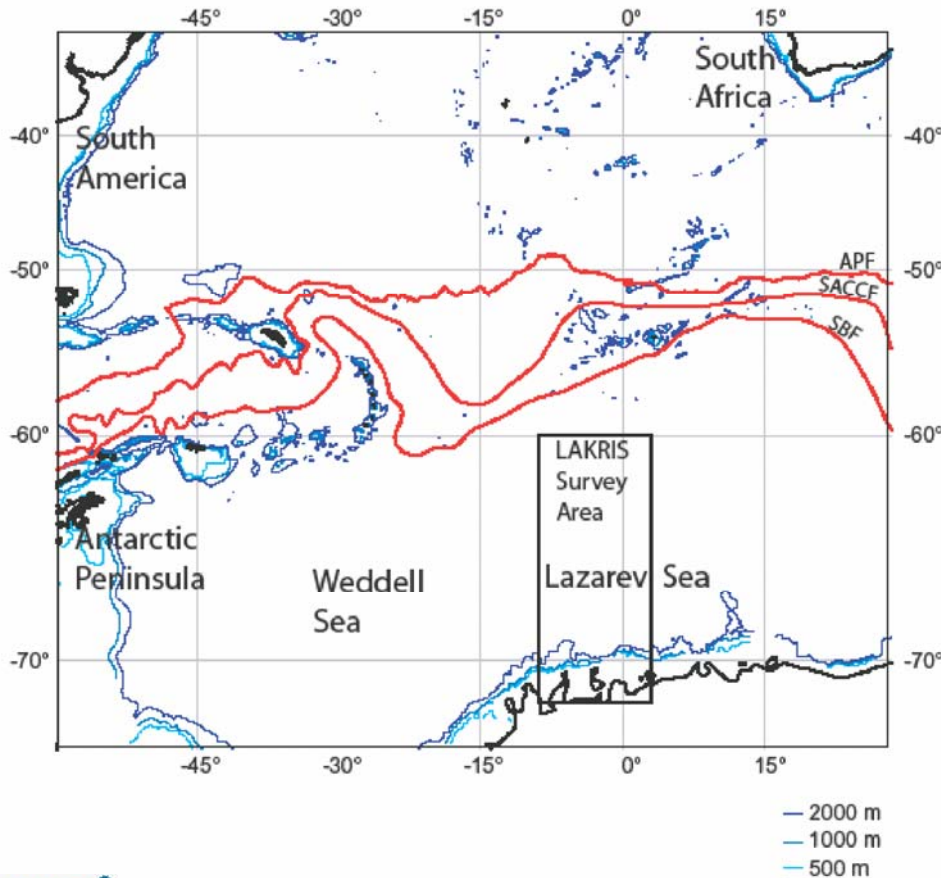


The Lazarev Sea krill study (LAKRIS)

The German contribution to the SO-GLOBEC program



Funded by the German Ministry of Education and Research



Duration: 1.8.2004 - 31.8.2008

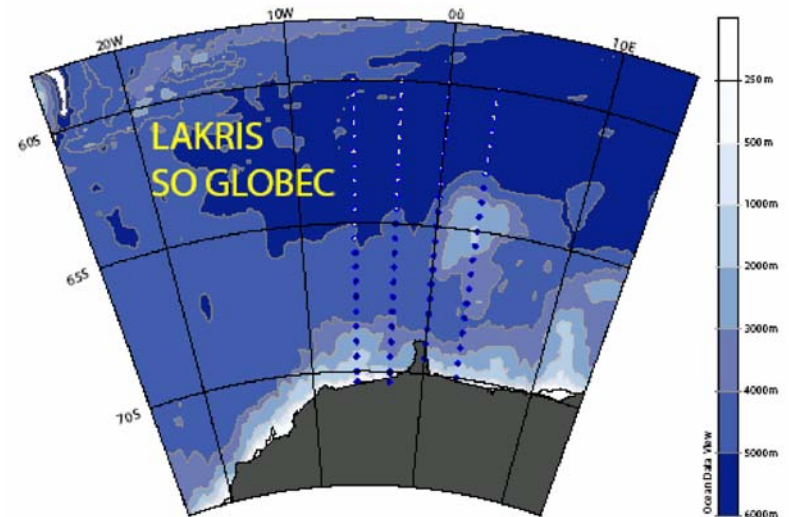
Expeditions with RV Polarstern:

ANTXXI-4 : Antarctic autumn 2004

ANTXXIII-2 : Antarctic summer 2005/2006

ANTXXIII-6 : Antarctic winter 2006

ANTXXV-2 : Antarctic summer 2007/2008



The LAKRIS network

Subproject 1:

Seasonal and interannual variability in krill demography of high latitude krill stocks in the Lazarev Sea

(Volker Siegel)

Subproject 2:

Horizontal and vertical distribution of krill and zooplankton in relation to the ocean current system

(Ulrich Bathmann)

Subproject 3:

Effects of water mass circulation and sea ice on the abundance of zooplankton

(Monika Rhein, Volker Strass)

Subproject 4:

Seasonal dynamics of physiological condition of krill with emphasis on its larvae stages

(Bettina Meyer)

Subproject 5:

Seasonal lipid dynamics and energetic adaptations of *Euphausia superba*, with emphasis on juvenile and adult stages

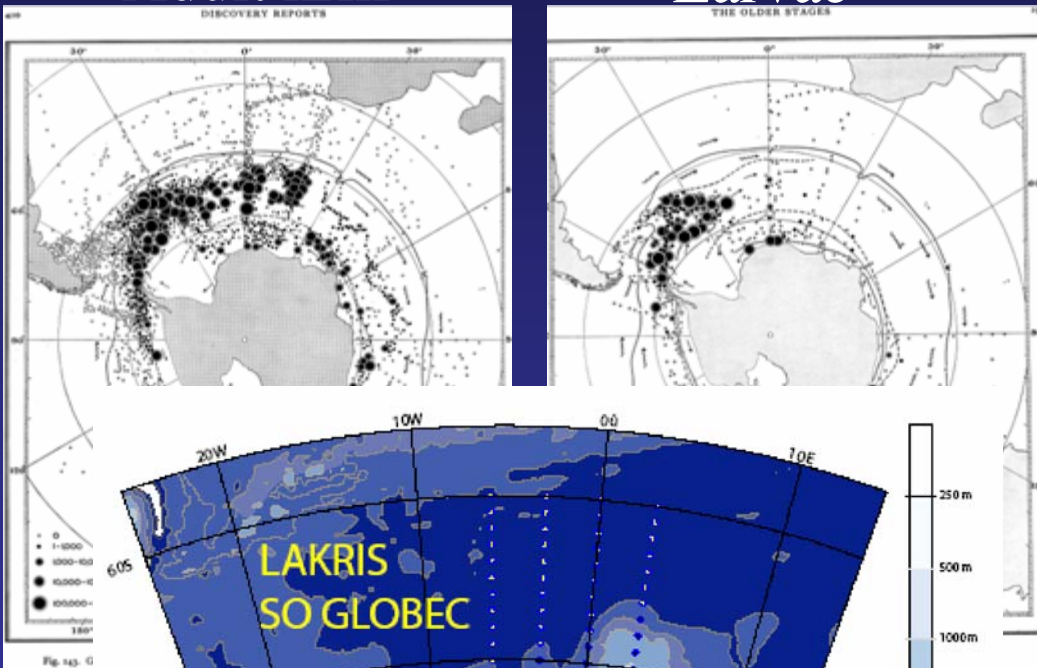
(Wilhelm Hagen)



Why choosing the Lazarev Sea for the German SO-GLOBEC program?

