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Fokje.Schaafma@wur.nl

Abstract:
Population dynamics of Antarctic krill in winter/early spring in the Weddell Sea

The condition, survival and recruitment of Antarctic krill (Euphausia superba) depend to a large extent on overwintering success. In winter, much of the krill habitat is ice covered. Models suggest that sea ice properties during the late winter – spring period have the largest effect on recruitment. During this period, larval and juvenile krill survive largely by feeding on sea ice biota. The under-ice surface layer, which is not sampled by pelagic trawls or sonars, has formerly been identified as an important habitat of one-year-old juvenile krill. This surface layer was specifically sampled with the Surface and Under Ice Trawl (SUIT) during Antarctic winter 2013, as well as with pelagic trawl nets. Using several sensors during under-ice fishing, a suite of environmental parameters was measured, including ice thickness and spectral light transmission. With this unique dataset the population structure and recruitment of larval and juvenile krill was investigated using length frequency distributions in relation to environmental parameters. Our analysis focuses on how the population structure is influenced by various factors, such as geographic location, diurnal vertical migration, habitat structure, and population origin.

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Population dynamics of Antarctic krill in winter / early spring

Fokje Schaafsma[1], Carmen David[2], Doreen Kohlbach[2], Benjamin Lange[2], Hauke Flores[2], Jan Andries van Franeker[1]

[1] IMARES Wageningen UR, P.O. box 167, 1790 AD Den Burg, The Netherlands
[2] Alfred Wegener Institute, Am Handelshafen 12, 27570 Bremerhaven, Germany

IMARES WAGENINGEN UR

Universität Hamburg

AWI

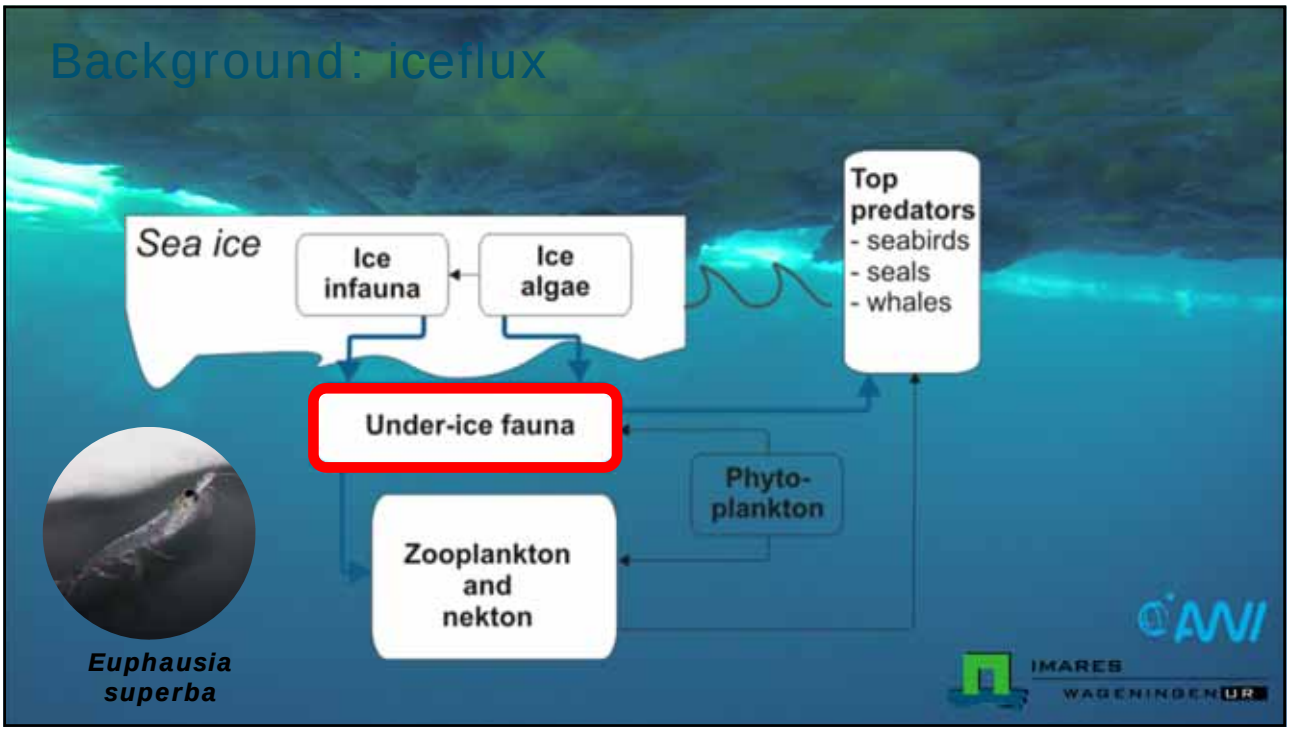
Questions

Describe distribution of different sizes & developmental stages in under ice surface

Can differences be explained by differences in diet?

