

# Long-term survey series on 0-group in the Barents Sea

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## Extended abstract

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## Background

Since 1965, annual 0-group surveys have been performed in the Barents Sea by IMR, Norway, PINRO, Russia, and the United Kingdom (up until 1976). Prior to 2003 the 0-group survey was conducted between late August and early September. However, since 2003, the 0-group survey has formed part of a Joint Norwegian-Russian ecosystem survey of the Barents Sea, designed and carried out from early August to late September (Anon. 2005). A standard trawling procedure has been used since 1980 (Anon. 1983).

The aim of the paper is to establish a corrected Joint Norwegian-Russian database, and to present the historical distribution (1980-2006) of capelin, herring, cod and haddock, based on re-calculated fish density taken from the new database. Identification of long-term trends in abundance and distribution of 0-group fish in relation to biological and environmental factors is also an important goal.

## Data source

The applied Norwegian and Russian databases contain 23 years of annual survey data. To investigate fish distribution, densities per square nautical mile of 0-group capelin, herring, cod and haddock were re-calculated by stratified sample mean methods (Anon. 2005). The water temperature was included in the analyses due to its link to the feeding conditions, and because it is influenced by the Atlantic water inflow into the Barents Sea. The mean April-August temperature for the depth layer 0-200m, given from the fixed Fugløya-Bear Island sections, were used in the analyses.

## Results and discussion.

The Barents Sea is the vital nursery area for 0-group fish of several species. The capelin is the most abundant 0-group fish in the area; however, the abundance varied dramatically. Abundant capelin year-classes, such as 1980-83, 1989, 1999, 2003 and 2006, were widely distributed. Our results also showed that, with higher 0-group numbers the mean fish lengths decreased, probably due to greater competition for food. The number of 0-group individuals decreased as capelin overlap with cod increased, while overlap with herring had an irregularly negative effect on the index. Like capelin, cod are distributed over large areas and high numbers of cod will overlap totally with capelin during the summer, while herring overlap with capelin in the central and southern areas, thus affecting the total abundance of capelin to a lesser degree. Therefore, both 0-group cod and herring are potential predators on capelin, and spatial and temporal overlap with capelin during the first summer will increase predation pressure, thus reducing capelin 0-group abundance.

The most abundant year classes (1991, 1993, 1996, 1998 and 2004) of herring were more widely distributed than weaker ones; density was highest in the central area, and the calculated fish density could be as much as one million fish per square nautical mile. The 0-group index was positively associated with water temperature and distribution area. Herring usually overlap spatially with capelin, but the occurrence of capelin in herring areas does not crucially influence the abundance of herring.

Numbers of 0-group cod were lower than capelin and herring. Cod were distributed over larger areas, and wider distribution increases the probability of an adequate food supply at high levels of abundance. Cod overlapped with herring in the central and southern parts of the Barents Sea, and a higher cod index was associated with a larger overlap with herring, probably as a result of sharing habitat. Cod overlapped with capelin, and the lower concentrations of capelin in cod areas suggest that cod which overlap capelin may consume the smaller and suitable prey. Capelin will thus have a positive impact on the abundance of cod.

The abundance of 0-group haddock varied from year to year, and was lowest in 1981 and highest in 2005. During the past four years (2004-2006) haddock have been highly abundant. The 0-group index was positively associated with temperature, suggesting that feeding conditions were better and /or that there was a greater influx of Atlantic water

## **Conclusions**

The goal with this work was to establish an improved joint Norwegian-Russian 0-group database which could be used with larger confidence in different studies (stock assessment, recruitment, temporal and spatial). The historical distribution (1980-2006) of the most important commercial fish species: Barents Sea capelin, Norwegian spring spawning herring, Northeast Arctic cod and Northeast Arctic haddock was presented. This study shows that temperature is an important predictor of fish abundance for all the species analysed, except cod, and that the 0-group indices are generally higher in warmer years. The results also indicate that the spatial overlap between capelin and cod lead to a depletion of the capelin and an increase in cod abundance.

## **References**

- Anon.1983. Preliminary report of the international 0-group fish survey in the Barents Sea and adjacent waters in August–September 1980. *Ann. Biol.* 37, 259–266.
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