HAVFORSKNINGSINSTITUTTET
INSTITUTE OF MARINE RESEARCH

Toktrapport/Havforskningsinstituttet/ISSN 1503-6294/Nr.5 – 2008

**«Cruise report»**

**RV Håkon Mosby 05.04-18.04.2008**

# Distribution and abundance of Norwegian spring spawning herring larvae on the Norwegian shelf in April 2008

**by**

**Erling Kåre Stenevik and Richard D.M. Nash**

Institute of Marine Research, P. O. Box 1870 Nordnes, N-5817 Bergen, Norway

Toktrapport/Havforskningsinstituttet/ISSN 1503-6294/Nr.5 – 2008

## Objectives

The objectives of this survey were to map the distribution of herring larvae and other fish larvae on the Norwegian shelf and to collect data on hydrography, nutrients, chlorophyll and zooplankton. The data are used to calculate an index of the abundance of herring larvae which is used by the ICES Northern Pelagic and Blue Whiting Fisheries Working Group (WGWIDE from 2008) in the assessment of Norwegian spring spawning herring. The index is used as an indication of the size of the spawning stock and is part of a time series which started in 1981.

## Participation

The scientific members during the cruise were:

Frøydis Rist Bogetveit, Terje Hovland (instrument), Richard Nash, Laura Rey and Erling Kåre Stenevik (cruise leader).

## Narrative

Due to bad weather the survey was delayed by one day and started in Tromsø on 6 March at 13:00 and the first station was taken at 70$^{o}$18N, 18$^{o}$48E at 19:30. After that the weather worsened again and the next station could not be conducted until 7 April at 09:40. During the rest of the survey the weather conditions were generally favourable. There were no problems with the survey's progress, with completion at the southern limit of the larval distribution occurring just south of Florø. The last station was taken at 61$^{o}$22.5N, 04$^{o}$31E on 18 April at 10:15 UTC. The vessel then headed for Bergen. During the survey a total of 173 CTD and larval stations were undertaken in addition to 57 WP II hauls for zooplankton biomass and species composition.

Toktrapport/Havforskningsinstituttet/ISSN 1503-6294/Nr.5 – 2008

**Methods**

The cruise tracks with larvae stations are shown in figure 1. CTD casts were taken on each station to collect data on temperature, salinity and oxygen between the surface and 10 m above bottom. If the bottom depth was greater than 500 m, the CTD was lowered to 500 m for the deepest measurement. On every third station, water bottles were used at standard depths to collect data on nutrients over the whole water column and chlorophyll *a* from the surface to 100 m depth.

Fish larvae were sampled with two different nets. During daytime, Gulf III sampler (375 μm) was used while during nighttime, T-80 net (375 μm) was used. The Gulf III was towed in a double oblique haul down to 75 m depth while the vessel maintained a speed of five knots. The T-80 net was hauled vertically from 150 m to the surface while the ship was stationary. The reason why two types of sampling equipment were used is that the T-80 underestimates the number of bigger larvae (> 11 mm) larvae during daytime because of avoidance. The Gulf III, however, samples representatively both during daytime and nighttime, but because of the high speed the larvae caught in this net is in a much worse condition. It is therefore sometimes difficult to measure the length of these larvae and to classify them in stages because the gut and yolk sac may be torn off. All herring larvae were counted and a maximum of 50 larvae from each station were staged according to Doyle (1977) and the standard length was measured. Other larvae were identified as far as possible and their standard length measured.

On every third station, a WP II net (180 μm) was used to sample zooplankton. This net was hauled vertically from 200 m depth to the surface and the sample was split in two. One of the sub-samples was dried for measuring biomass (three size fractions) and the other preserved in formaldehyde for later analyses of species and stage composition.

Toktrapport/Havforskningsinstituttet/ISSN 1503-6294/Nr.5 – 2008

**Results**

The number of herring larvae found this year was very high and the total number was estimated to be $107.9*10^{12}$, resulting in the highest recorded Larvae Production Index (LPI) of 393.3. This is the highest number of larvae recorded since the time series started in 1981 (table 1). The mean size of the larvae was 11.9 mm which is similar to the last four years but somewhat lower than preceding years. Most of the larvae were in early first feeding stages (stages 1d and 2a, Table 2) and a few older larvae were found. The fraction of yolk sac larvae was the second lowest found in the time series.