Adult krill

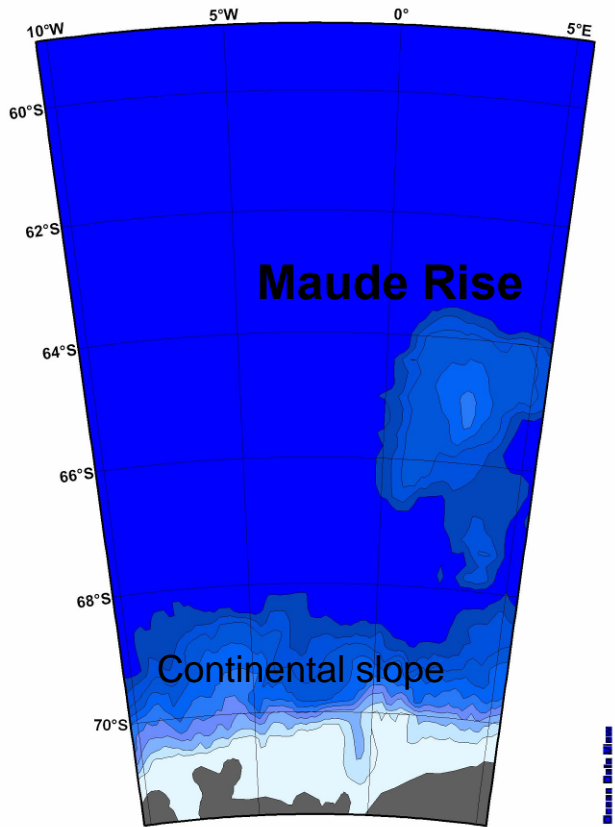
Larvae



- Hotspot of krill between western Peninsula and Greenwich meridian
- Eastern part of the hot spot not well studied
- Lazarev Sea might be a gateway for krill population enter the Weddell Gyre
- The widest latitudinal range of krill distribution

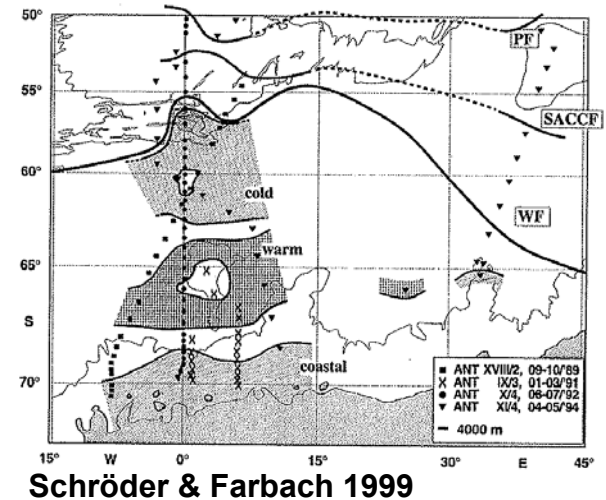
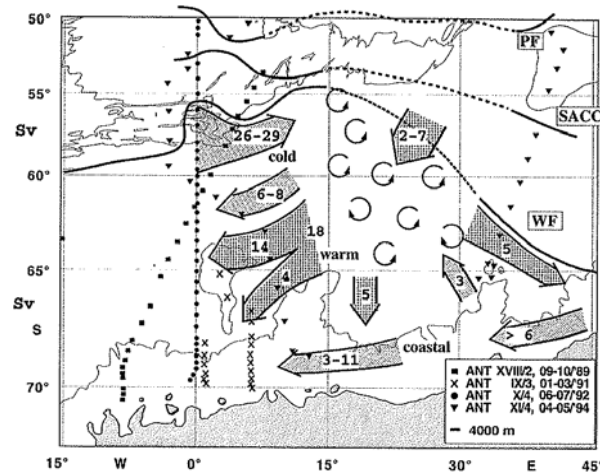
LAKRIS

Bathymetry, water masses and ice distribution



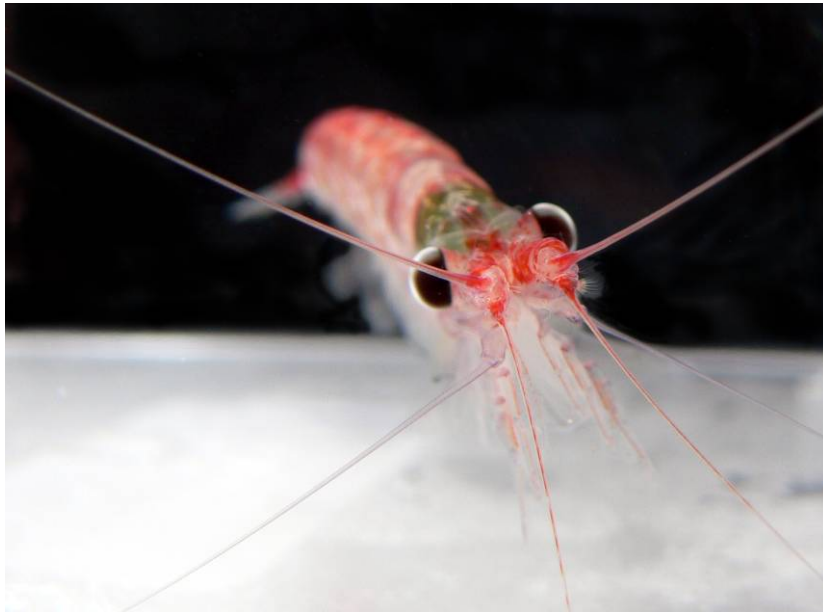
Bathymetrie
LAKRIS Gebiet

1989-1994



Schröder & Farbach 1999

Krill - *Euphausia superba* Distribution and Abundance during LAKRIS 2004, 2005, 2006



