

Ice matters

*Arctic and Antarctic under-ice communities linking
sea ice with the pelagic food web*

Hauke Flores, J. A. van Franeker, **C. David**, **B. Lange**,
V. Siegel, E. A. Pakhomov, U. Bathmann ...

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Hauke Flores

- 1996-2002 **Studies**
UHH
- 2002-2003 **Fisheries observer**
Federal Research Centre
for Fisheries (HH)
- 2003-2009 **PhD**
Univ. of Groningen
IMARES (NL)
- 2007-2011 **Junior Scientist**
IMARES
- Since Jan
2012 **Group leader** HGF Young
Investigators Group
AWI & UHH

Current project:

Iceflux

*Ice-ecosystem carbon flux in
polar oceans*



Outline

1. Introduction

2. The sea ice – food web link

- a) Lessons from the Antarctic ice underside
- b) The *Iceflux* approach
- c) First insights from a field study in the Arctic

3. Conclusions



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Deutsche Trawler wollen in der Antarktis fischen

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23.10.2012, veröffentlicht von [Eva Schaper](#)

Zum Auftakt des Jahrestreffens der antarktischen Schutzkommission [CCAMLR](#) (Commission for the Conservation of the antarctic marine living Resources) fordert Greenpeace die Bundesministerin [Ilse Aigner](#) auf, die von ihrem Ministerium beantragte Fangquote von 150.000 Tonnen Krill (kleine Krebse) in der Antarktis zurückzuziehen. Sie bilden die Nahrungsgrundlage der dort beheimateten Tiere - dazu gehören neben Pinguinen und Robben auch Blau- und Buckelwale.

Bildergalerie

[1](#) [2](#)[>>](#)

Antarctic krill



Fish feed



Euphausia superba

Functional
food



Cosmetics

whoi.edu

Antarctic krill



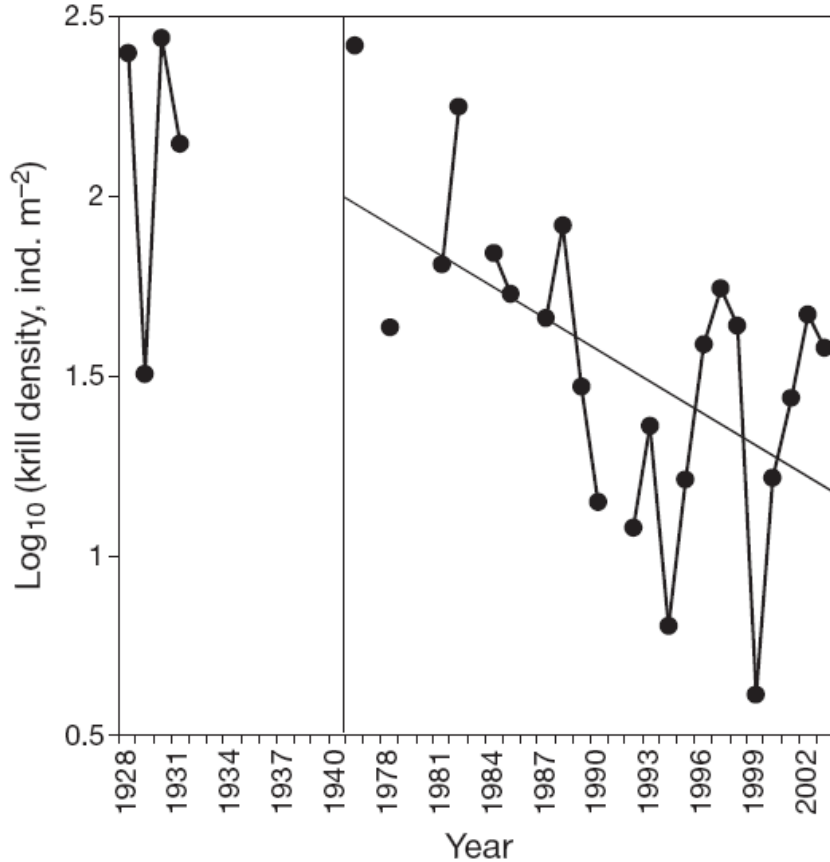
- Bioluminescent
- Size up to 6 cm
- Age up to 6 yrs
- Swimming speed up to 0.65 m s^{-1}

Euphausia superba

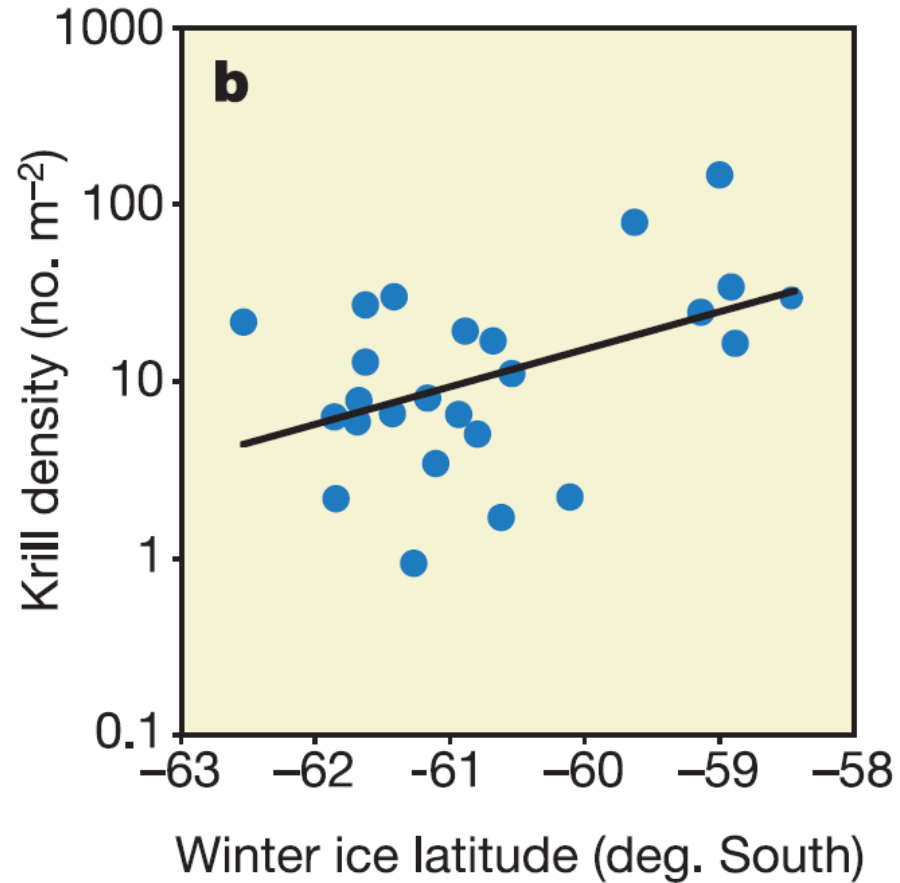
- Total biomass ~ 380 Mio t
(NE Atlantic herring SSB: ~ 6 Mio t)
- Huge swarms (up to 10s of km)
- Key prey item of Antarctic birds and mammals

whoi.edu

Krill decline in past decades



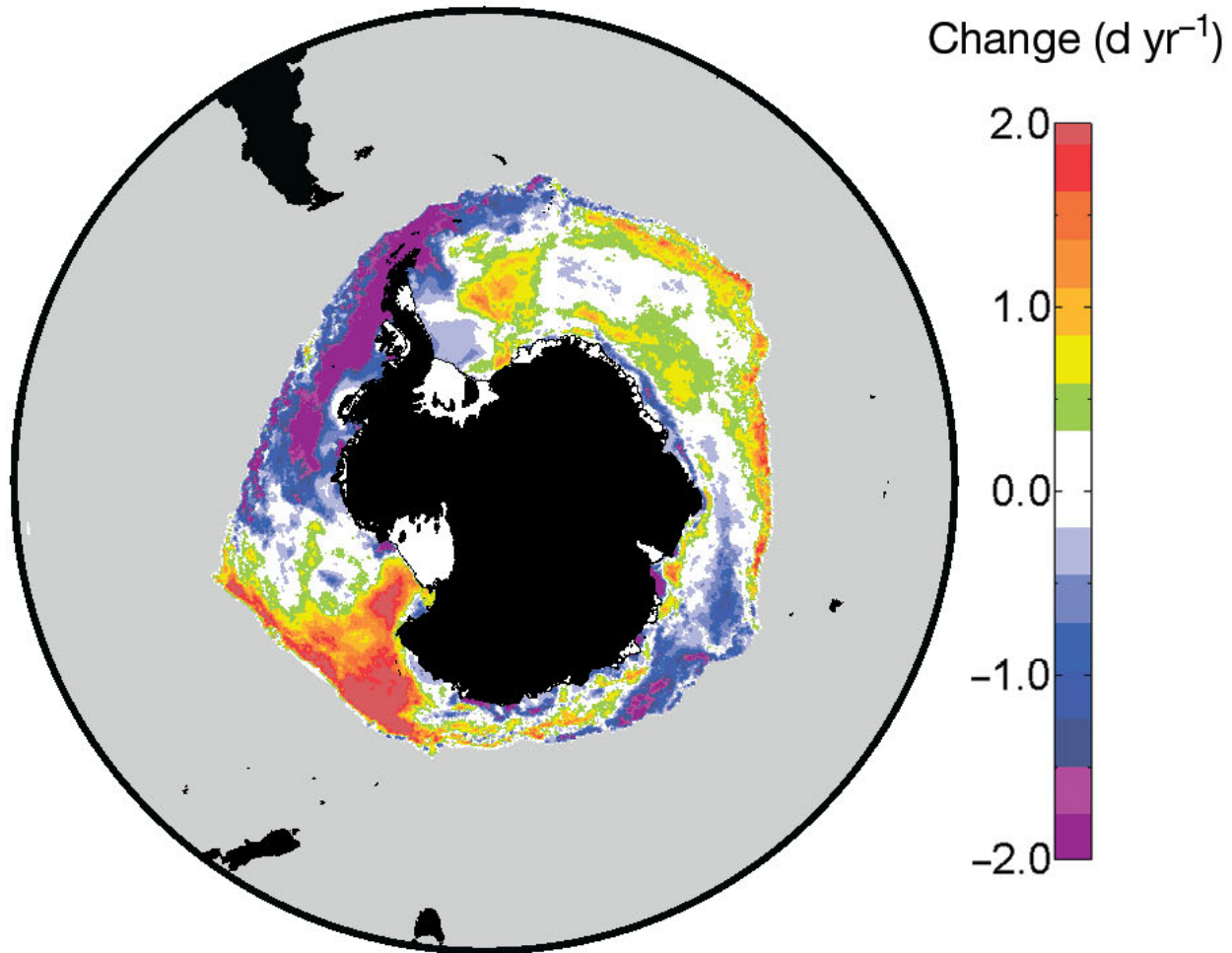
Atkinson et al (2008)
Mar Ecol Prog Ser 362:
1-23

