

Inter-annual Variation in Fat Content of the Icelandic Capelin (*Mallotus villosus*).

Viðar Engilbertsson (1), *Guðmundur J. Óskarsson* (2) and *Guðrún Marteinsdóttir* (1)

(1) Institute of Life and Environmental Sciences, University of Iceland, Sturlugata 7, 121 Reykjavík; (2) Marine Research Institute, Iceland Skúlagata 4, 121 Reykjavík. Presenter contact details: vidar@hafro.is Tel: +354-575-2000

Summary

In this study, the variation of seasonal and inter-annual fat content of foraging capelin (*Mallotus villosus*) is described. To explore long-term changes in fat content of capelin, annual fat index was made 1975 to 2012. The index was used as a response variable to see which environmental factors are likely to affect fat content of capelin such as temperature, salinity, zooplankton, biomass and large scale oceanic/atmospheric features (e.g. NAO, Blocking index). The annual fat index was also used as a predictor variable to explore if fat content can effect capelin stock recruitment and mean weight. A regression linear model showed that the only environmental factor significantly affecting capelin fat content was the NAO index, explaining 25.9% of observed variation. The linear model also showed that the annual fat index has significant relationship with both recruitment- and mean weight of the capelin stock.

Introduction

Capelin (*Mallotus villosus*) is a small pelagic, planktivorous schooling fish, native to the northern hemisphere. Capelin is generally characterized by their small body size, short generation time and high variability in population size. The Icelandic capelin undertakes feeding migration north of Iceland in the area between Iceland, Greenland and Jan Mayen, and spawns in coastal water south and west of Iceland (Vilhjalmsson, 1994). Distribution behavior of capelin is known to be quite variable, and since the year 2002, the foraging capelin schools have moved westwards into the colder waters off Greenland, thus demonstrating one of the largest shifts in spatial distribution ever recorded in the stock (Vilhjalmsson, 2007; ICES, 2011). The condition and general health of the capelin stock can be estimated by assessing its fat content, which reflect the feeding conditions during the previous feeding season.

Materials and Methods

The fat measurements of capelin were done for Icelandic fish processing plants and carried out and provided by Matis (formerly Icelandic Fisheries Laboratories) using standard soxhlet extraction where each sample was composed of 50-100 individuals. An annual fat index was prepared by fitting a polynomial function for whole fat against week during 1975-2012. The mean residuals of the fitted and observed fat content were used to establish the values of the annual fat index. A least square linear regression model was used for statistical testing.

Results and discussion

The fat content of capelin varies from one season to another (Figure 1). During the summer period, at the time when the capelin undertakes the feeding migration, the fat content rises from approximately

5% to 20%. In the following fall and winter periods the fat content slowly declines, until the spawning migration begins in early January where the fat content drops drastically from about 15% to 5% in mid-April. Inter-annual variation in fat content was also observed as represented by the annual fat index (Figure 2).

The annual fat index was found to be positively related to NAO (North Atlantic Oscillation index; $p > 0.01$, $r^2=0.259$) but not significantly related to temperature, salinity, zooplankton and capelin biomass.

There was a positive relationship between the annual fat index and number of 2 years old immature capelin ($p > 0.05$, $r^2=0.191$). There was also a positive relationship between annual fat index and mean weight of 2 years old immature capelin ($p > 0.01$, $r^2=0.218$). These results indicate that recruitment of the stock may be influenced by the feeding condition as represented by the annual fat index.

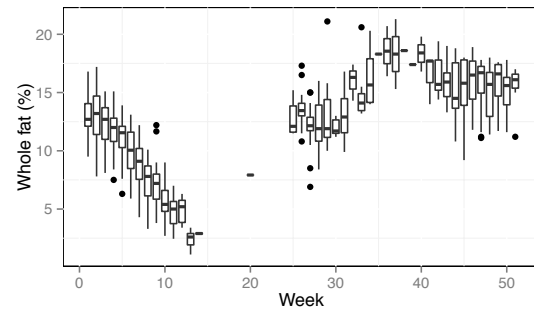


Figure 1. Mean whole fat content (%) for each week of the year.

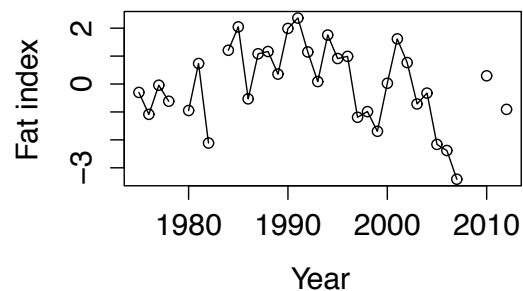


Figure 2. Anomaly of whole fat of the Icelandic capelin.

References

- ICES. 2011a. Report of the North Western Working Group (NWWG), 26 April - 3 May 2009, ICES Headquarters, Copenhagen. 378-384.
- Vilhjálmsón, Hjálmar. (1994). The Icelandic Capelin Stock - Capelin, *Mallotus villosus* (Muller) in the Iceland - Greenland - Jan Mayen area. *Journal of the marine research institute reykjavik*. 13: 1-281.
- Vilhjálmsón, Hjálmar. (2007). Impact of changes in Natural Conditions on Ocean Resources. *Law, Science & Ocean Management*. 11, 256-262.