Do sea ice properties have an effect on size/stage distribution?


Background
(Eicken, 1992; Quetin & Ross, 2003; Arrigo & Thomas, 2004; Flores *et al.*, 2012)


Background: iceflux
Sea ice
Ice infauna
Ice algae
Top predators
- seabirds
- seals
- whales
Under-ice fauna
Phyto-plankton
Zooplankton and nekton
Euphausia superba
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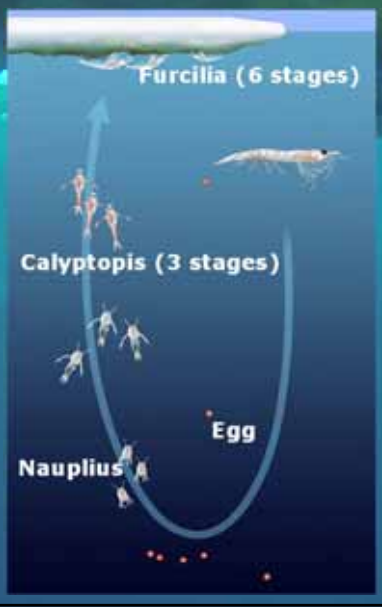
Background



First year:
Furcilia → juveniles ~ 15 mm

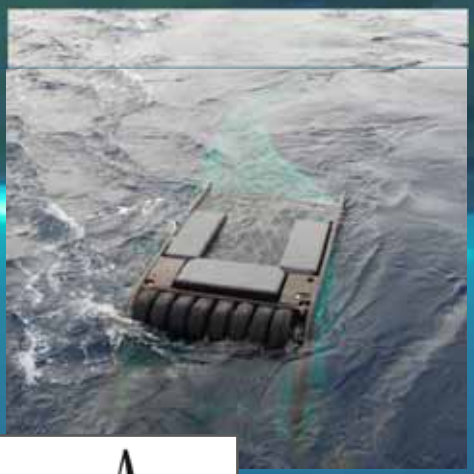
Second year:
Juveniles < 33 mm
Juveniles → sub-adults > 26 mm

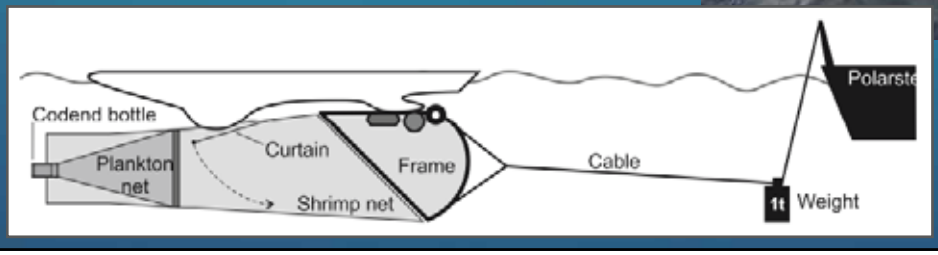
Third year:
Sub-adults → adults > 35 mm

(Fraser, 1936; Bargmann, 1945; Marr, 1962; Siegel, 2000; Meyer & Oettl, 2005; Flores *et al.*, 2012; Jia *et al.*, 2014)