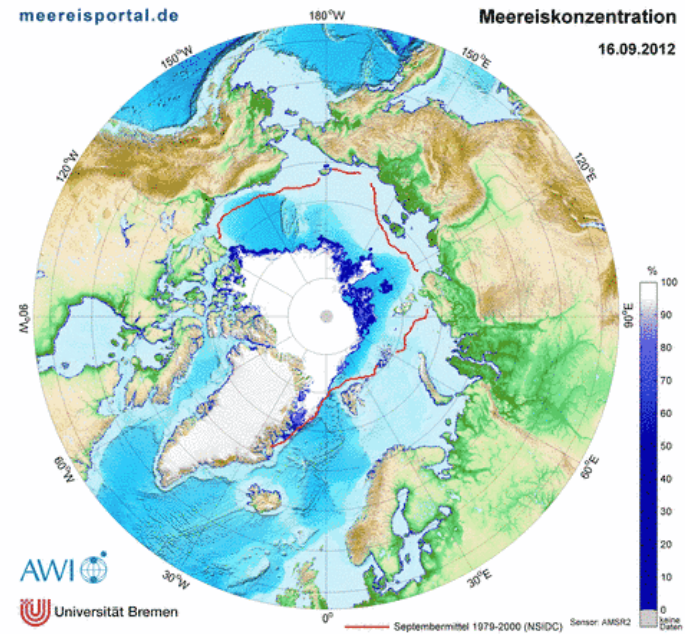
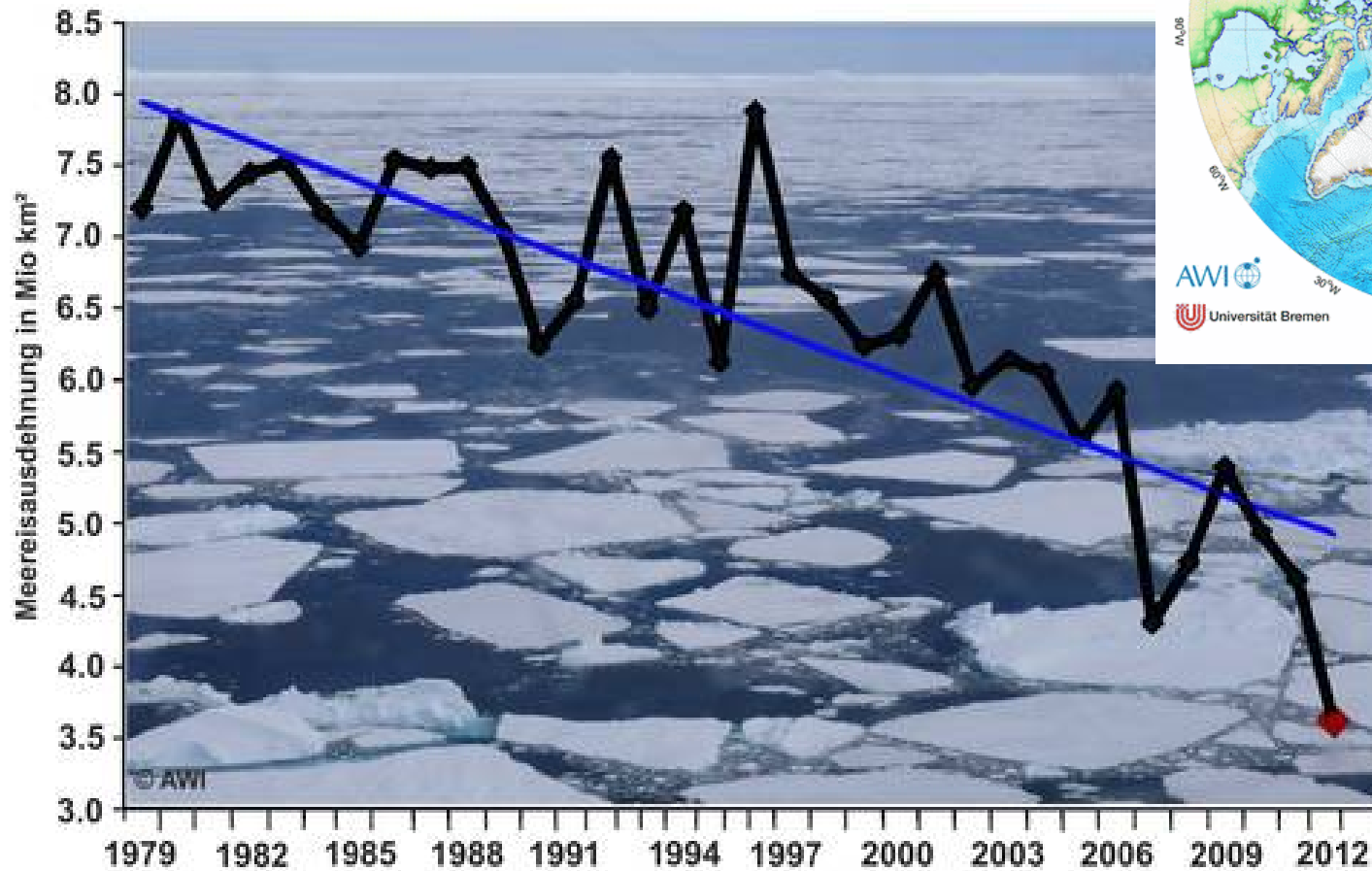


