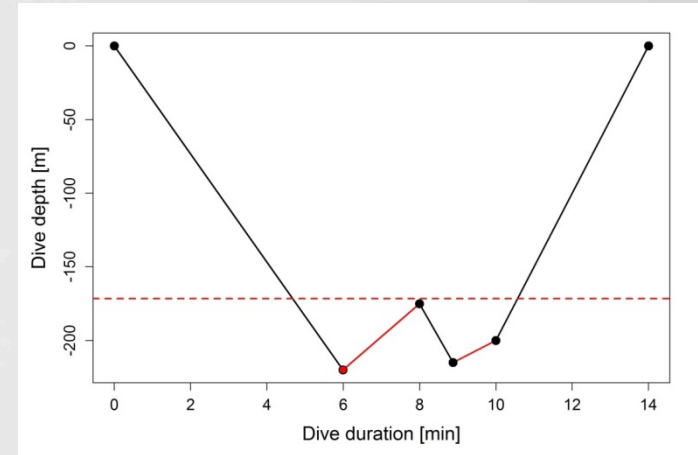
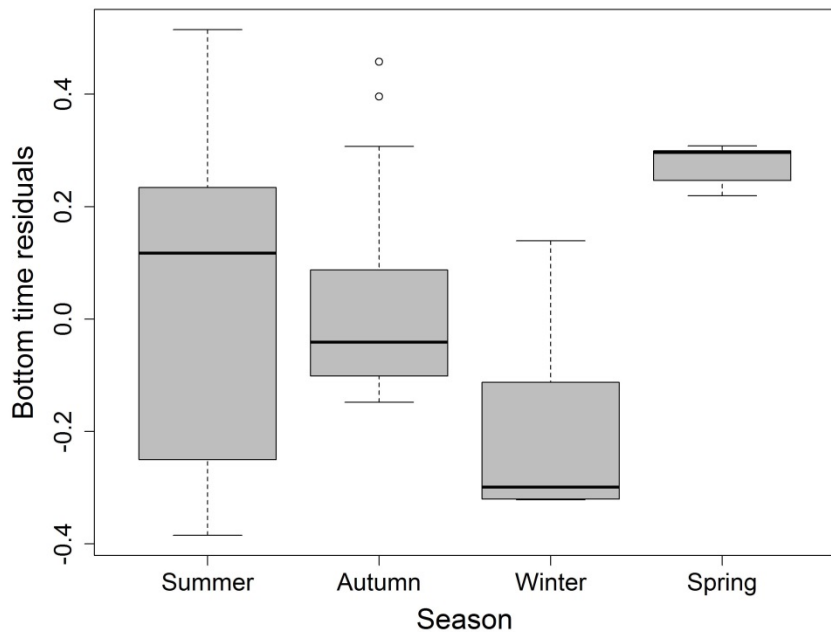
Results & Discussion