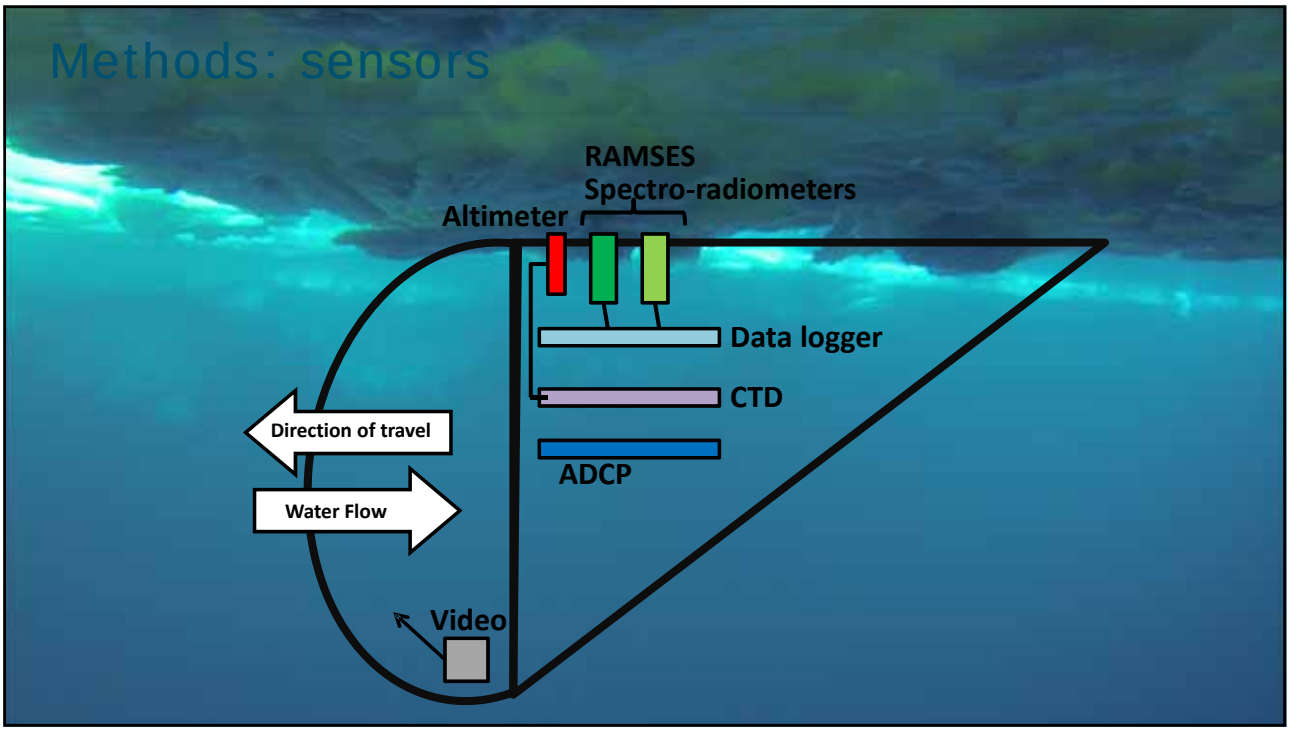
Methods: SUIT

Surface and Under Ice Trawl

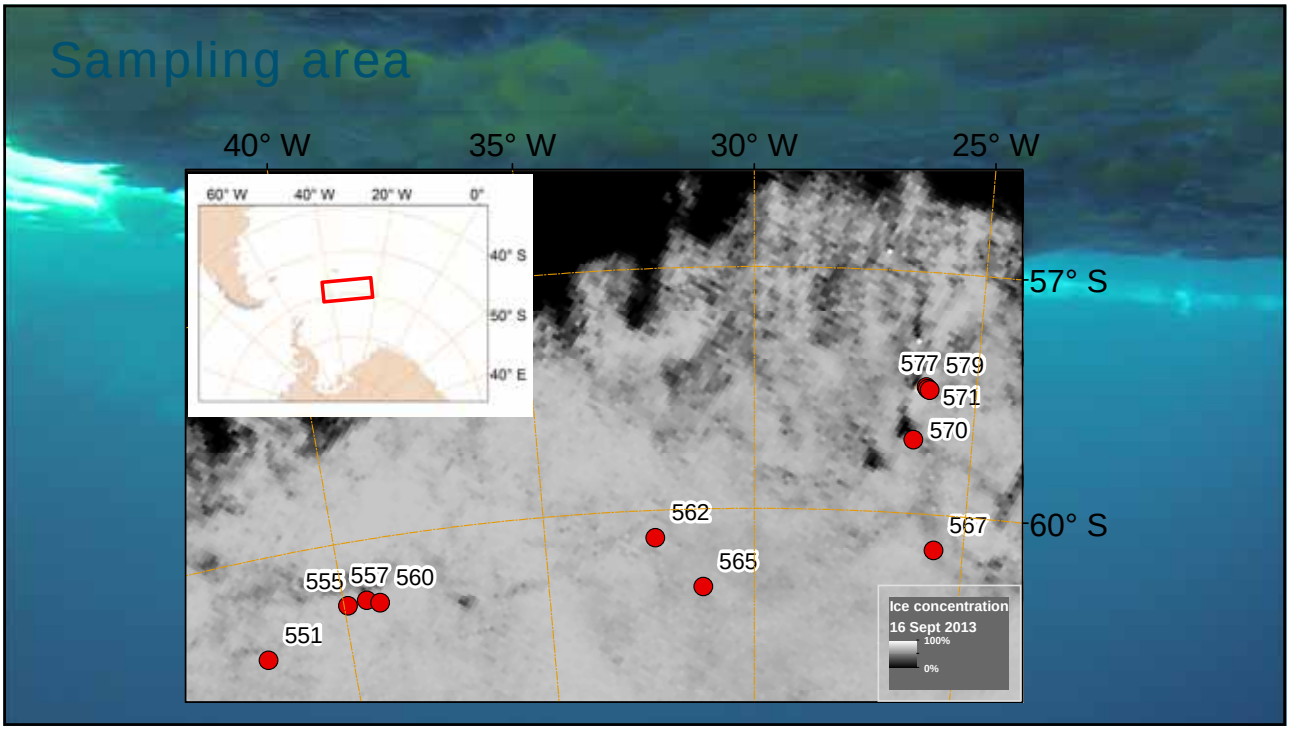




Methods: sensors

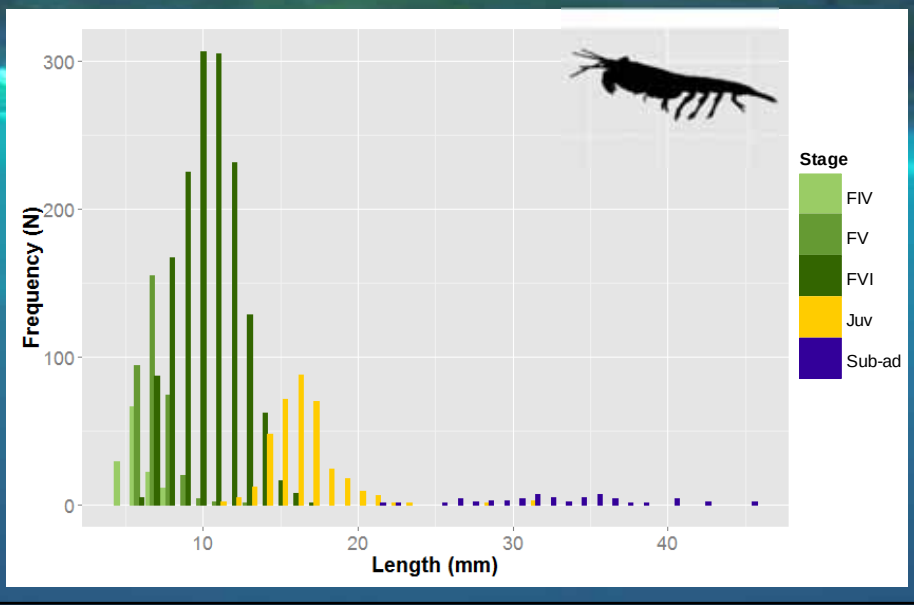