As shown in figure 1, herring larvae were observed throughout the sampling area. However, zero values were found both on the northernmost and on the southernmost section. Also, the western extent of the larval distribution were found on all transects. Since there has been very limited spawning activity on the traditional spawning grounds south of Møre (i.e. Karmøy) in recent years, it was concluded that the survey covered the total distributional area of herring larvae. Highest abundance of herring larvae were found on the Møre spawning grounds, but with a slight southward trend compared to previous years when the highest larval abundance on the Møre spawning grounds have been found at Buagrunn. This year, however, the highest abundance was found at Mebotn just north of Breisunddjupet. In this area, exceptionally high abundance of larvae was observed. On one station here, the abundance of larvae was 48 843 larvae $m^{-2}$ and this is the highest abundance of larvae observed on one station during the whole time series. All the larvae here were in the first feeding stages (1d and early 2a), and therefore mostly less than two weeks old. Relatively high abundance of young larvae was also found just north of Haltenbanken, indicating that spawning had also occurred on this coastal bank this year. In the northernmost sampling area, a band of herring larvae (between 100 and 1000 larvae $m^{-2}$) was observed between the Lofoten Islands and Malangsgrunnen in accordance with what has been observed during the last ten years. It is mostly young herring (from the 2004 year-class this year) that spawns on the northern spawning grounds (Aril Slotte pers comm.) and the importance of these northern areas may change with changes in the age distribution of the spawning stock.

Herring larvae dominated the catch, but all other fish larvae were also identified and measured. The most frequent of these were saithe (figure 2), which were found in the southern part of the survey area and outside Lofoten and Vesterålen. Cod larvae were almost exclusively found outside Lofoten and Vesterålen (Figure 3). The most northly station on this survey was exclusively capelin.

**Acknowledgements**

All the participants and the crew on board RV "Håkon Mosby" are thanked for their valuable work during the cruise. Kjell Bakkeplass is thanked for calculating the herring larvae and saithe larvae indices.

**References**

Doyle, M.J. 1977. A morphological staging system for the larval development of herring, *Clupea harengus* L. *J. mar. biol. Ass. U.K.* 57: 859-867.

Table 1. Total number of herring larvae found on the Norwegian shelf during the period 1981 to 2008 (numbers in $10^{12}$). Index 1 is the total number found during the survey while index 2 is the back-calculated number of newly hatched larvae using a 10% daily mortality rate (LPI). The age of the larvae is estimated from the duration of the yolk sac stages and the size of the larvae.

| Year | Index1 | Index 2 | Year | Index 1 | Index 2 |
|---|---|---|---|---|---|
| 1981 | 0.3 | | 1995 | 18.2 | 36.3 |
| 1982 | 0.7 | | 1996 | 27.7 | 81.7 |
| 1983 | 2.5 | | 1997 | 66.6 | 147.5 |
| 1984 | 1.4 | | 1998 | 42.4 | 138.6 |
| 1985 | 2.3 | | 1999 | 22.5 | 73.0 |
| 1986 | 1.0 | | 2000 | 20.8 | 89.4 |
| 1987 | 1.3 | 4.0 | 2001 | 40.7 | 135.9 |
| 1988 | 9.2 | 25.5 | 2002 | 27.1 | 138.6 |
| 1989 | 13.4 | 28.7 | 2003* | 3.5 | 18.8 |
| 1990 | 18.3 | 29.2 | 2004 | 56.6 | 215.1 |
| 1991 | 8.6 | 23.5 | 2005 | 73.9 | 196.7 |
| 1992 | 6.3 | 27.8 | 2006 | 98.9 | 389.0 |
| 1993 | 24.7 | 78.0 | 2007** | 90.6 | - |
| 1994 | 19.5 | 48.6 | 2008 | 107.9 | 393.3 |

*Poor weather conditions in 2003, plus survey in late April.
**In 2007 the northern spawning grounds were not covered

Toktrapport/Havforskningsinstituttet/ISSN 1503-6294/Nr.5 – 2008

Table 2. Fraction of herring larvae in different developmental stages (Doyle, 1977) during the survey.

| Stage | 1a | 1b | 1c | 1d | 2a | 2b-2d |
|---|---|---|---|---|---|---|
| Age (days) | 0-2 | 3-5 | 6-7 | 8-9 | 10-24 | 24+ |
| Fraction (%) | 0.22 | 0.61 | 0.73 | 32.48 | 64.48 | 1.72 |