Atkinson et al (2004)
Nature 432: 100-103

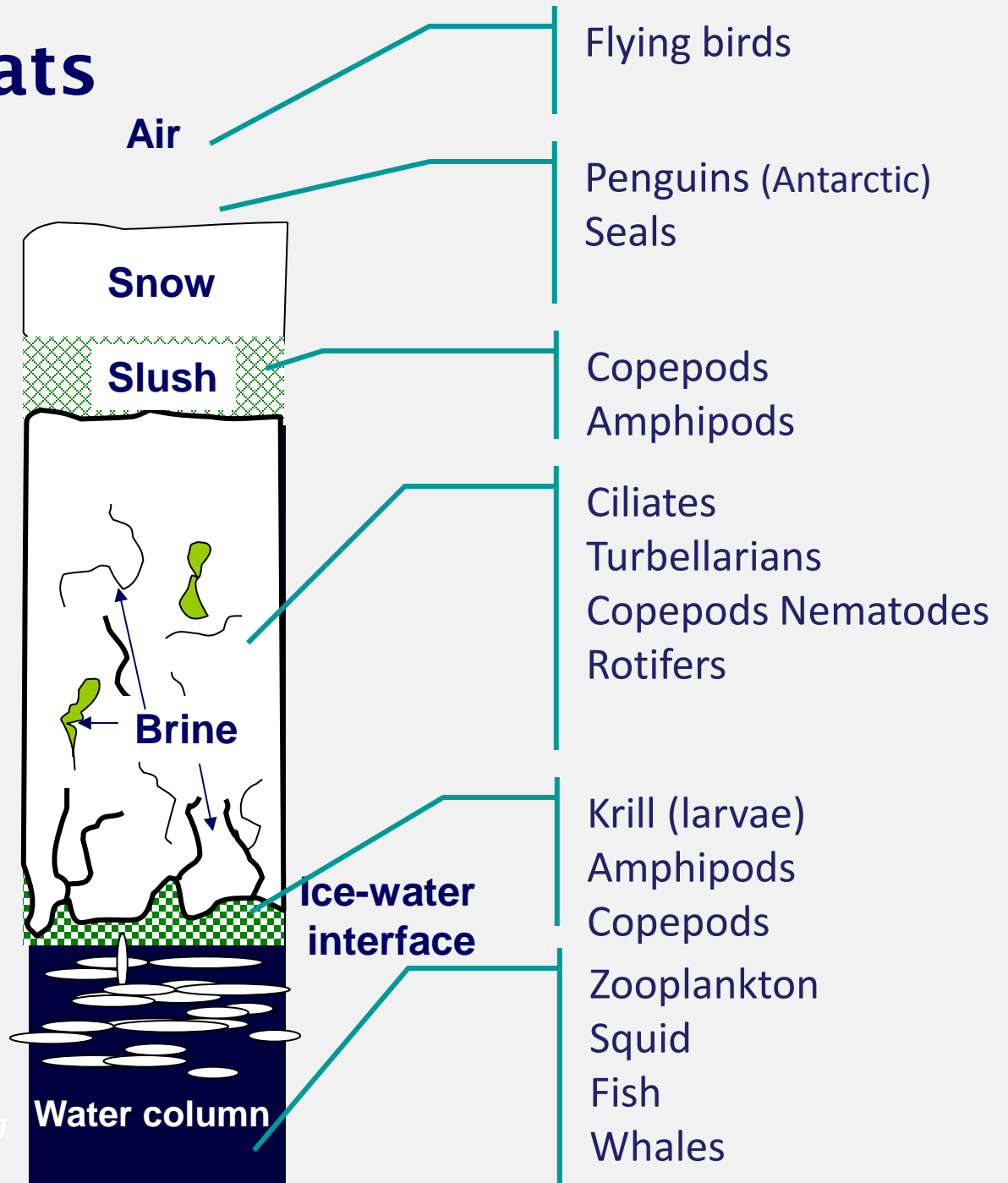
C

Change in duration of sea ice season





Sea ice habitats

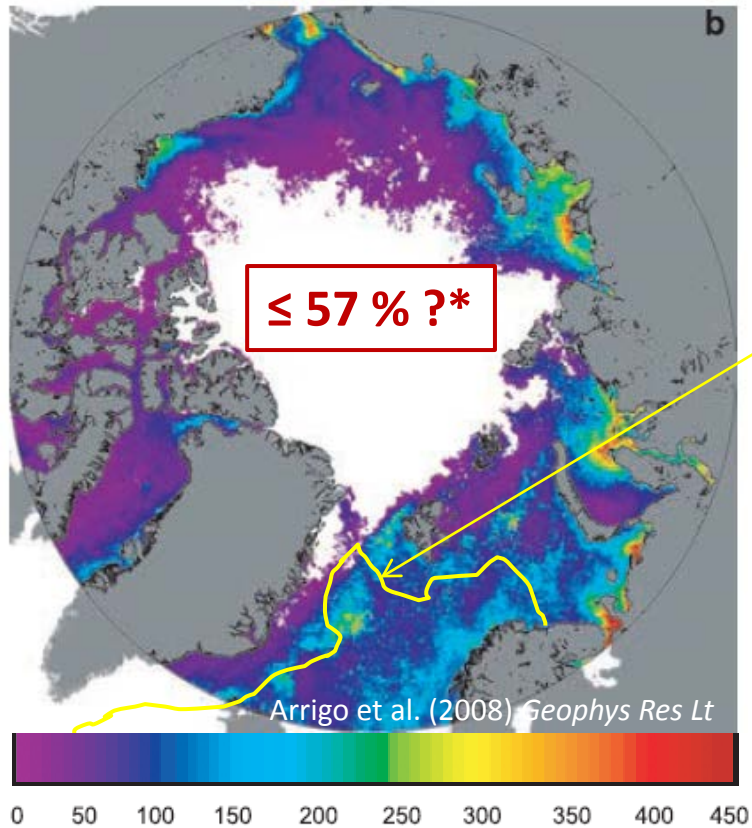




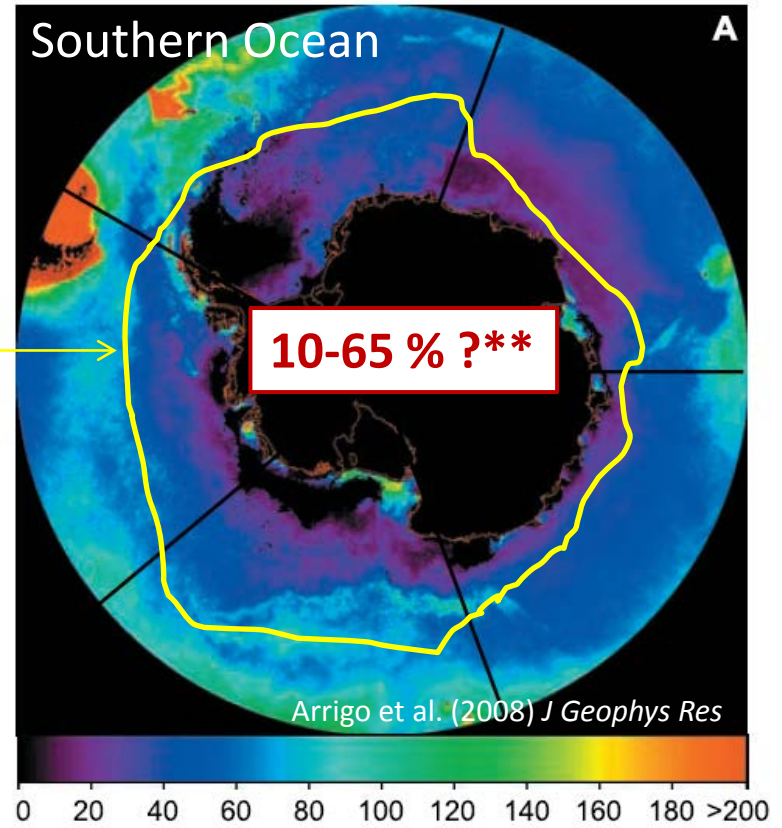
Ice algae

High life stock in a low productive ocean?

Annual water column primary production ($\text{g C m}^{-2} \text{y}^{-1}$)



*Gosselin (1997)
Deep-Sea Res II



** Arrigo & Thomas
(2004) *Ant Sci*,
McMinn et al.
(2010) *Mar Biol*

Proportional contribution of ice algal primary production

Euphausia superba



Sea ice-associated fauna

Antarctic

Boreogadus saida

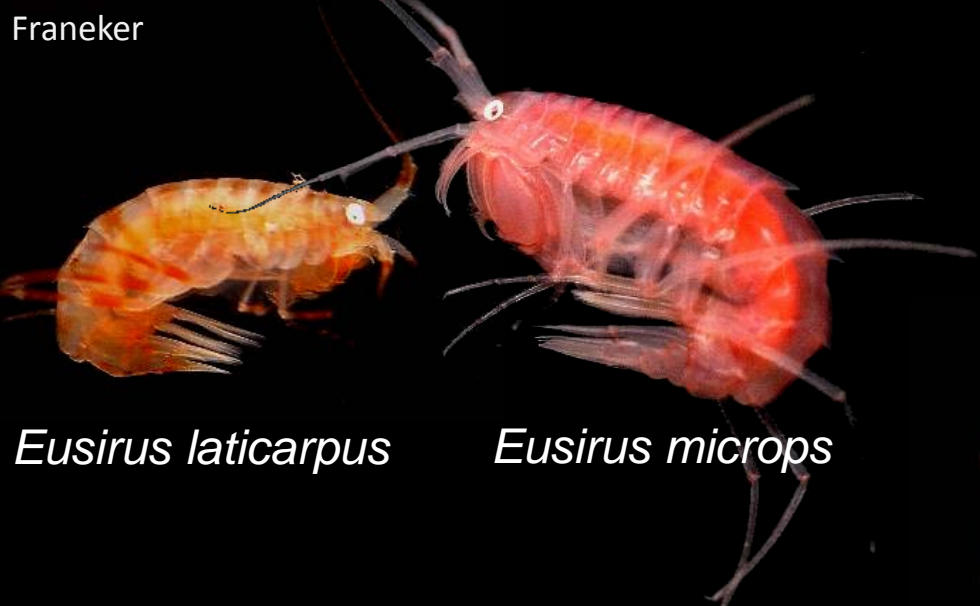


Arctic

Gammarus wilkitzkii



J.A. van Franeker



Eusirus laticarpus

Eusirus microps



Apherusa glacialis

Arcodiv.org

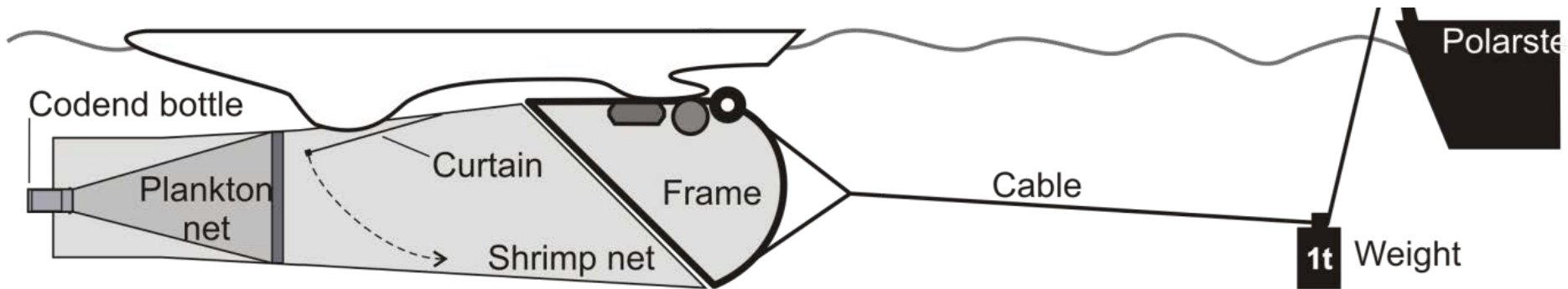
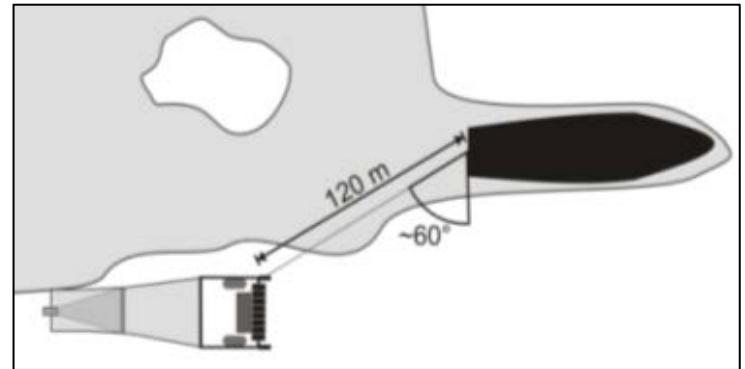
Bluhm&Gradinger UAF/CoML