Photos: Carsten Pape



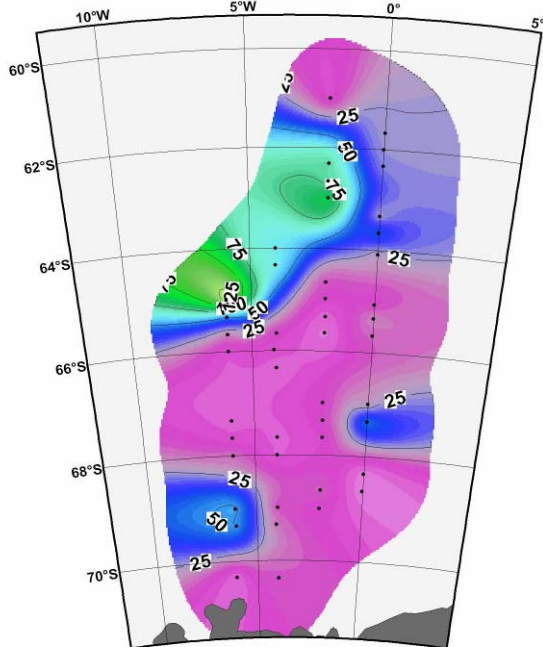
LAKRIS - *Euphausia superba* - Adults -

Fall 2004, Summer 2005, Winter 2006

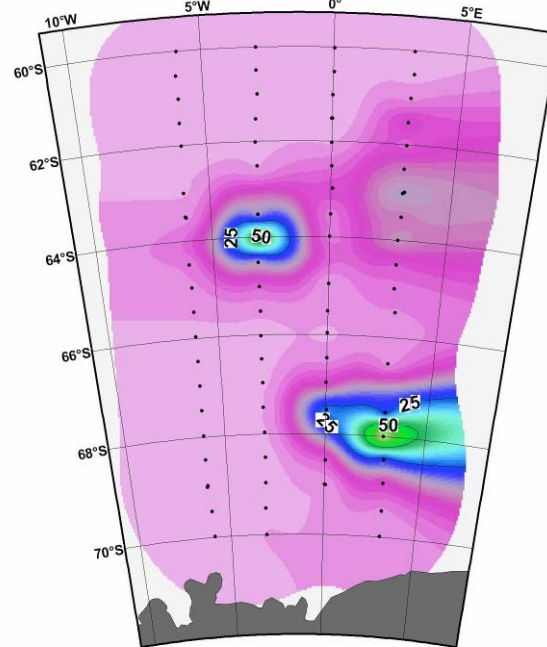


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Hamburg

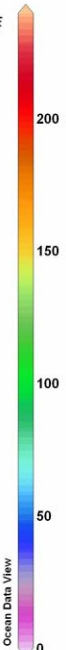
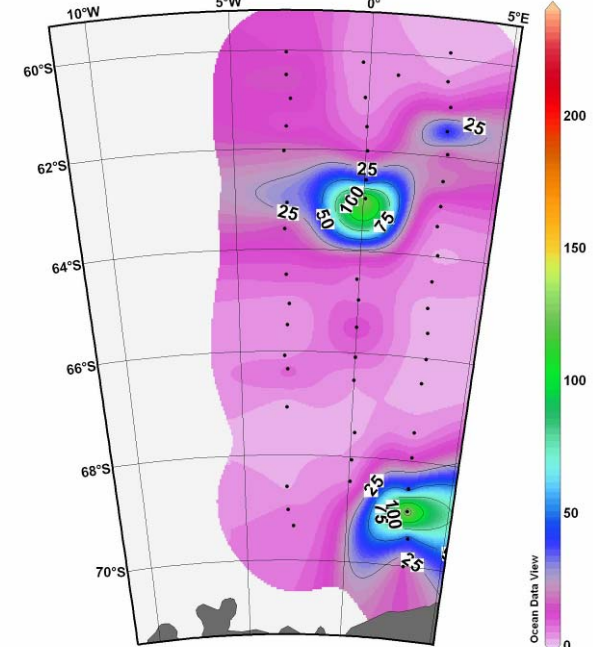
Euphausia superba 2004