- foraging effort in bottom phase:
 - negative in autumn and winter

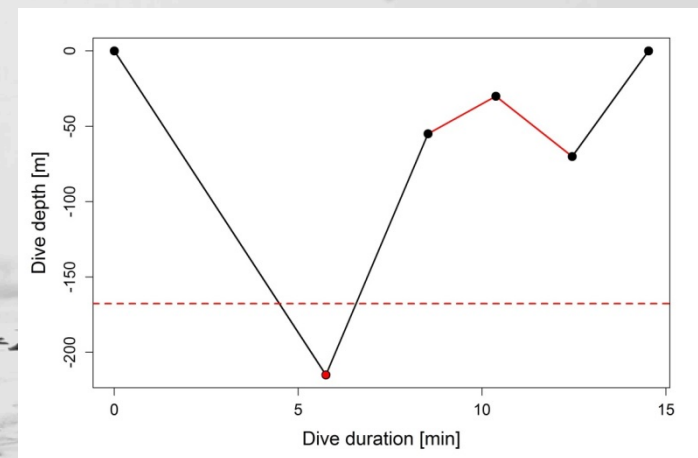


Results & Discussion

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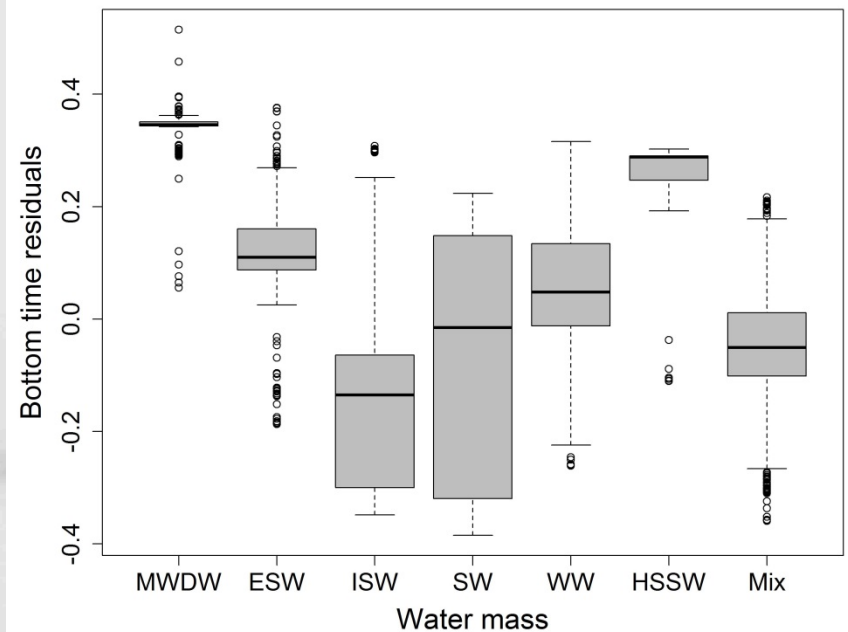
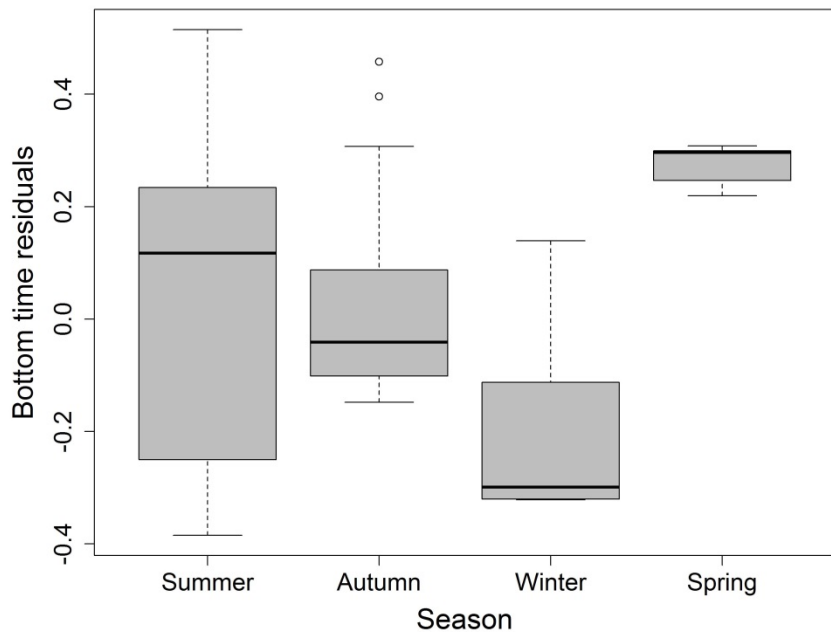


mismatch!



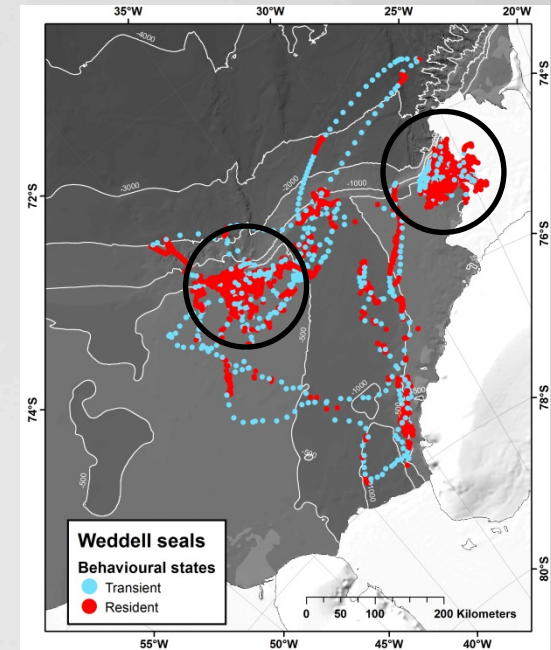
Results & Discussion

- foraging effort in bottom phase:
 - negative in autumn and winter
 - highest in MWDW



Conclusions

- two potential foraging hotspots
- diel variation in dive depths
 - vertical migrations of prey species
- hydrographic conditions (MWDW & ESW) influence foraging activities



Conclusions

- Weddell seals increase hunting time during winter
- generally, sea ice concentration and distance to polynya not important
- foraging effort in the bottom phase decreases during dark season
 - Weddell seals may shift foraging strategies?



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for your
attention!**