Ocean Sci. Discuss., 3, S23–S27, 2006
www.ocean-sci-discuss.net/3/S23/2006/

Ocean Science Discussions

Interactive comment on "Distribution of overwintering *Calanus* in the North NorwegianSea" *by* A. Edvardsen et al.

A. Edvardsen et al.

Received and published: 16 May 2006

The authors would like to thank the referee for a constructive feedback on the manuscript. The fact that the referee is named adds credit to the comments provided, and we are very pleased that we are able to improve the ms by the help of a leading scientist within this field. There are some disagreements, specially on the data processing side. First, we have commented on the general critics of the referee. At the end we have provided answers and comments on the more specific issues.

Horizontal distribution

For the horizontal mapping/interpolation based on the point measurements, integrated concentrations (m^{-2}) was never used because of the reasons stated by the referee. Our concern of aggregation and dispersal during the descent and overwintering phase

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

should be addressed by looking at the concentrations, not at the depth integrated abundance. We did use the average concentration (m^{-3}) for the whole water column to provide the map, and we do not agree that this approach represents a "sin" as stated by the referee. Net sampling by itself do average data along the depth interval sampled, and the "sin" will be committed regardless if the depth interval is 300 or 1500 m. Our approach for the horizontal mapping resembles one net being used for the whole water column. We acknowledge that there might be "high-frequency" features caused by the non-uniform depth distribution that are smoothed by our approach compared to the method suggested by the referee. But it is important to keep in mind that the basin scale survey area, in the order of $10^5\ km^2$, is to be described by very few (ca. 50) point measurements over a period of a month, during which the spatial distribution of copepods could change quite dramatically. The lack of coverage in space and time is probably a more troublesome aspects of the sampling design than the "low-pass filter" applied for making the distribution showed in figure 5. It is of course possible to apply the method suggested by the referee, but according to our arguments given above, we do not feel that this approach will add more confidence to the basin scale distribution as given in figure 5. The authors will however revise the method chapter to better describe what was done in the data processing.

The role of deep currents

No one, including the authors, have empirical data on the deep water currents acting on the overwintering population. In such a situation, the results from SINMOD have been vital in developing ideas of possible mechanisms for the observed winter distribution and the high variability of biomass in the adjacent Barents Sea during summer. It is true that we have not established any hard facts on the existence of eddies since the publication of Halvorsen et al. (2003), but the modelling work has been an ongoing and fruitful process since then and therefore it is also included in this ms. Very soon, we will be able to present deep water current measurements from the Lofoten Basin from November to March. However, we do agree that the modelling part

OSD
3, S23–S27, 2006

can be moved to the end of the discussion, but it should not be removed from the ms.

In context of 2000-2002 Lofoten Basin data and the pan-Atlantic map
It is beyond the scope of this ms to compare data for all years. At the project termination (end of 2006), there will also be data available for 2005 and 2006. At that stage, 2000-2002 data will be included to analyze the the body of data extending over 7 years. It would be most interesting to make a northward extension of the pan-Atlantic map as suggested by the referee. If such step is to be taken, the area between 63N and 68N probably must be covered better. Also, the areas north of 72N is pristine, but will contain overwintering Calanus. Strong pulses of C. finmarchicus have been observed in the fjords at the west side of Spitzbergen. However, scientist that report these results are still puzzled by the fact that these pulses are not very well connected to events of Atlantic water entering these fjords. This fact strengthen our contention that the patchy distribution of the overwintering population makes a difference when the spawning population enters surface waters and are advected onto shelf areas such as the Barents Sea or the the fjords on Spitzbergen. Further, it is likely that the Fram Straight pathway represents an effective sink for the population in the North Atlantic. As far as the authors know, there are no data on abundance of Calanus in the Barents Sea during winter. Such information would be very useful to assess the degree of sustainability in this very productive shelf ocean. Since this area is generally shallow, it would be less suitable for holding overwintering populations. We suspect that the eastern part will represent a sink for the population while for the western parts descending adults can be drained over the shelf break and into the NE Norwegian Sea. Westward draining of water is known to take place in the Bear Island trough and this might also take place in the many canyons intersecting the shelf break.

Specific comments

- We will clarify the introduction with respect to the relation between the current ms

OSD
3, S23–S27, 2006

and the work by Halvorsen et al (2003) both with regard to data and the climate related issues.

- C. finmarchicus and C. glacialis was distinguished based on prosome length in the same way as used in the TASC project, during which the intercalibration procedure distinguishing Cf, Cg and Ch proved successful. For determination, published works such as Unstad and Tande, Polar Res. 1991, 10(2):409-420 and Hirche et al. Polar Biol. 1994, 14:491-503 were used. For adults, discrimination was based mainly on works by Frost, Mar.Biol. 1974, 26: 77-99; Frost, J.Fish.Res.Bd.Can. 1971, 28: 23-30; Fleminger and Hulsemann, Mar.Biol. 1977, 40: 233-248. In some cases, dissection to study morphological features was also used. In retrospect, comparing the sample processing to the influence of cold (polar) water masses in the area indicate that the above approach was not totally off. However, we included a comment on the unreliability and included the reference kindly provided by the referee.

- It is appears that the referee would have liked to see the depth integrated abundance values rather than the depth averaged ones. We believe that the patchy nature of the overwintering stock is formed by the current regime in this area, and in this context the abundance per unit volume is the more appropriate way to map the distribution. However, at a later stage the integrated values should be used, and the referee has already suggested a sensible way of proceeding with the data analysis. See also above.

- For the (lack of) structure of the discussion chapter , we tried to follow the subsections of the result chapter. We do see that the part dealing with the results from the SINMOD current simulations is speculative, although, in our opinion, highly relevant. To meet some of the referees concerns, we agree to move this section (p34, l26- p35, l22) to the end of the discussion chapter. Figs 7 and 8 will then have to swap places.

OSD

3, S23–S27, 2006

Interactive comment on Ocean Sci. Discuss., 3, 25, 2006.

OSD

3, S23–S27, 2006