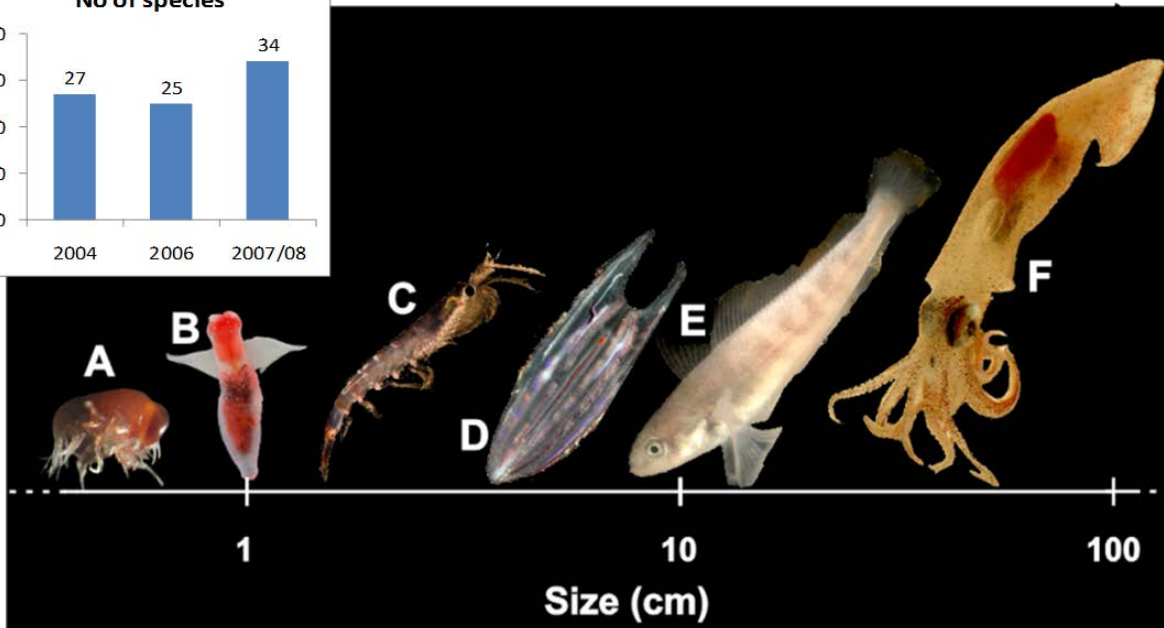
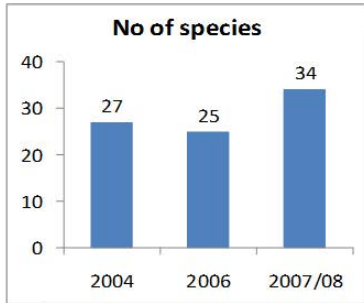
Onissimus glacialis

Arcodiv.org

Bluhm UAF/CoML

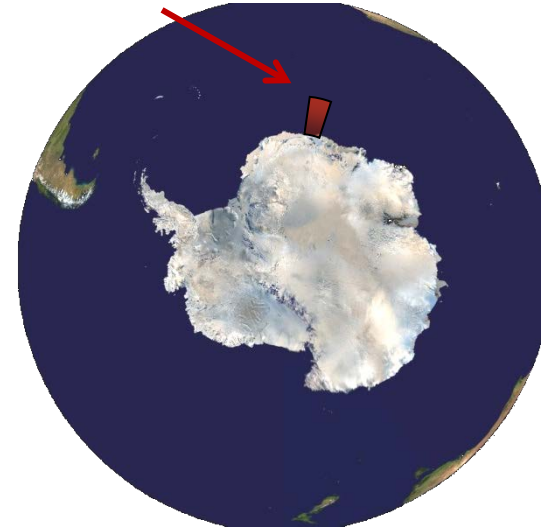


Macrozooplankton sampled under Antarctic sea ice



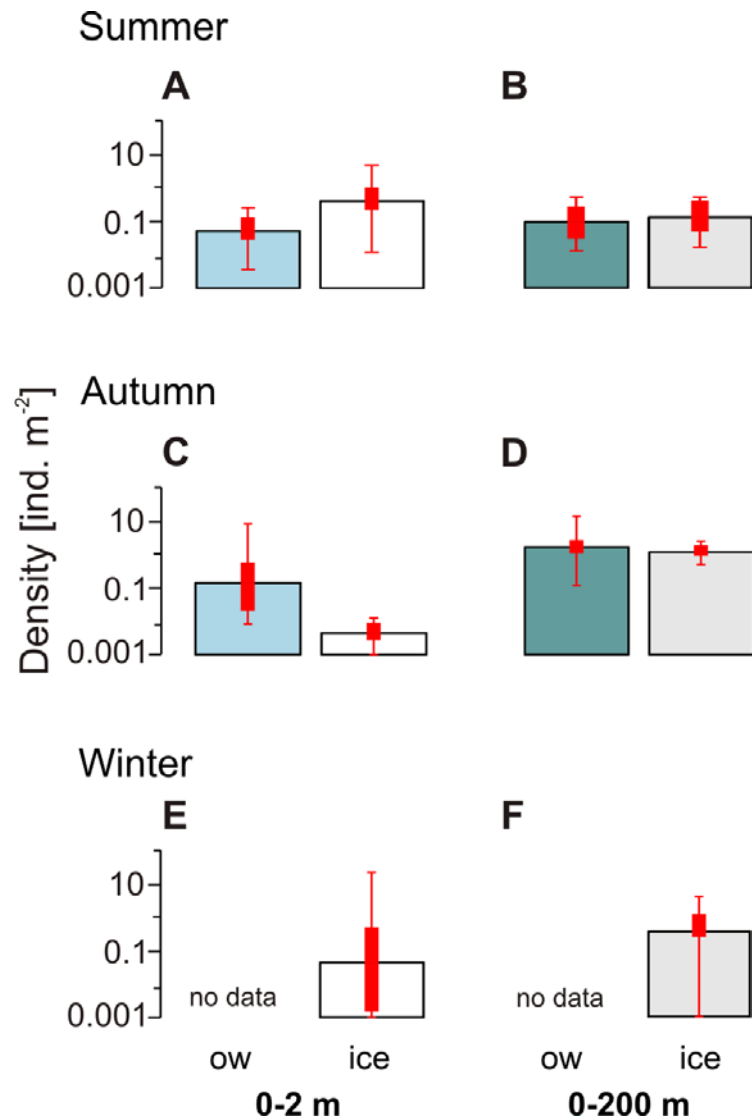
A: *Hyperiella dilatata*; B: *Clione antarctica*; C: Antarctic krill
D: *Callianira antarctica*; E: *Aethotaxis mitopteryx*;
F: *Slosarczykovia circumantarctica*

Lazarev Sea



RV Polarstern

Antarctic krill under sea ice



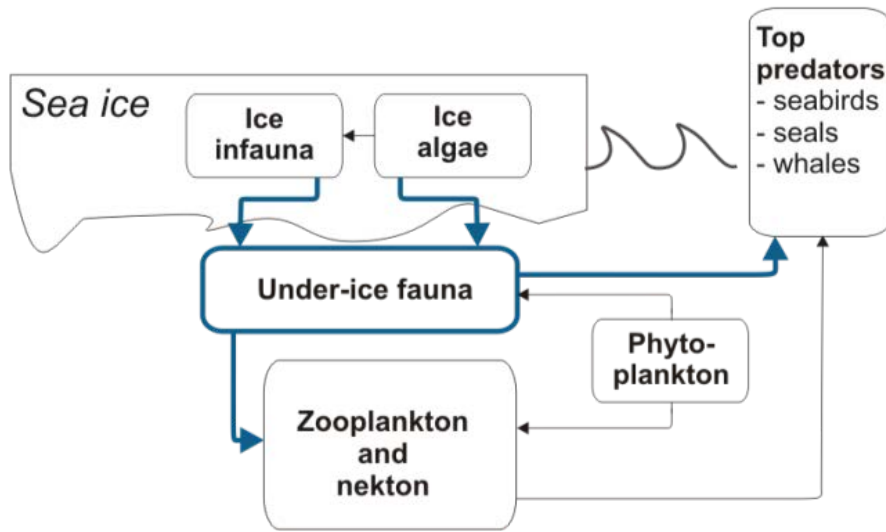
Summer:

- Krill signific. **more abundant** under ice than in ow
- Under ice per-area abundances consistantly **higher** than 0-200 m abundances from pelagic nets

Winter

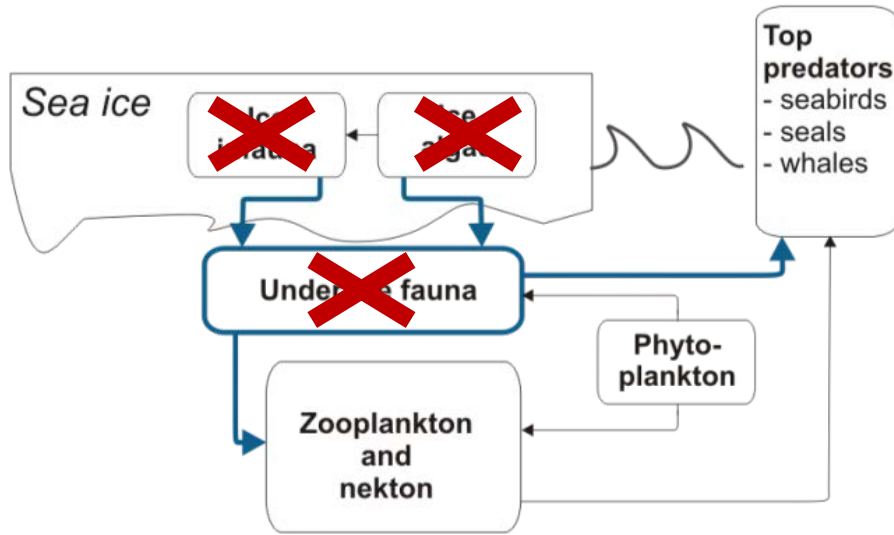
- **Maximum** seasonal abundances under **winter sea ice**
- Local per-area **abundances far exceeded** 0-200 m abundances



