

Recent changes in migration and distribution of capelin in the Iceland-East Greenland-Jan Mayen area and their effect on managing the fisheries.

Asta Gudmundsdottir, Thorsteinn Sigurdsson, Sigurdur Th. Jonsson and Sveinn Sveinbjornsson.

Marine Research Institute, Reykjavík, Iceland. Presenter contact details: asta@hafro.is, Phone +354 575 2000.

Summary

Capelin, *Mallotus villosus* (Müller), in the Iceland-East Greenland-Jan Mayen area is a short lived cold water species and only enters into warm Atlantic water for spawning. Spawning mortality is believed to be almost complete and the fishery is focused on pre-spawning fish, mainly from one year class (age 3). In the beginning of the 2000s a western displacement of the nursery and feeding area occurred. The spawning area, however, has remained the same. Although spawning time remains the same, return migration from the feeding areas in the Iceland Sea occurs 1-2 months later than previously with a resulting delay of the spawning migration. Capelin abundance has also decreased during this period. These changes coincide with climate changes. As consequences of this delayed migration, acoustic assessment of the spawning stock, which is the basis for the final advice on seasonal TAC, has been problematic.

Introduction

The biology of the capelin, *Mallotus villosus* (Müller), in the Iceland-East Greenland-Jan Mayen area has been well described by Vilhjálmsson (1994, 2002). They spawn in March and spawning mortality is considered very high. The fishery started mid 1960s with limited fishery on pre-spawning fish but by late 1970s the fishery expanded both geographically and seasonally and became multinational with annual catches around 1 million t. In 2006-2011 the catches were in the range of 5-450 thous. t. Catches have been regulated by annual quotas and a management plan has been in place since early 1980s which requires a spawning stock of minimum 400 thous. t at the end of the fishing season.

The stock has been monitored by acoustic surveys since 1978; age groups 1-3 in autumn and ages 3-4 during winter. Vilhjálmsson (1994, 2002) mapped the distribution and migration pattern of the Icelandic capelin, based on survey results as well as information from the fishery. Capelin spawns in shallow waters off the south and west coasts of Iceland. The larvae drift with currents towards north and the nursery areas are on the continental shelf and slope north off Iceland and on the East Greenland plateau, west of the Denmark Strait. In spring and summer maturing 2 and 3 year old capelin undertake extensive feeding migrations north into the Iceland Sea and the Greenland Strait. In September to October they migrate southward again and assemble near the shelf edge north and northwest off Iceland, from where they start the spawning migration, which takes place from December to March, usually clockwise around Iceland. This migration pattern was as described until early 2000s (Vilhjálmsson, 2002) but since then it has been difficult to locate and measure the stock.

In this paper we examine the western displacement of the stock and link it to observed changes in environmental parameters. Furthermore, we discuss these changes in relation to survey timing and the timing of advised TAC.

Materials and Methods

For this compilation we have used survey reports, ICES Working group reports and annual

reports of State of Marine Stocks in Icelandic Waters in addition to the references.

Results and Discussion

Surveys in autumn 2010 and 2012, carried out 1.5-2 months earlier than previously, have confirmed that juvenile capelin occur in the area NW of Iceland, but also along the continental slope of east Greenland. They also showed that the adult stock was more westerly in recent years than previously.

This change in distribution involves that a larger area has to be surveyed, but surveying E-Greenland waters late autumn can be problematic because of drift-ice. Therefore in 2010, the time when the surveys took place was put forward to September/October.

We believe that observed higher temperature and increased inflow of warm Atlantic water north of Iceland has played an important role in the displacement of the capelin. The years 1972-1995 belong to an intermediate period, but the years since 1996 are considered warm (Astthorsson, 2008). The distribution and the migration pattern of the capelin stock was the same during the whole intermediate period, but changed with warmer climate in the early 2000s.

Too low indices on young capelin from the surveys in autumn do not allow for any fishery in the next summer or autumn. Since 2002 it has been most often the case. In such situation, the advice is given after measuring the adult stock in autumn (rarely) and/or winter (final advice often given in late January/February).

Even if there has been an initial quota, like in 2011/12, there has been no or almost no fishery in autumn, as the spawning migration in recent years is arriving around 1-2 months later from the Iceland Sea to the area north/northwest of Iceland. This implies a delay of the acoustic measurements and accordingly the TAC. As the capelin spawn around mid March this means that the fishing season can be as short as only two months.

Whether the distribution and the migration pattern for the capelin will return back to "normal" depends likely on the environment. The temperature on the Northern hemisphere has been forecasted to increase due to global warming until 2090 (ACIA). In Icelandic waters, the last "warm period" lasted for 40 years. Little is known about the size of the capelin stock during that period. During that period Sæmundsson (1934) noted that capelin became scarce or totally absent on their main spawning grounds at the south and southwest of Iceland, while spawning migrations increased in the north and east. Such changes have not been observed during current "warm period" but if such changes would occur, it is clear that a new harvest strategy and approach on the measurements is required to ensure the sustainability of the resource.

References

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