Euphausia superba 2005



Euphausia superba 2006



N 1000m³

LAKRIS - *E.superba*

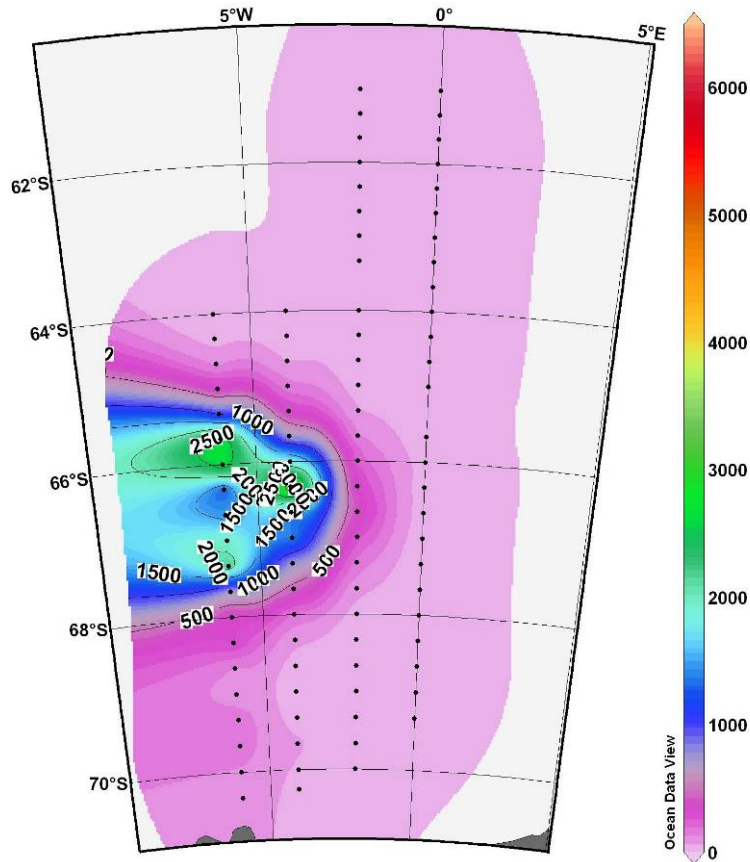
- Larvae -

Fall 2004, Calyptopis & Furcilia

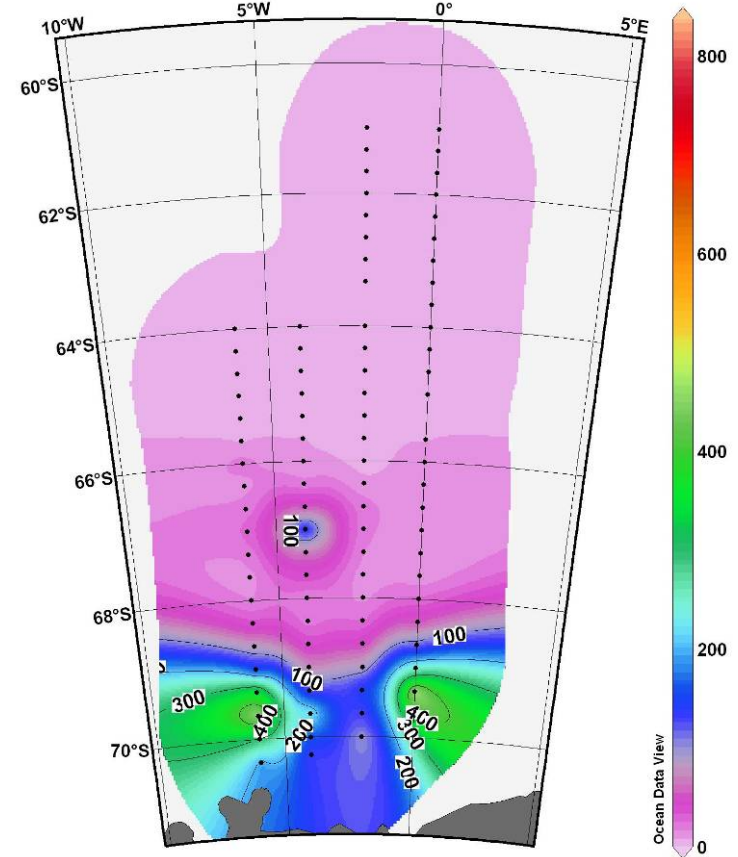


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Hamburg

E.superba Larven C



E.superba Larven F

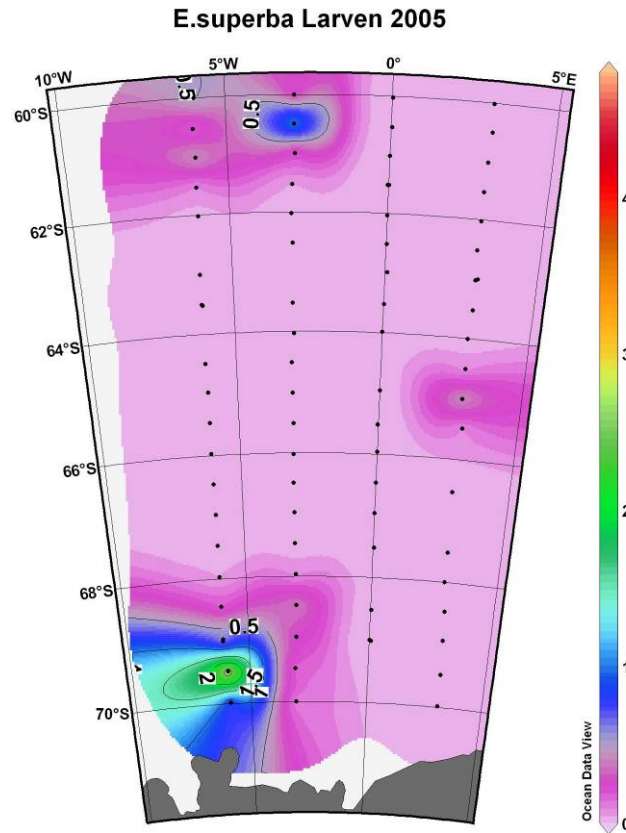


(N m^{-2})

Euphausia superba

- Larvae -

Summer 2005

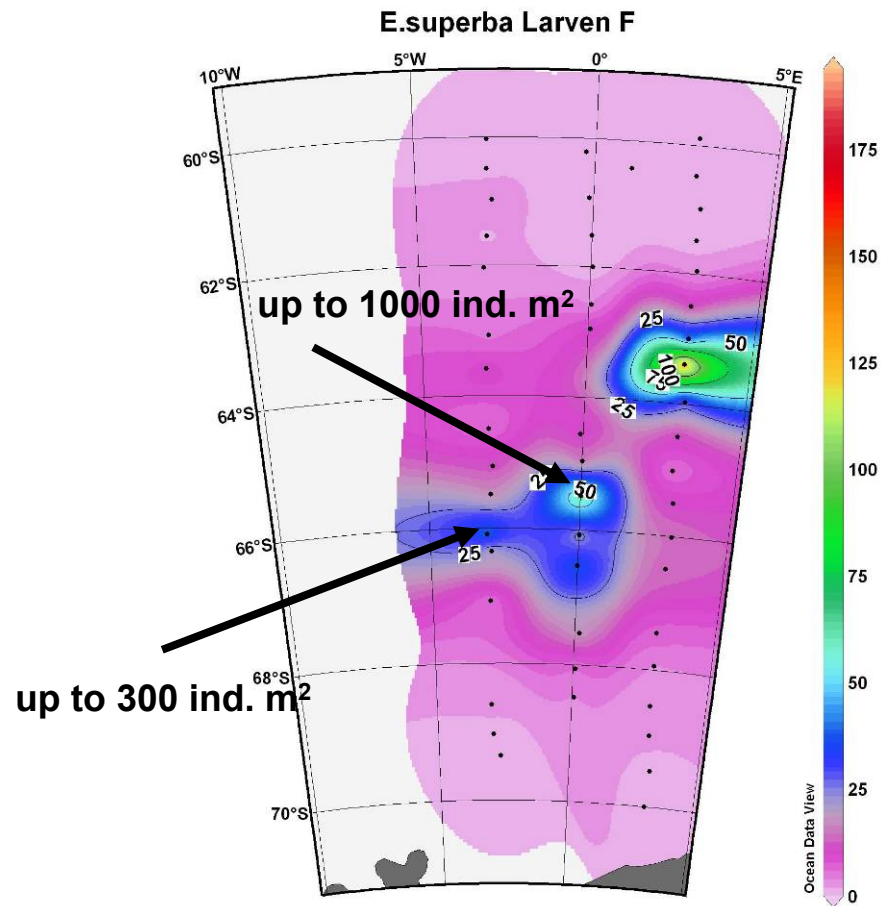
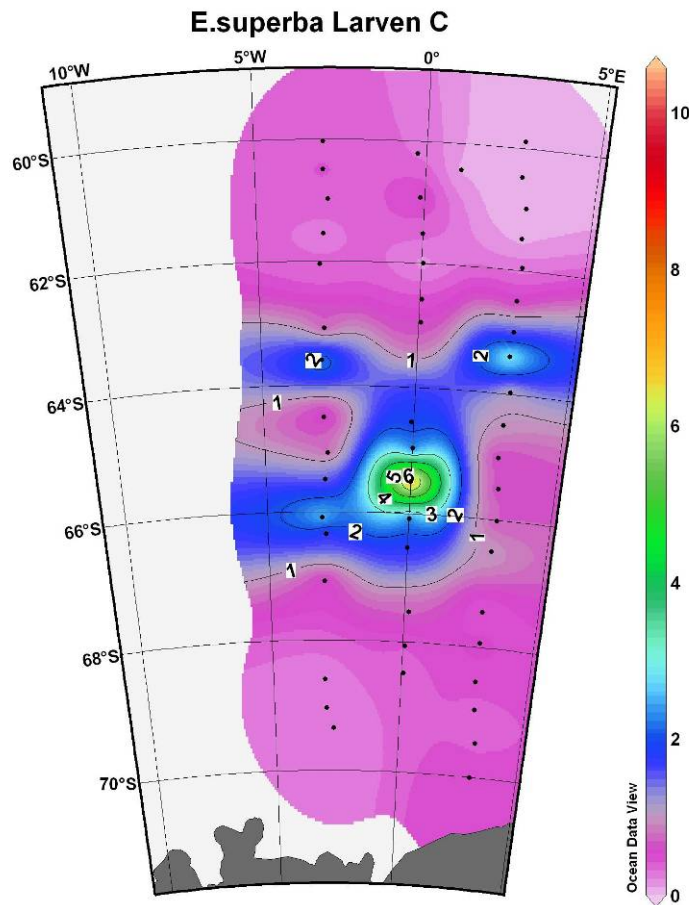


(N m²)



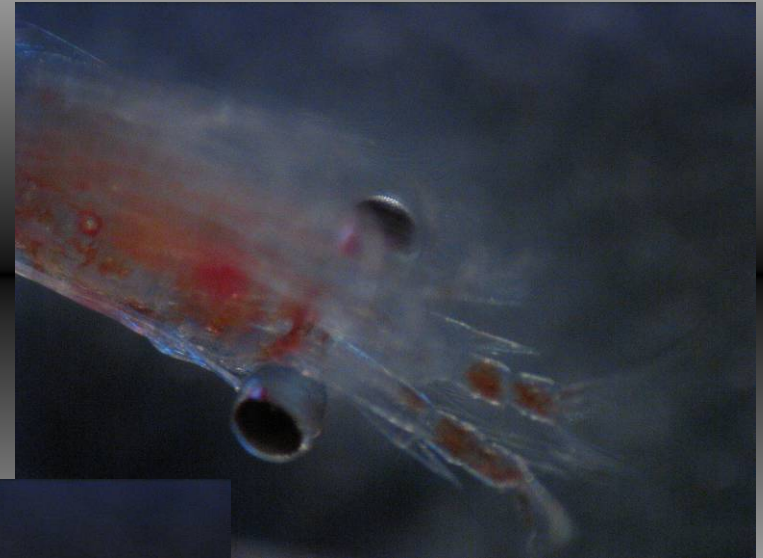


E. superba - Larvae - Winter 2006, Calyptopis & Furcilia



(N m²)