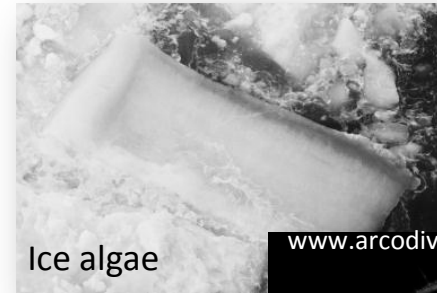


Carbon flux through sea ice food web



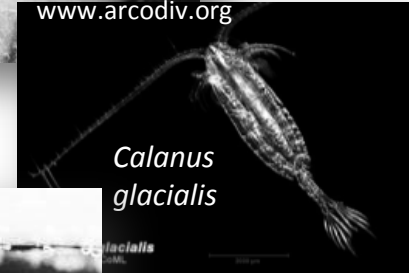


Carbon flux through sea ice food web



Ice algae

www.arcodiv.org



Calanus glacialis

J.A. van Franeker



Antarctic krill



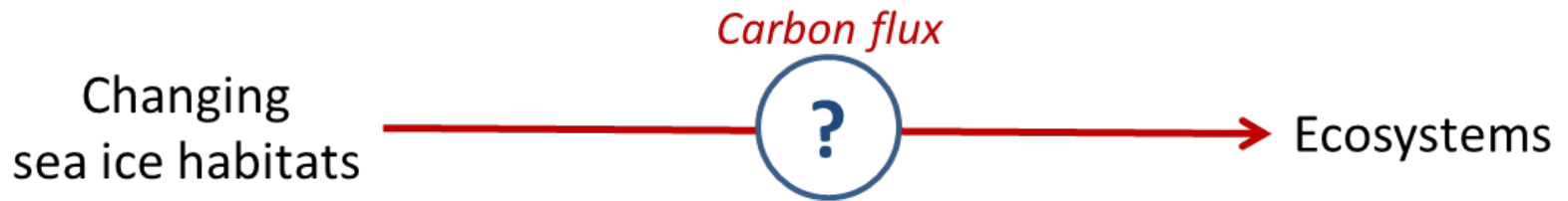
Humpback whale



The importance of sea ice-derived carbon in polar marine ecosystems

Hauke Flores

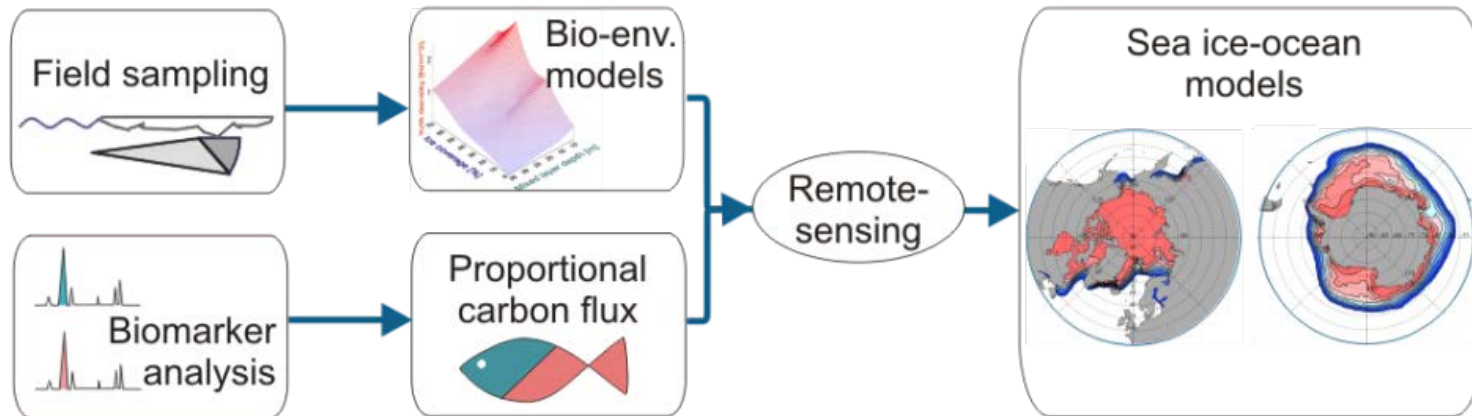
Iceflux approach

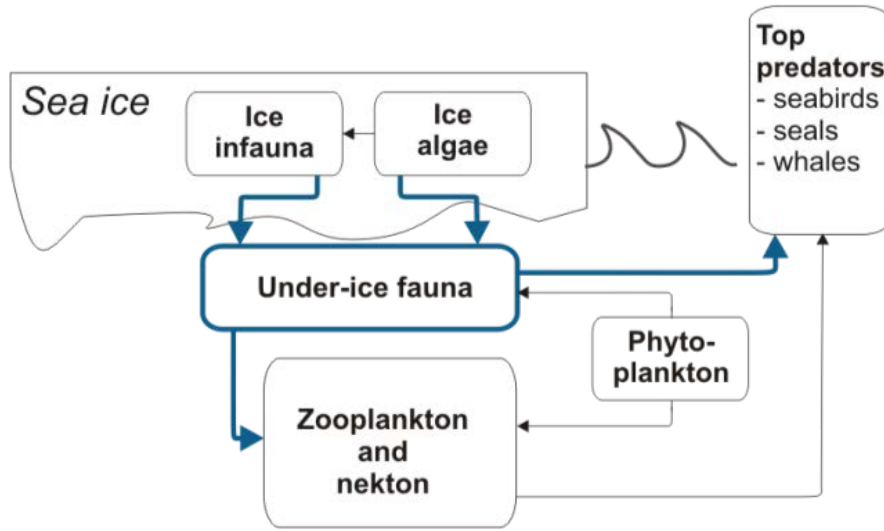


Objective:

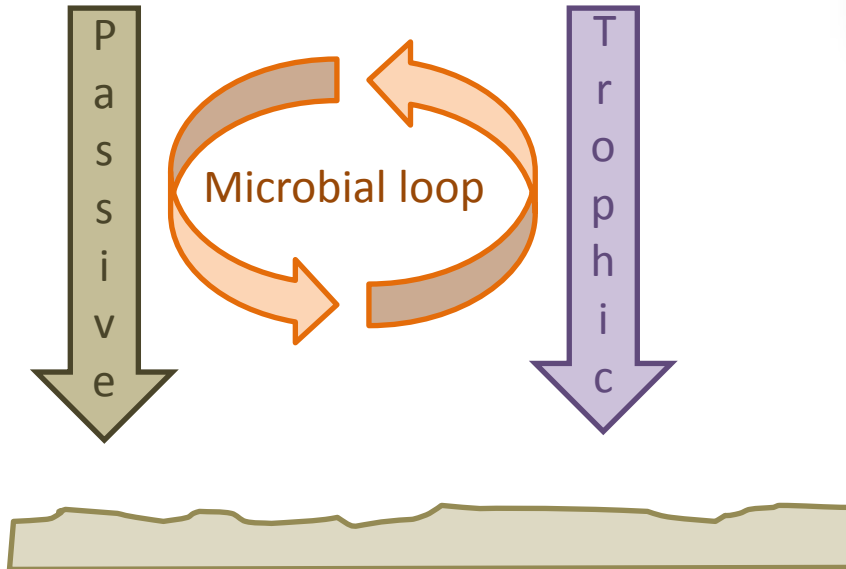
Quantifying the flux of sea ice-derived carbon into the under-ice communities in Arctic and Antarctic ecosystems

Iceflux approach



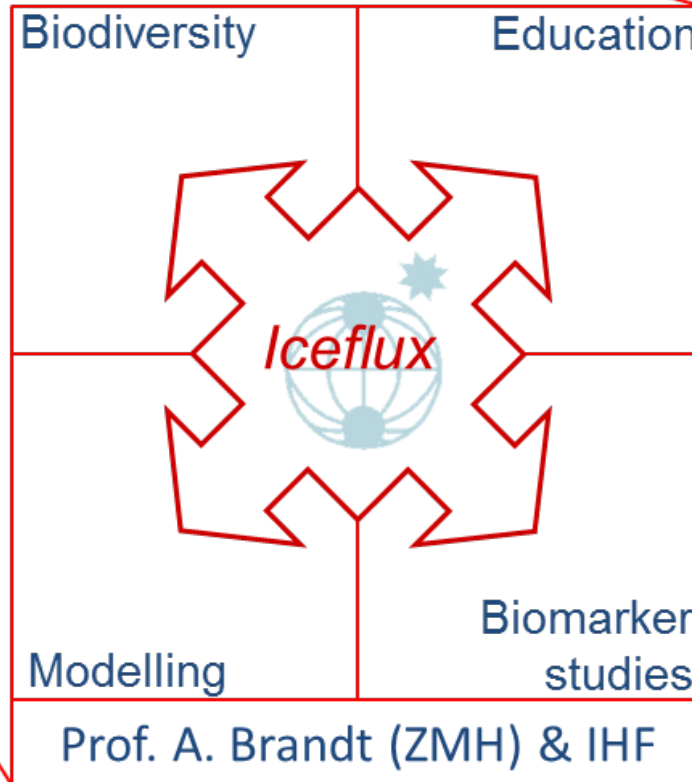


Carbon flux through sea ice food web





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Lectures & Seminars
Introduction to Biological Oceanography (Msc, IHF)

MSc, BSc projects

Research projects
ANDEEP-SYSTCO II
(DFG)
KuramBio (BMBF)



Maud Rise – a snapshot through the water column

A. Brandt^{a,*}, U. Bathmann^b, S. Brix^c, B. Cisewski^b, H. Flores^d, C. Götsch^b, S. Kruse^b, H. Leach^f, K. Linse^g, E. Pakhomov^h, I. Peeken^{b,i}, T. Riehl^a, J. M. Schrödl^k, E. Schwabe^k, V. Strass^b, J.A. van Franeker^d, E. Wilmser^j

^a Biocentrum Grindel and Zoological Museum, Martin-Luther-King-Platz 3, 20146 Hamburg, Germany