Sampling area



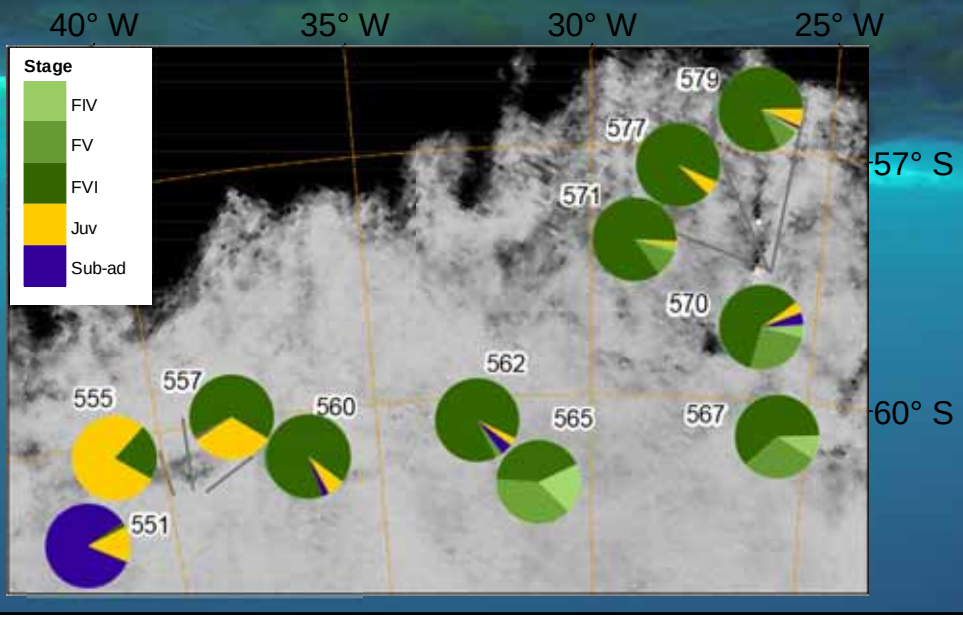
Results: catch

size & stage distribution



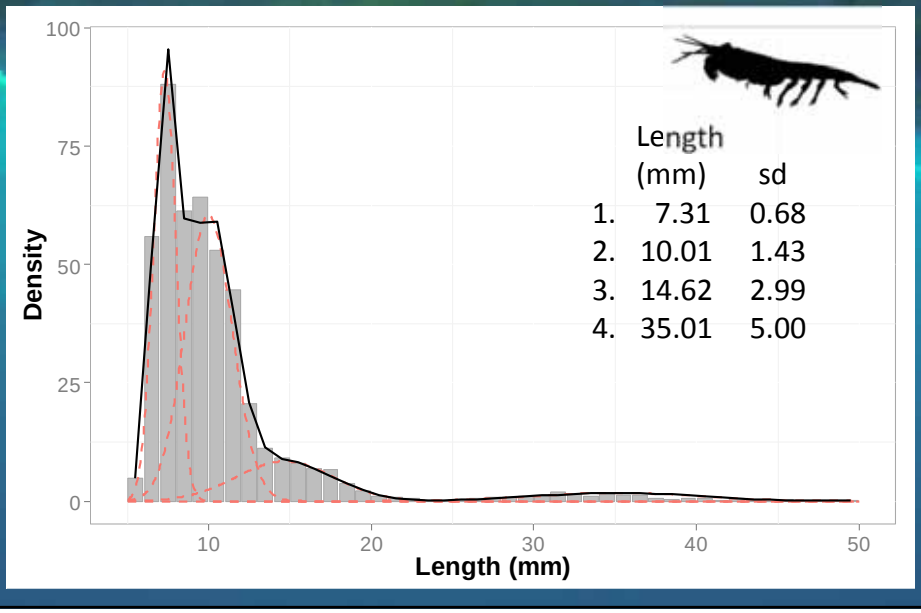