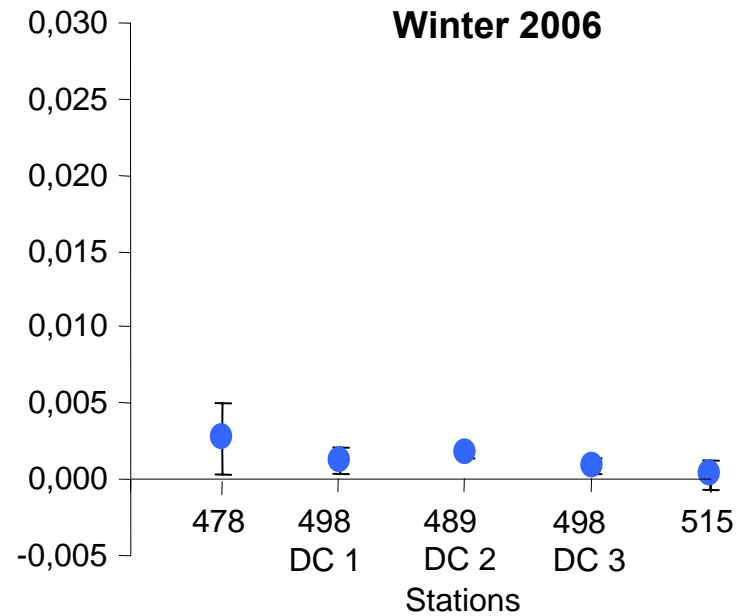
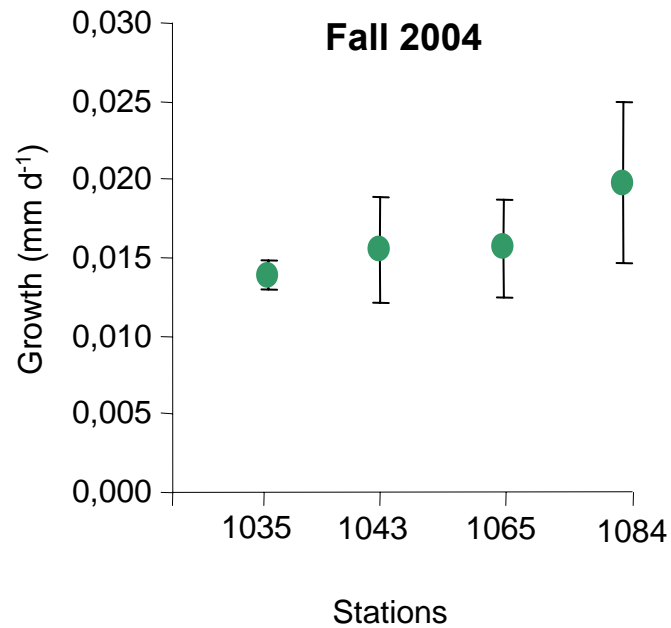
-LAKRIS - *Euphausia superba*
Physiological condition of larvae
Fall 2004 and Winter 2006



Bettina Meyer
Alfred-Wegener Institute
for Polar and Marine Research

LAKRIS – Larval Krill - Condition factors, Fall 2004 and Winter 2006

● Fall 2004
● Winter 2006

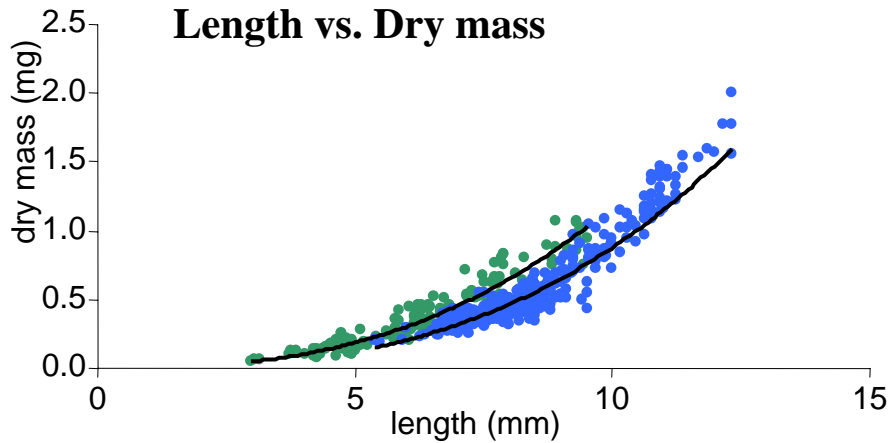


LAKRIS – Larval Krill - Condition factors, Fall 2004 and Winter 2006



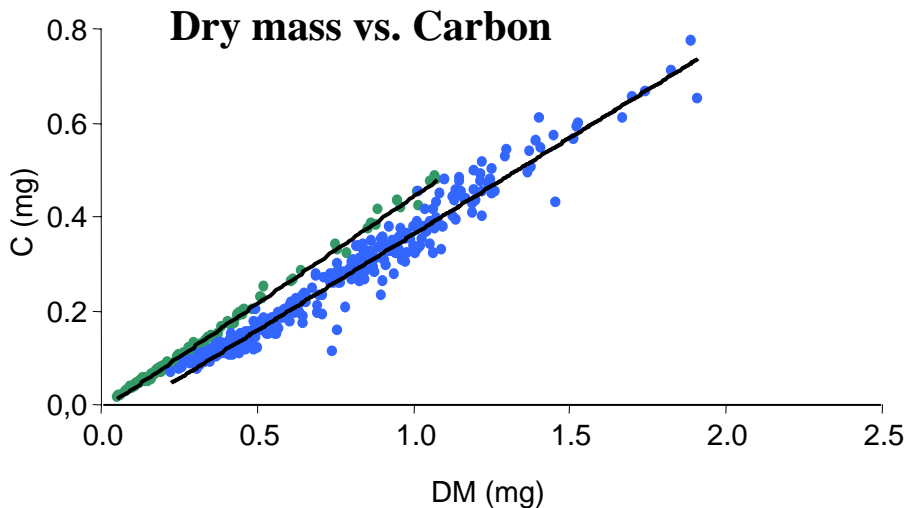
Bettina Meyer
Alfred-Wegener Institute
for Polar and Marine Research