^b AWI: Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany

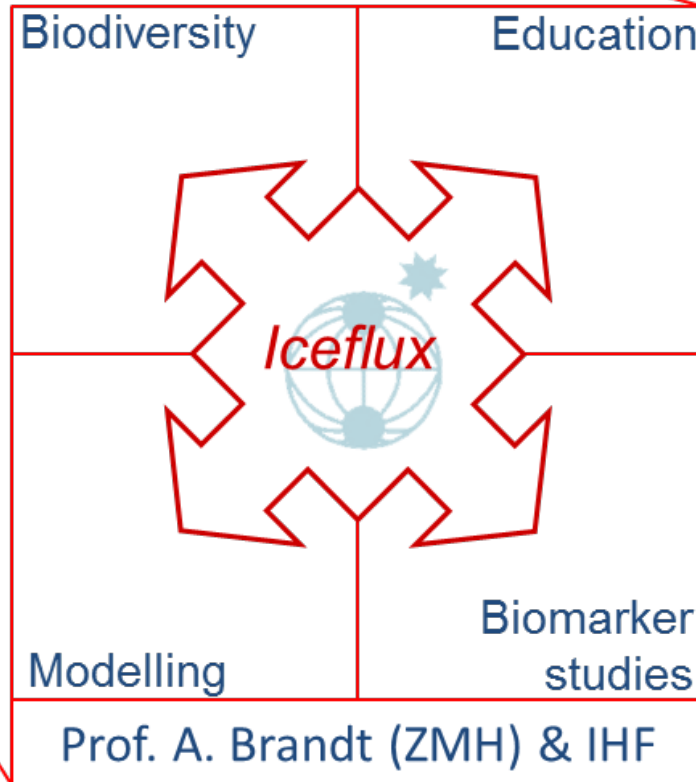
^c Deutsches Zentrum für Marine Biodiversitätsforschung, Senckenberg, Hamburg, Germany

^d Institute for Marine Resources and Ecosystem Studies (IMARES), P.O. Box 167, 1790 AD Den Burg, The Netherlands

Brandt et al. (2011)
Deep-Sea Res II



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Collaboration AG Brandt

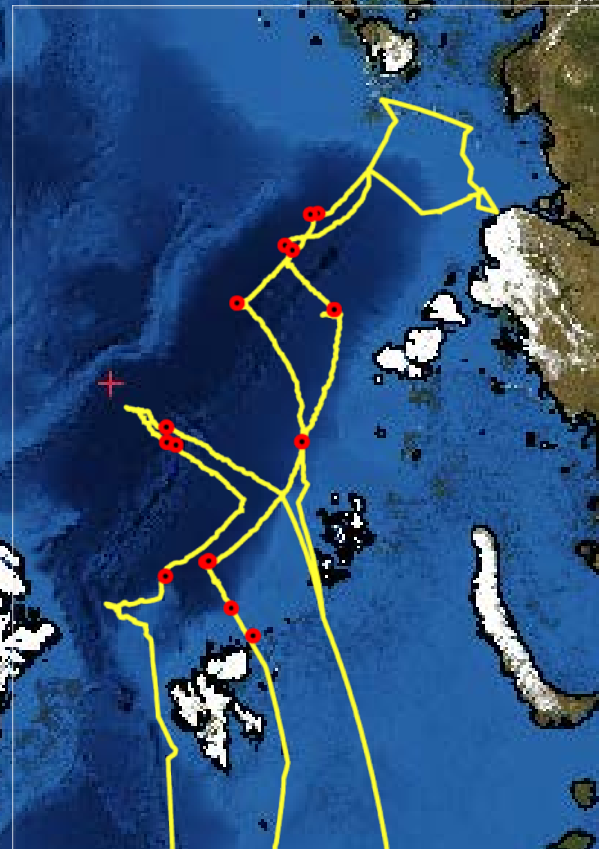
Taxonomy
Biodiversity studies
Cryo-benthic coupling
Museum samples
Education

Other possible collaborations

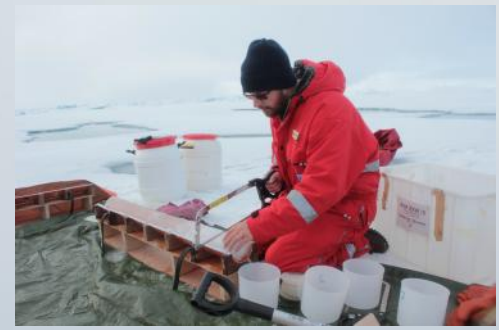
Trophic studies (FA, SI)
Habitat modeling
Zooplankton ecology



