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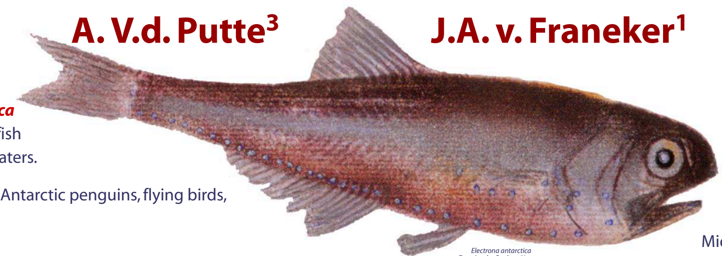
Ecological Significance of Lanternfish in the Southern Ocean

H. Flores[1,2] A. V.d. Putte[3] J.A. v. Franeker[1] F.A.M. Volckaert[3]



Electrona antarctica
Drawing by Boshou Nagase
From: Mitsuo, Marchant, Nagase: Antarctic Fishes
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The lanternfish *Electrona antarctica* is the most abundant mesopelagic fish species in high Antarctic offshore waters.

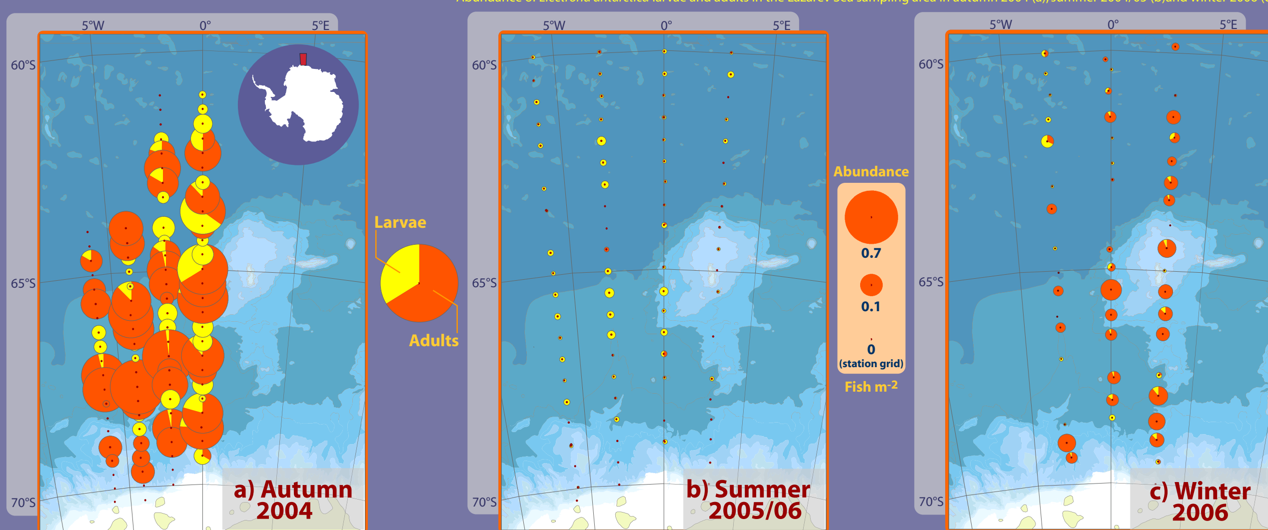
The fish is important in the diet of Antarctic penguins, flying birds, seals and whales.

Looking at *E. antarctica* can thus tell a lot about the status of the pelagic ecosystem.

We tried to quantify the distribution and abundance of *E. antarctica* over three seasons in combination with energy measurements and modeling efforts.

Fish were caught with Rectangular Midwater Trawls (RMT) to a fishing depth of 200 m at 3 seasons in the Lazarev Sea, Antarctic Ocean.

Figure 1.
Abundance of *Electrona antarctica* larvae and adults in the Lazarev Sea sampling area in autumn 2004 (a), summer 2004/05 (b)and winter 2006 (c).

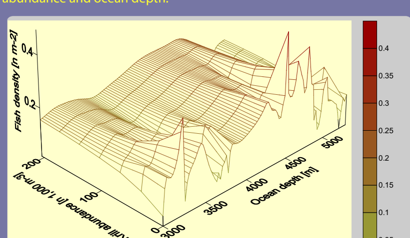


Larvae and adults were abundant throughout the sampling area (**Figure 1**).

Few adults were sampled in summer 2005/06, stocks only indicated by the presence of their larvae.

They avoid daylight and only migrate to the upper 200 m layer at darkness.

Figure 3.
Visualisation of modeled density of *E. antarctica* projected on krill abundance and ocean depth.



Generalized Additive Models (**GAM**) were used to model the abundance of E. antarctica in 2004 using various environmental datasets.

Fish abundance was significantly correlated with a combination of ocean depth, abundance of Antarctic krill and surface sea temperature, esplaining 75% of the deviance (**Figure 3**).

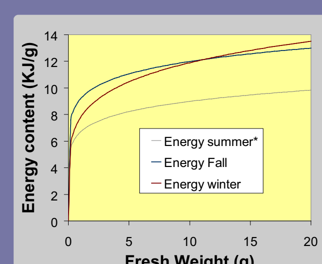
Table 1. Summary statistics of adult *E. antarctica*. Abundance estimates were based exclusively on night hauls

	Autumn 2004	Winter 2006
No of fish sampled	987	565
Size range [mm]	20 - 102	20 - 106
Abundance [n m^{-2}]	0.17	0.10
Biomass density [g m^{-2}]	0.26	0.14
Energy content [KJ g^{-1}]	9.35	8.01
Energy density [KJ m^{-2}]	2.82	1.29
Krill energy density [KJ m^{-2}]*	7.80	3.81

Energy density of *E. antarctica* in the upper 200 m alone was ca. 30 % of the energy bound in krill in autumn and winter, and probably equal if a wider depth range were considered (**Table 1**).

* based on biomass estimates kindly provided by V. Siegel (BFAFi Hamburg) and an energy content of 4.1 KJ g (1)

Figure 2.
Energy content of *Electrona antarctica* in relation to body mass at three seasons, estimated by means of bomb calorimetry.



Energy content increases with size, with the strongest increase in juveniles (**Figure 2**).

High energy content in winter and low values in summer indicate that reserves support the survival of *E. antarctica* during the less productive period of the year.

* Data from different area (BROKE west 2005/06)

Modeling techniques allow to improve our knowledge about which forces drive the distribution of this widely distributed and abundant species.

***E. antarctica* binds ecosystem energy** comparable to Antarctic krill, emphasizing its role as a decisive energy transmitter in the pelagic food web.

In combination with more dedicated sampling schemes, *E. antarctica* is a potential **ecosystem monitor**.

(1) Torres J, Donnelly J, Hopkins T, Lancraft T, Aarset A, Ainley D (1994) Proximate composition and overwintering strategies of Antarctic micronektonic crustacea. Marine Ecology Progress Series 113:221-232

Coorperation partners:

AWI Alfred Wegener Institute for polar and marine research Bremerhaven

Institute of Sea Fisheries Hamburg

Affiliations:

1) Wageningen IMARES
P.O. Box 167
NL-1790 AD Den Burg

hauke.flores@wur.nl

2) University of Groningen
Center for Ecological and Evolutionary Studies
P.O. Box 14
NL-9700 AA Haren

3) Katholieke Universiteit Leuven
Laboratory of Animal Diversity and Systematics
Ch. Deberiotstraat 32
B-3000 Leuven