Length vs. Dry mass

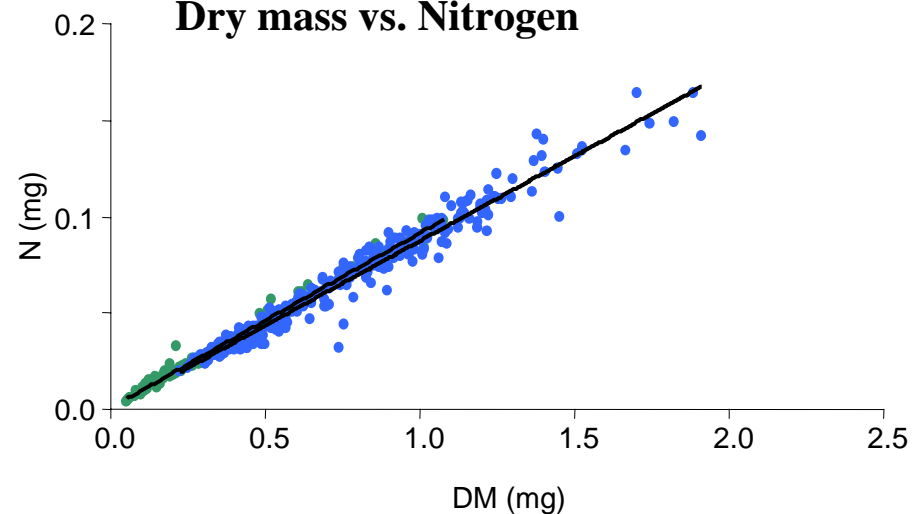


- Fall 2004
- Winter 2006

Dry mass vs. Carbon



Dry mass vs. Nitrogen



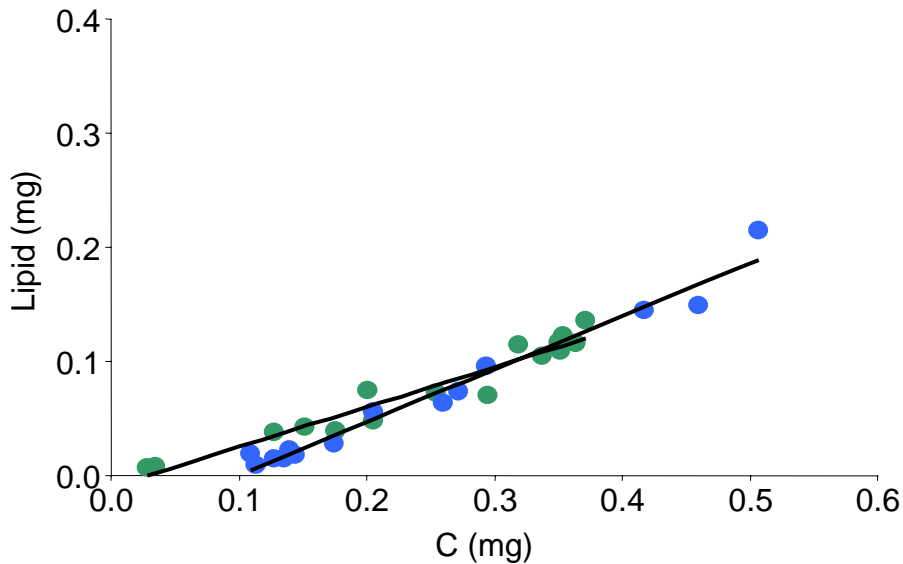
LAKRIS – Larval Krill - Condition factors, Fall 2004 and Winter 2006



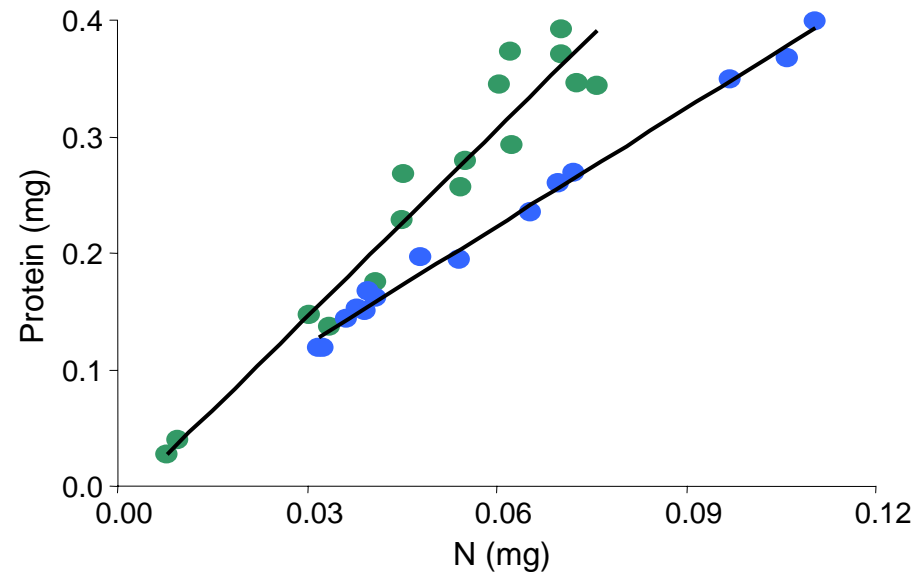
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- Fall 2004 : Total Lipids 13% total Protein 43%
- Winter 2006: Total Lipids 9%, total Protein 34%