**ARK XXVII/3 „IceARC“
02.08. – 08.10.2012**



Ice station





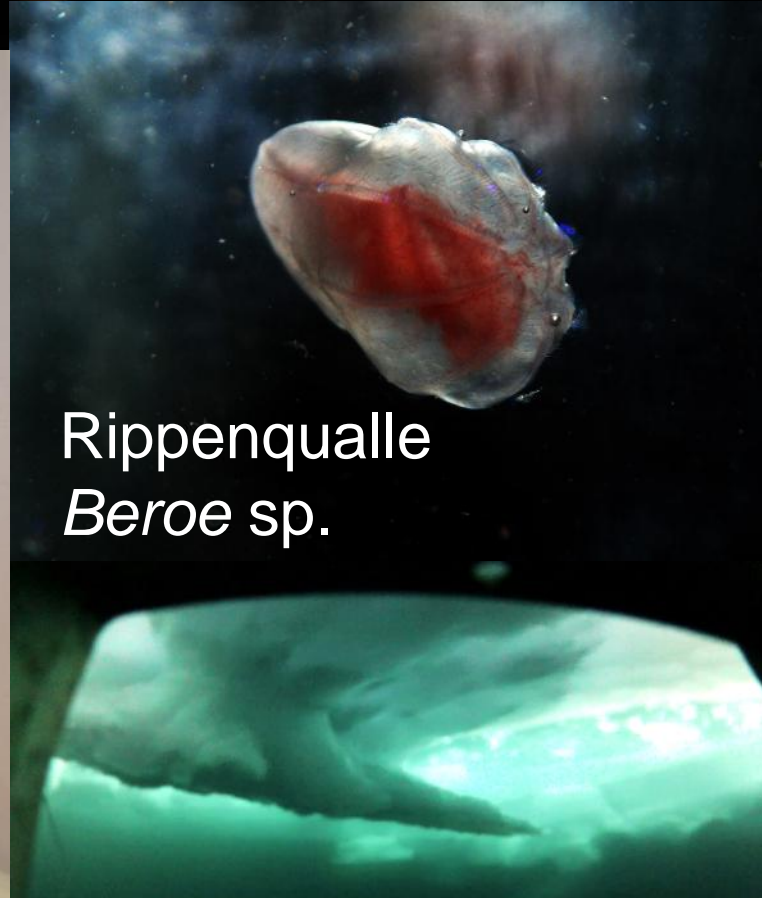
Flügelschnecke
Clione limacina



Flohkrebs
Gammarus wilkitzkii

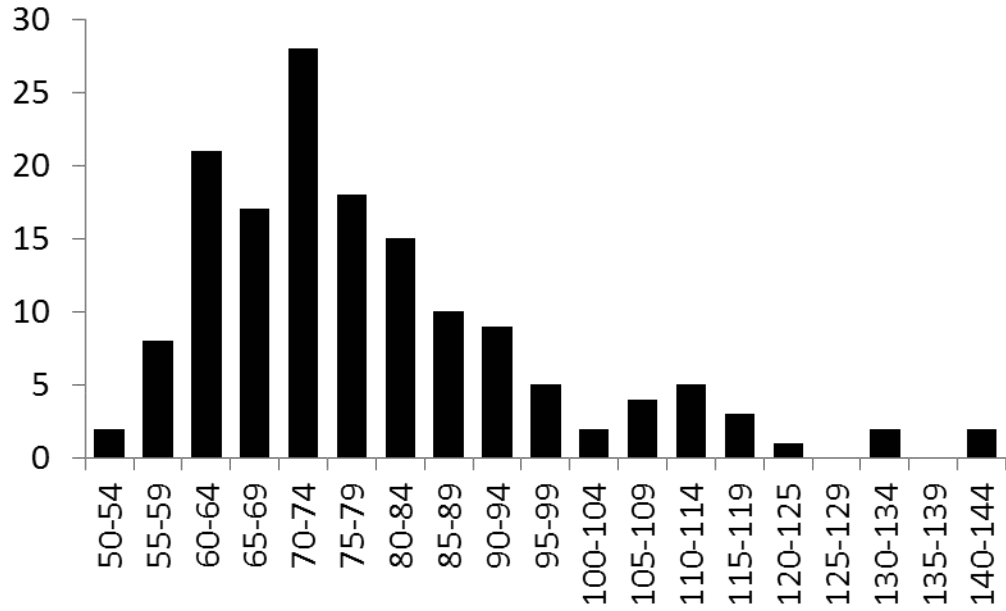


Polardorsche

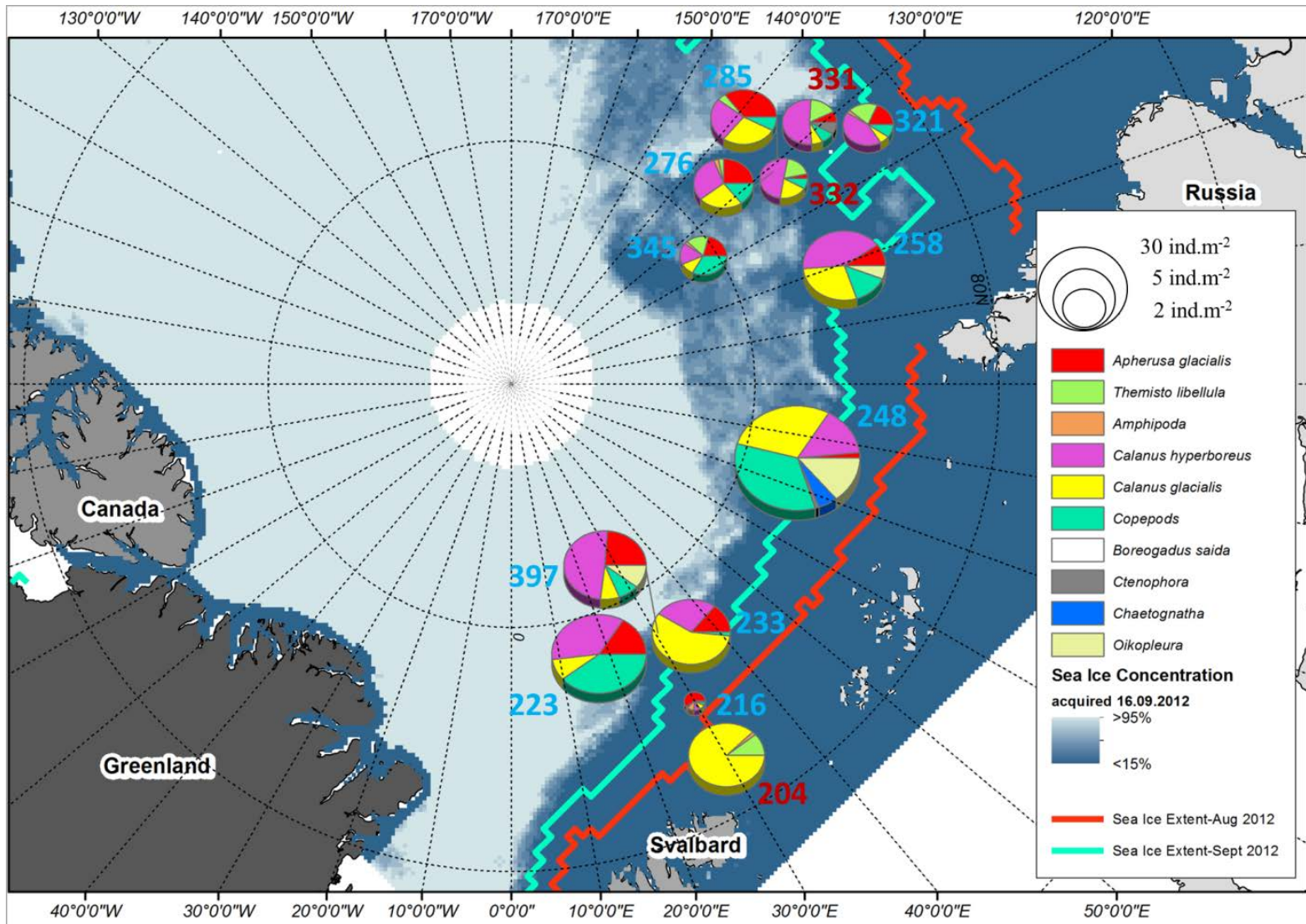


Rippenqualle
Beroe sp.

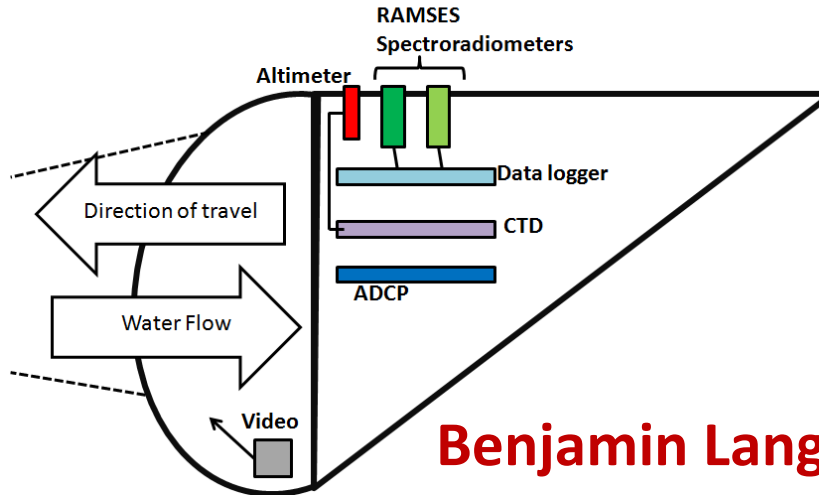
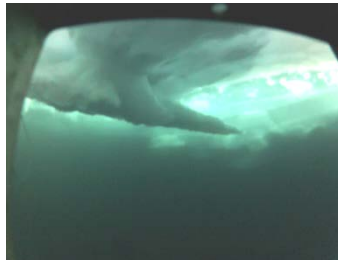
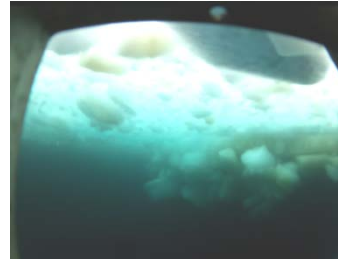
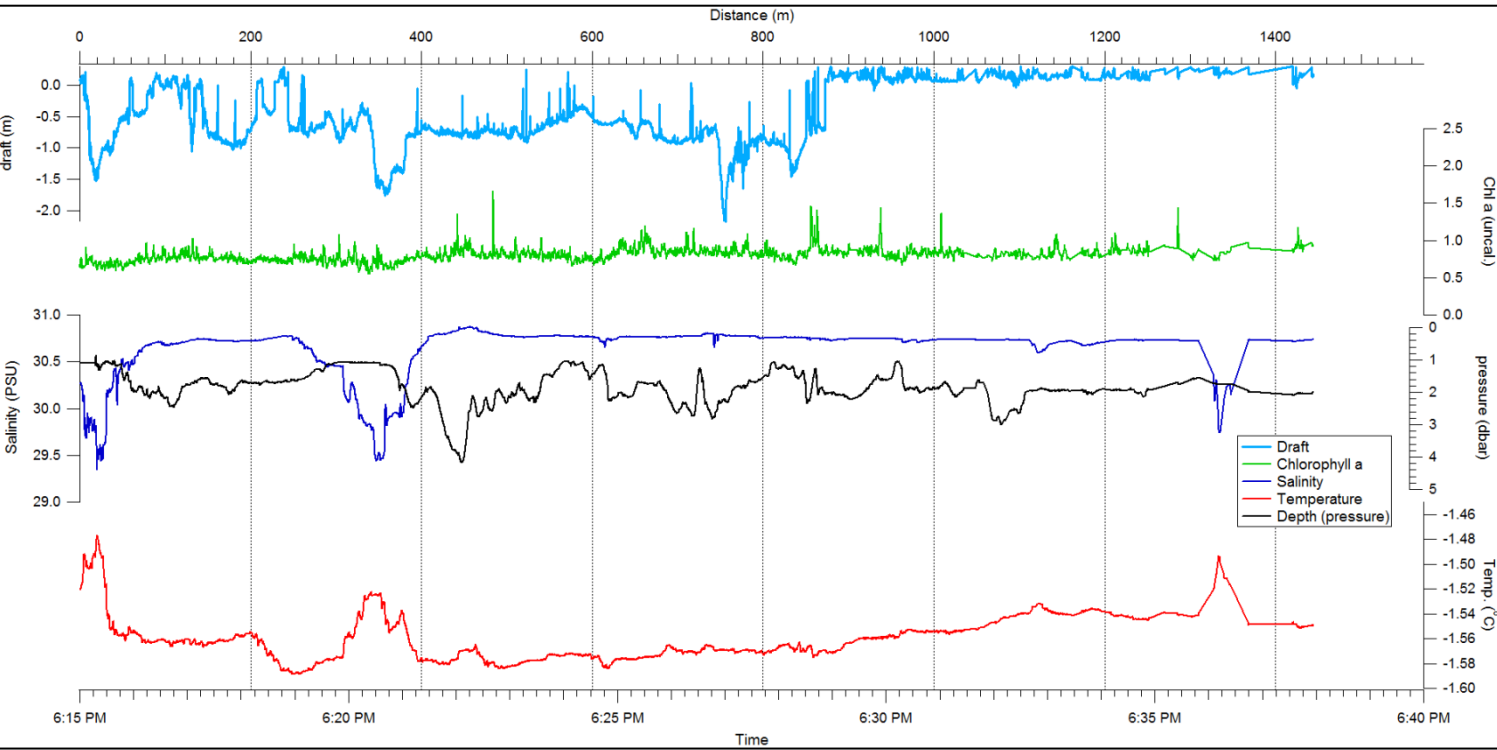
Polar cod



Community composition

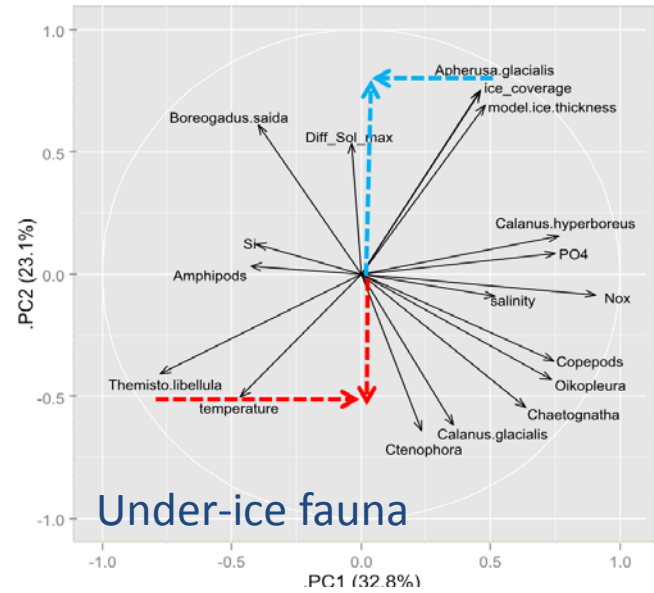
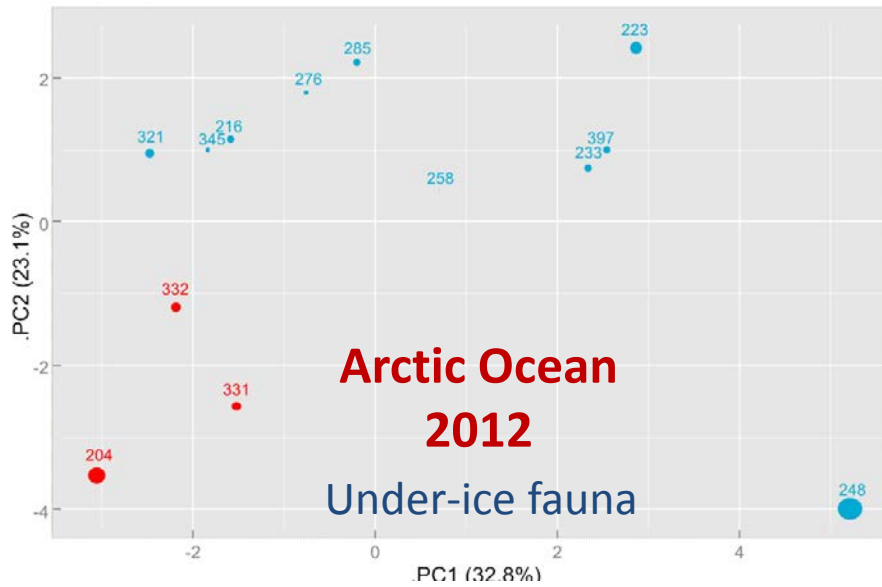