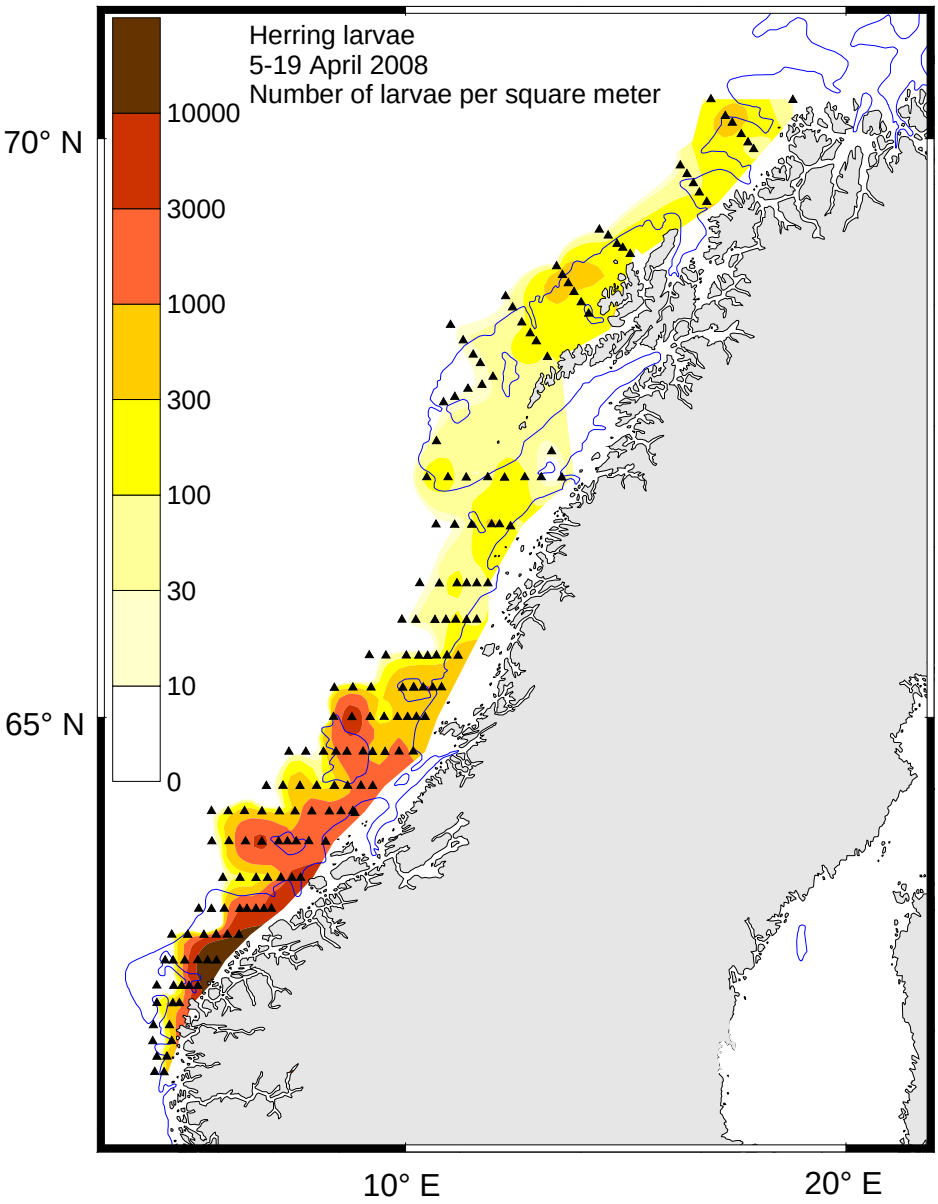


Figure 1. Distribution of herring larvae on the Norwegian shelf. The larval sampling stations and the 200 m isobath are also shown. Numbers per square metre surface.