Carbon vs. Lipid

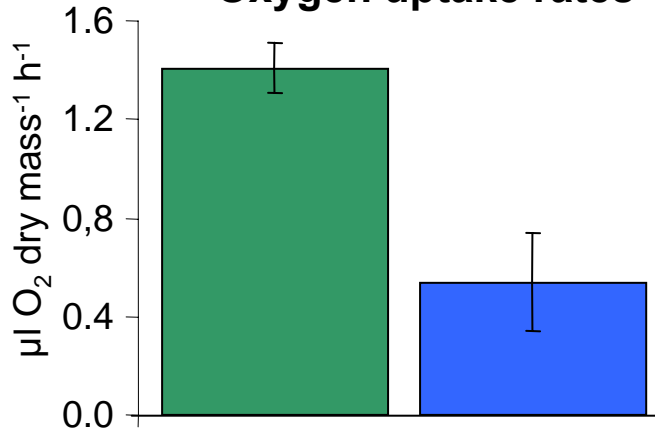


Nitrogen vs. Protein

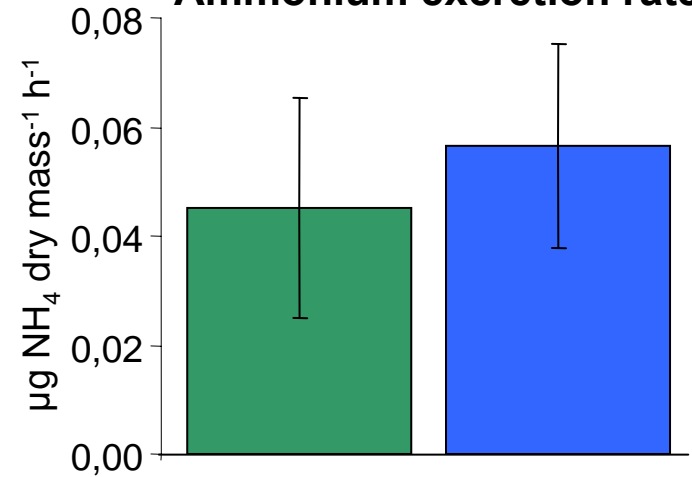


LAKRIS – Larval Krill - Metabolic rates, Fall 2004 and Winter 2006

Oxygen uptake rates

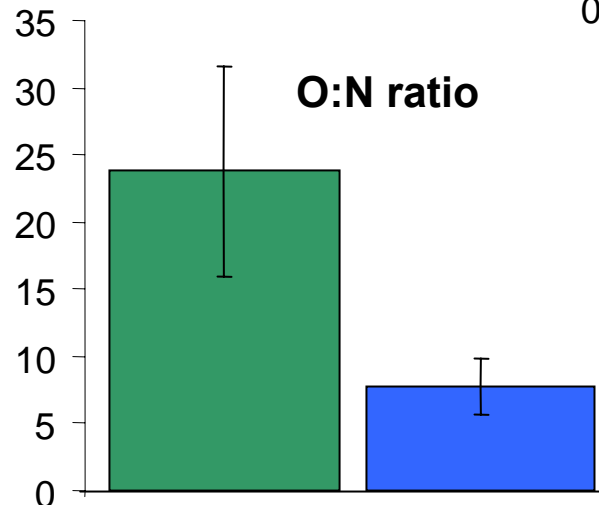


Ammonium excretion rates



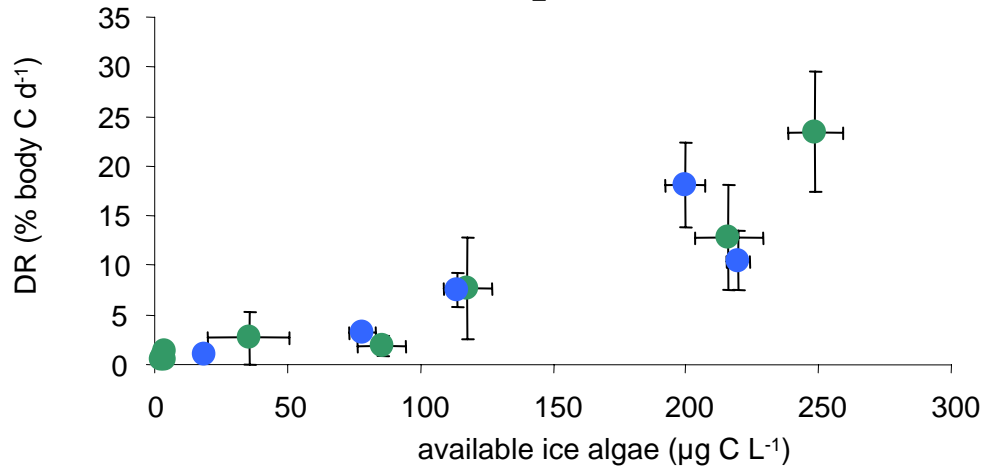
- Fall 2004: n = 23
- Winter 2006: n = 17

O:N ratio



LAKRIS – Larval Krill - feeding activity, Fall 2004 and Winter 2006

Incubation experiments



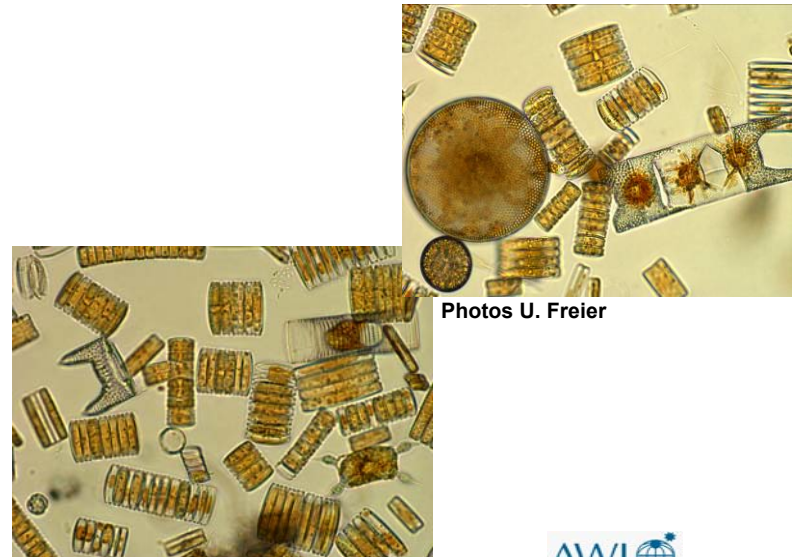
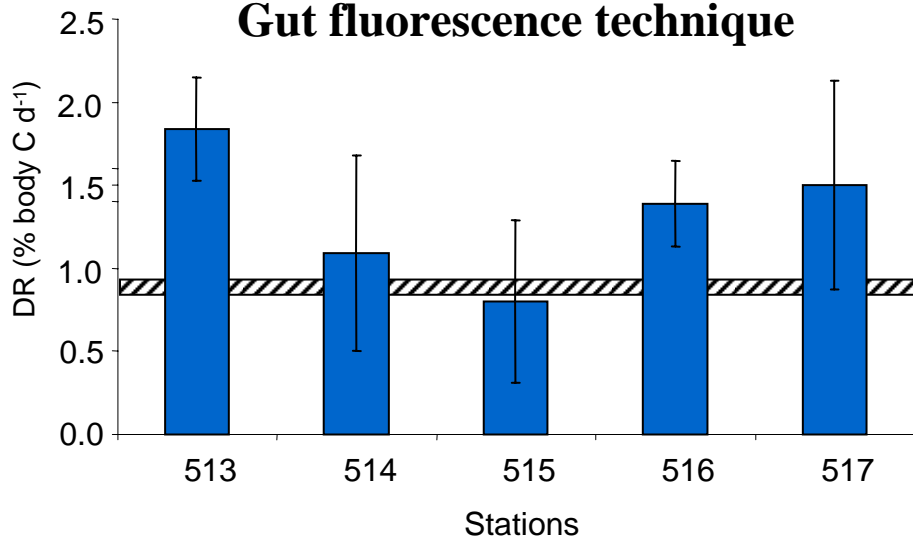
● Fall 2004: $y = 1.13e^{0.012x}$, $r^2 = 0.87$