Linking data



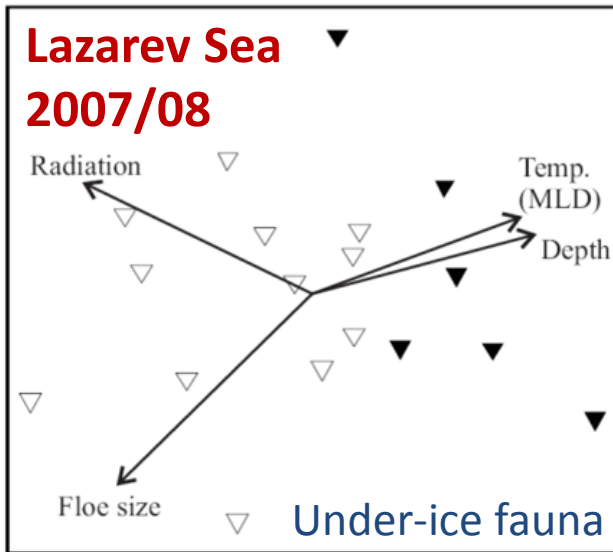
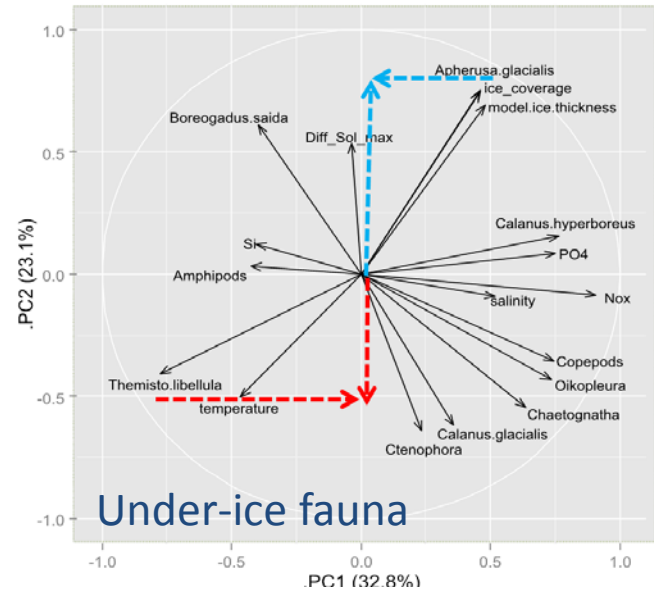
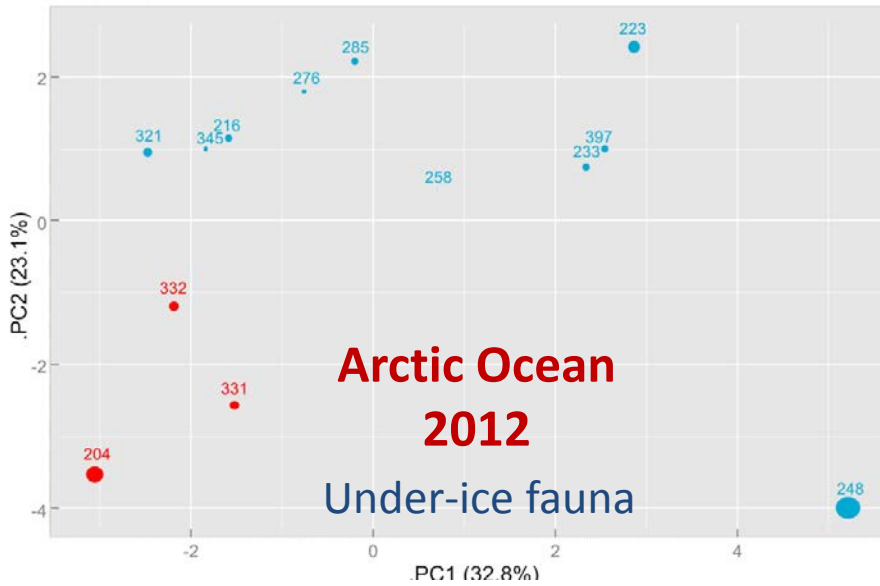
Benjamin Lange

Linking data



Clione limacina

Linking data

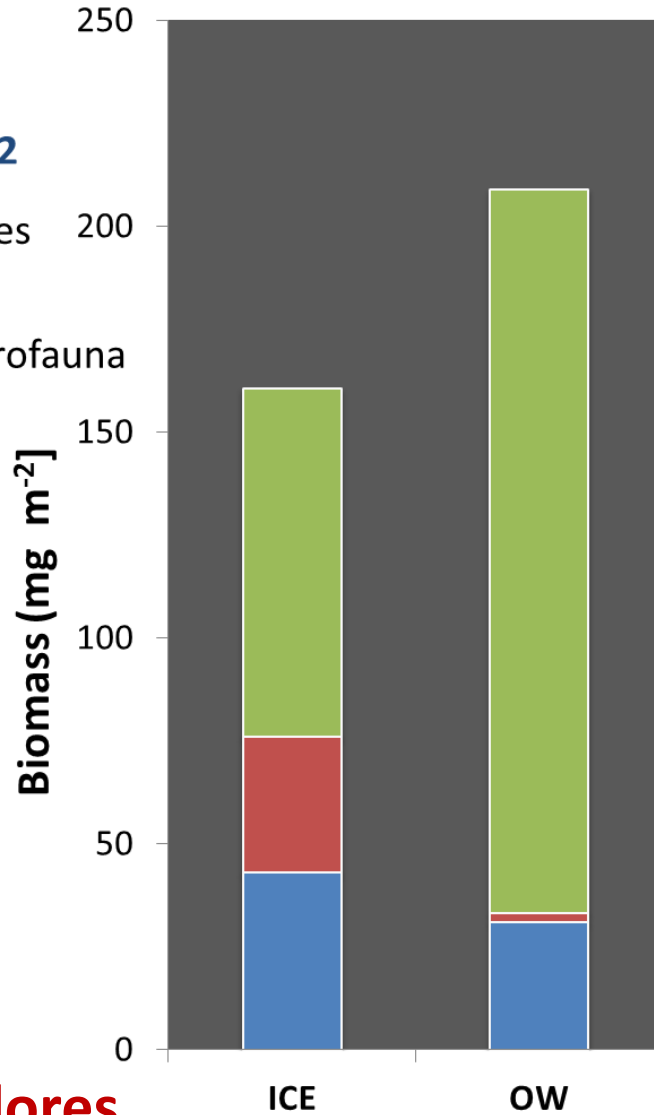


Carmen David

Biomass comparison

Arctic Ocean
Summer 2012

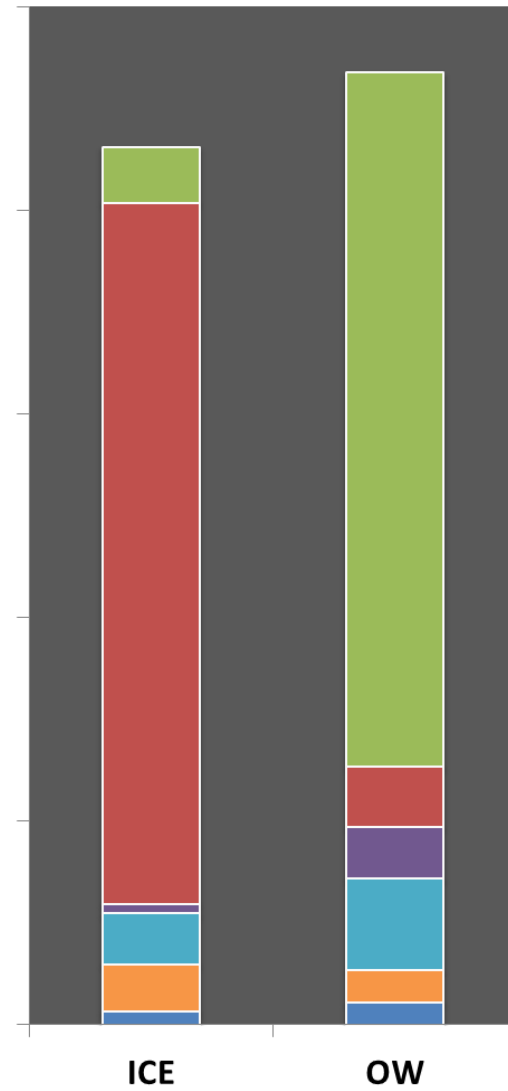
- Ctenophores
- Polar cod
- Other macrofauna



Hauke Flores

Lazarev Sea
Summer 2007 / 2008

- Ctenophores
- Euphausia superba
- Clio pyramidata
- Sagitta gazellae
- Thysanoessa macrura
- Other macrofauna



Carmen David

Conclusions

- The Antarctic under-ice habitat hosts an abundant and diverse community
- Antarctic krill is particularly associated with sea ice nearly year-round
- In the Arctic Ocean, a similarly diverse under-ice community exists throughout the “low productive” central basins
- Arctic cod and Antarctic krill may play similar key roles in transferring carbon from sea ice into the pelagic food web
- In both Polar Regions, sea ice-associated key species are threatened by rapidly changing habitats, with possible ramifications for ecosystem structure





Thank you.

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SUIT on-deck crew, Polarstern ARK XXVII/3