Results: stages

size & stage distribution



Results: mixture distribution

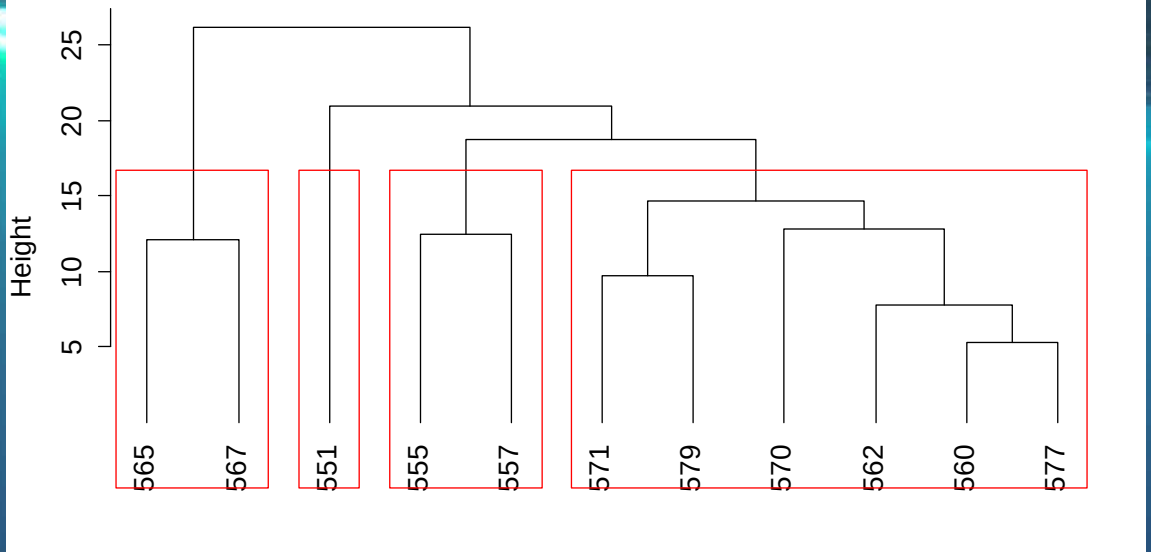
size & stage distribution



(method in De la Mare, 1994)