● Winter 2006: $y = 0.78e^{0.014x}$, $r^2 = 0.87$

Chla µg/L: 0.01-0.04

% body C d⁻¹ = 0.8

Gut fluorescence technique



Photos U. Freier

LAKRIS – Larval Krill - Feeding activity, Fall 2004 and Winter 2006



Bettina Meyer
Alfred-Wegener Institute
for Polar and Marine Research

Stomach and gut content

- Diatom fragments
- Mandibles, Copepod appendages
- Tintinnids

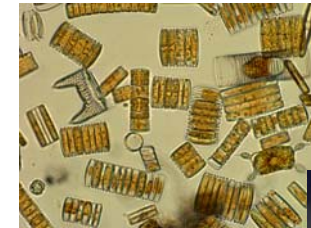
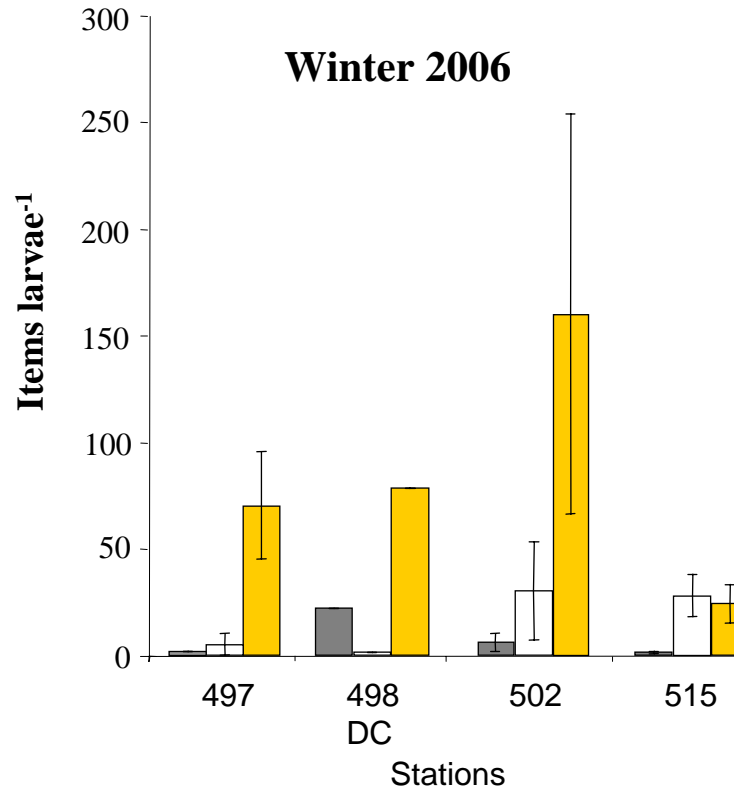
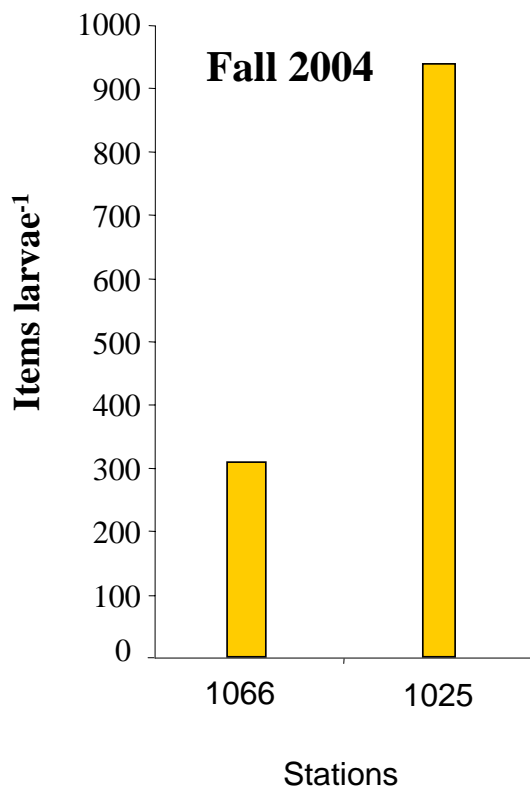


Photo U. Freier



Photo V. Fuentes



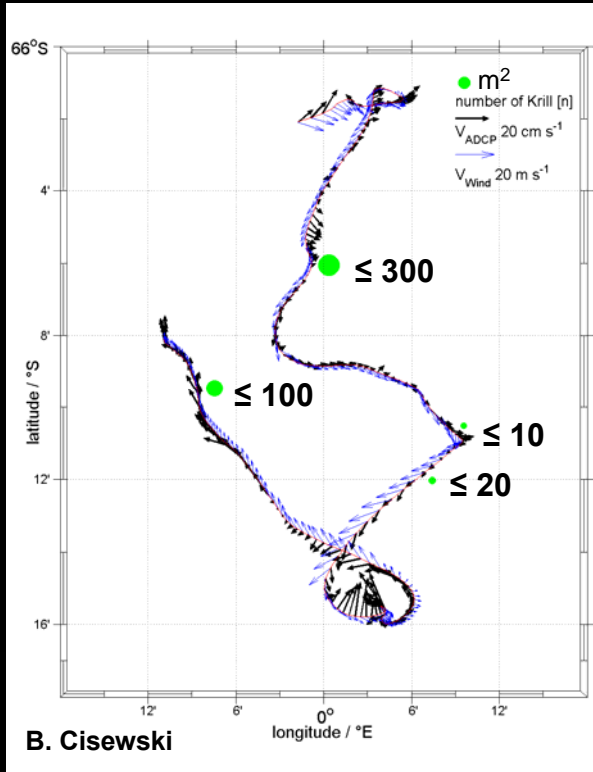
Photo Urrutxurtu

General résumé of our results from the Lazarev Sea

- Larval krill has to enter the winter season in an advance developmental stage e.g. FII and high lipid content
- Larvae use their lipids but also with high extent their proteins for energy requirements during winter
- heterotrophic organisms play an important role as additional food source during winter

- Early spawning and optimal food condition before entering the winter season
- Good developed under ice habitat

LAKRIS – Larval Krill - Winter 2006: Dive camp (5 days)



Total drift of the ice floe 48.5 nm



Photo Carsten Pape

LAKRIS – Larval Krill - Winter 2006

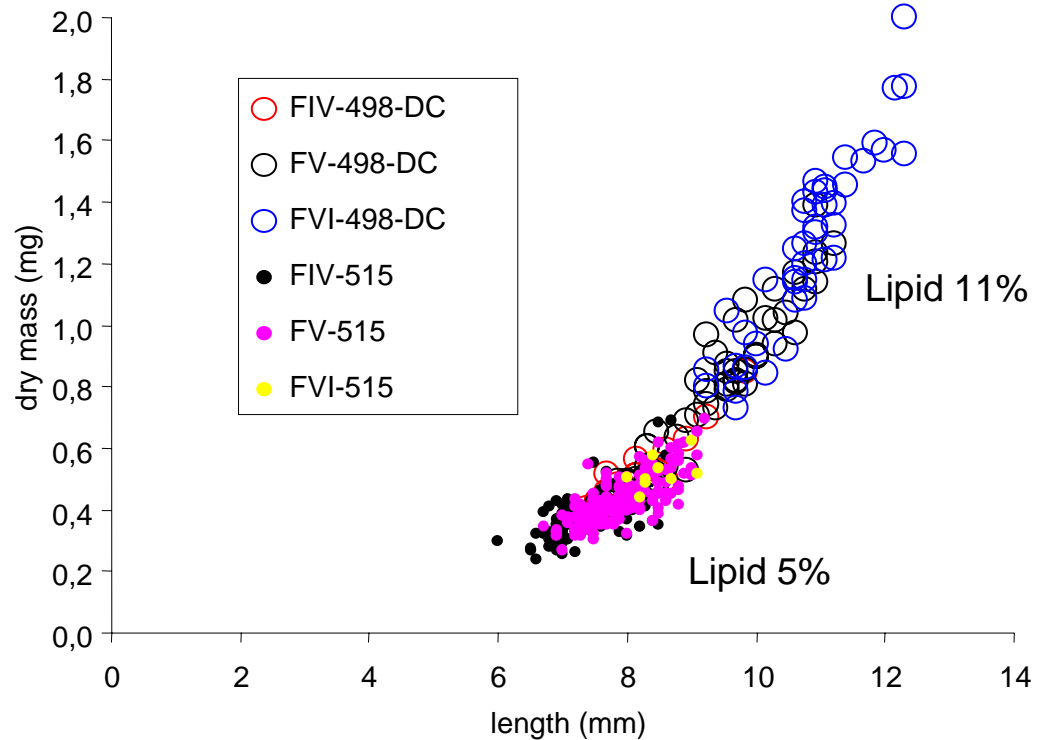


Dive camp
498



Station 515

Condition of larvae between two dive spots



Future effort to understand larval development and survival and hence recruitment success of krill



Photo Carsten Pape

The interaction between Currents (meso and micro scale) under ice topography and sea ice biota

Multidisciplinary and international approach:

- a) Sea ice physic and biology**
- b) Meso and micro scale currents**
- c) Krill physiology and nutrition**
- d) Modeling**

Synthesis in future terms: International expertise (a-d) on one working platform, in different seasons (late fall /early winter, mid/late winter) in one region.