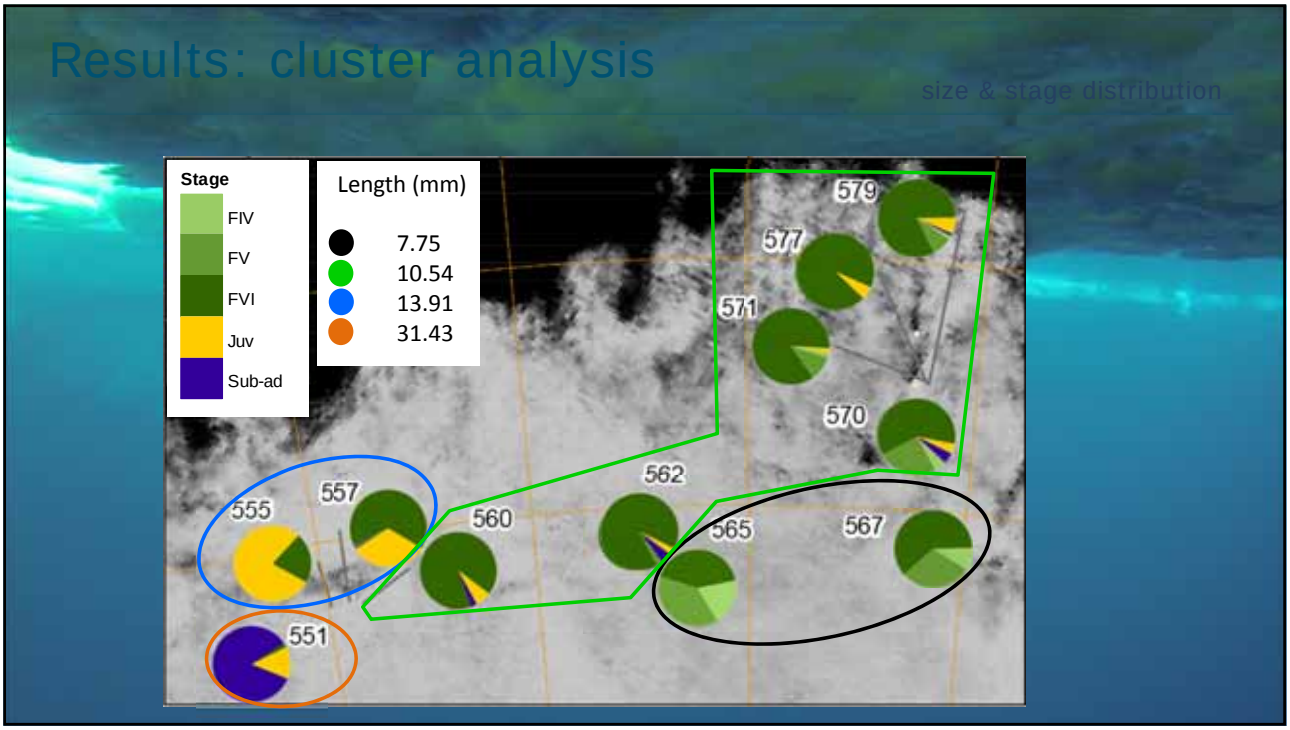
Results: cluster analysis

size & stage distribution



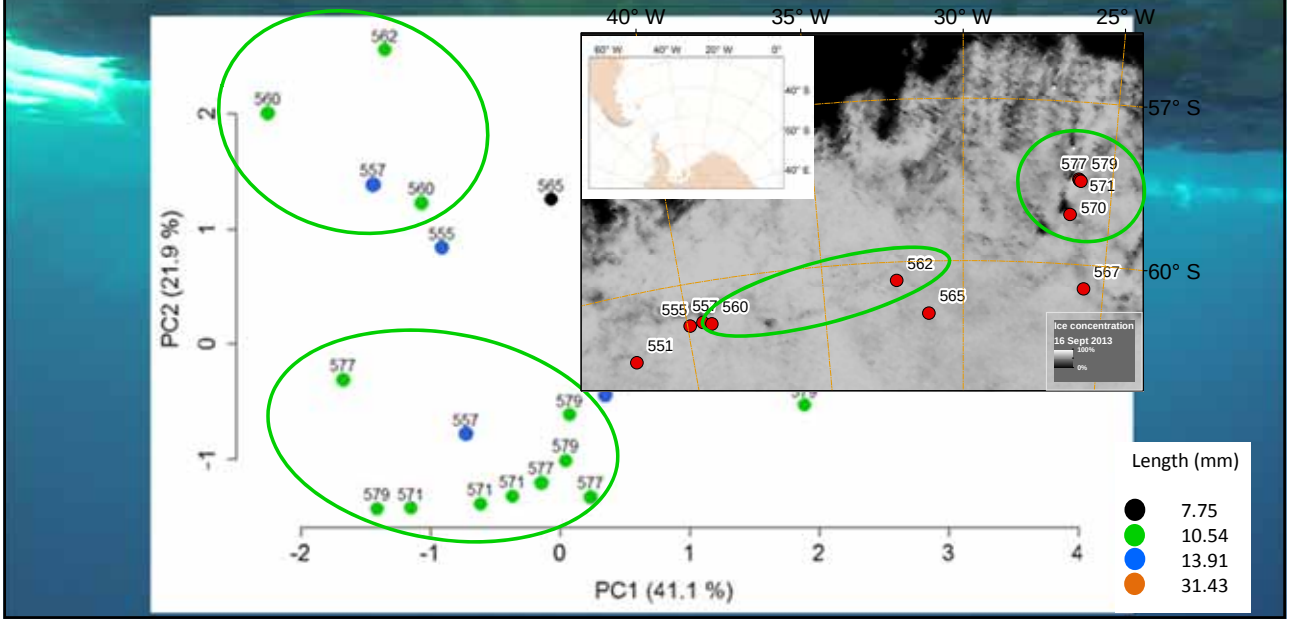
Results: cluster analysis

size & stage distribution

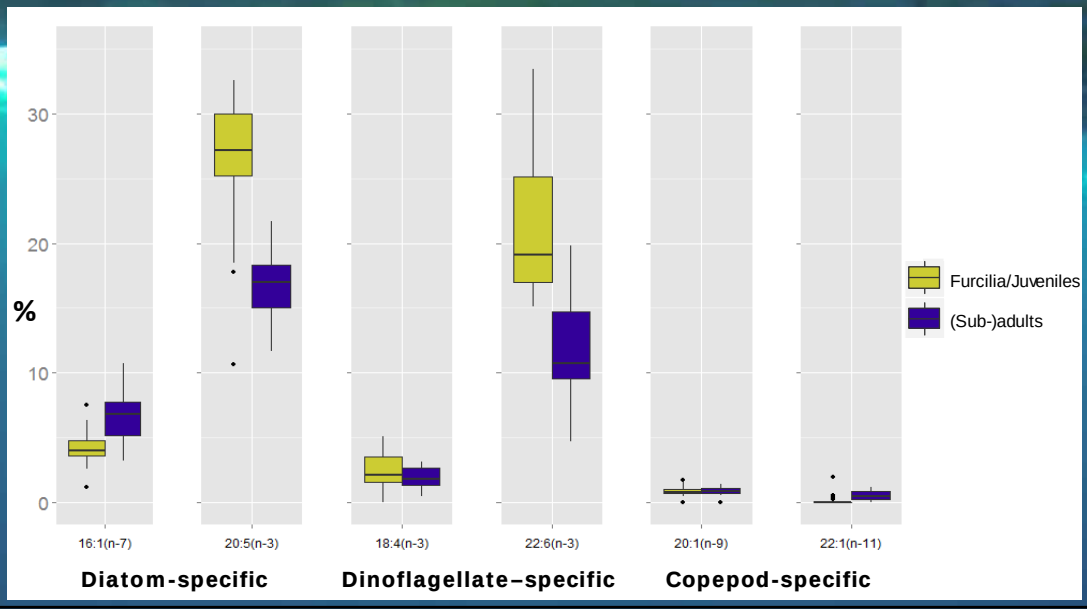


Results: fatty acid profile first year krill

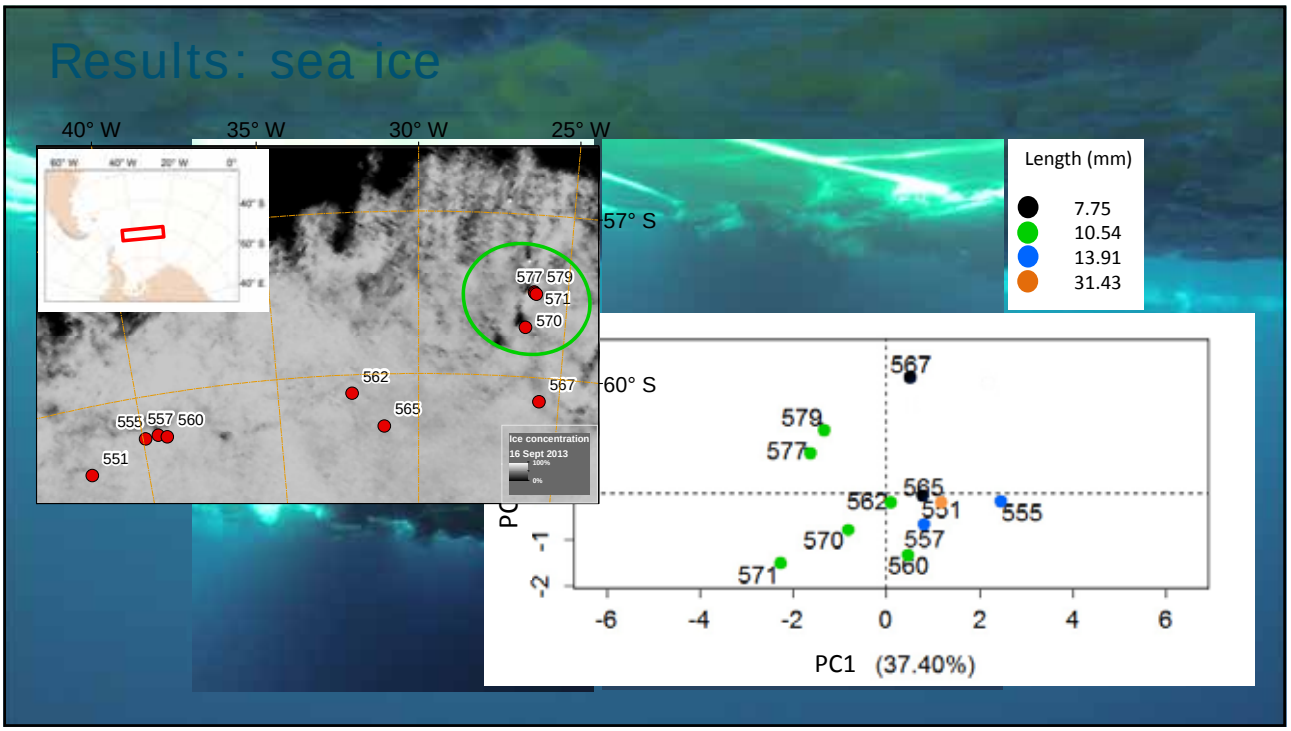
Diet



Results: fatty acid biomarkers



Results: sea ice



Conclusions

Krill found in the area are from different age classes → different origin or prolonged reproductive season

(Quetin & Ross, 2003)

A separation in size and/or location is reflected in fatty acid composition.

First year krill have a different carbon source than adults.

Length distribution does not seem to be associated with sea ice or under ice properties.

Thank you!

Fokje Schaafsma, Carmen David, Doreen Kohlbach, Benjamin Lange, Hauke Flores, Jan Andries van Franeker

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