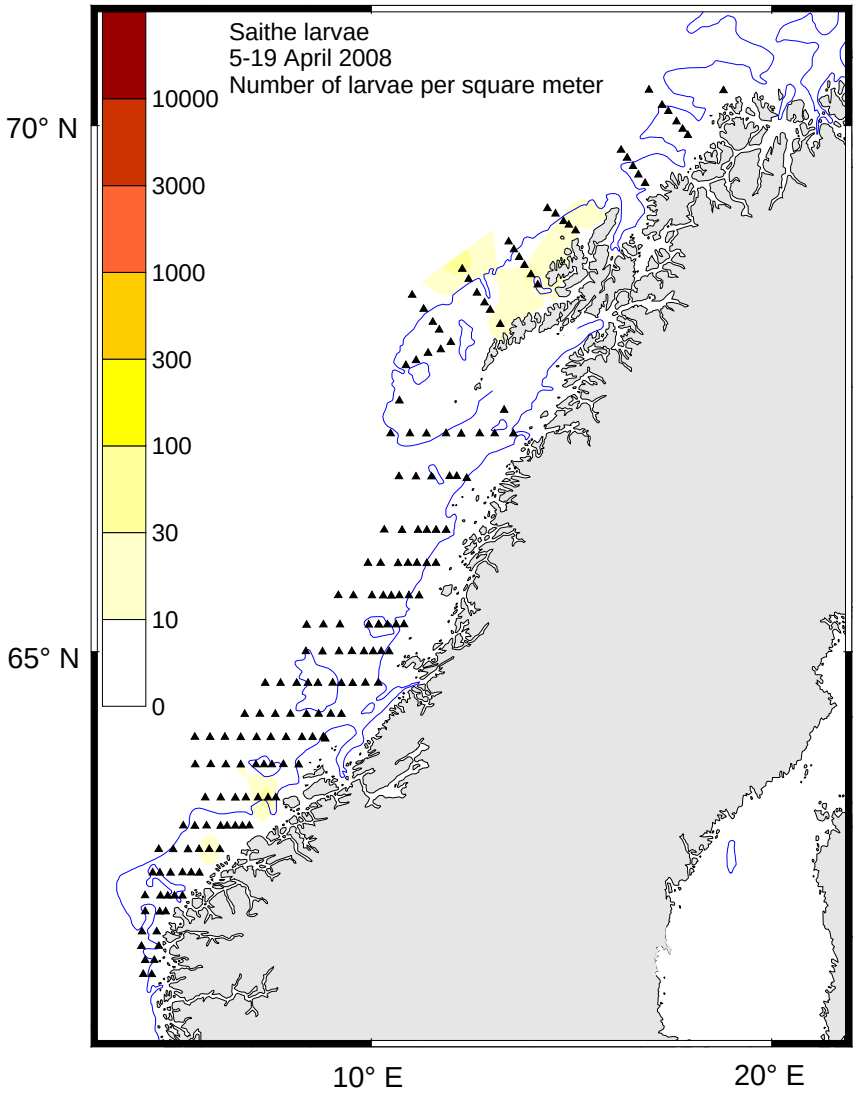


Figure 2. Distribution of saithe larvae found on the Norwegian shelf. Numbers per square metre surface.

Toktrapport/Havforskningsinstituttet/ISSN 1503-6294/Nr.5 – 2008

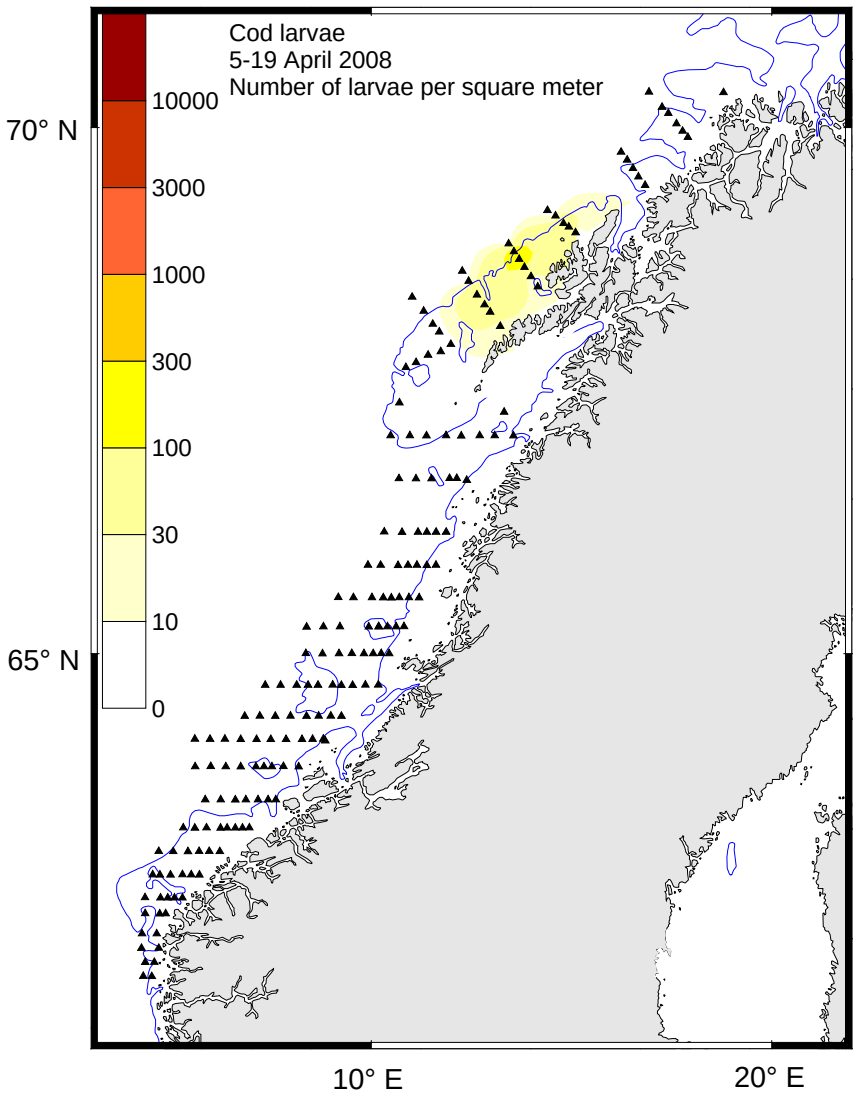


Figure 3. Distribution of cod larvae found on the Norwegian shelf. Numbers per square metre surface.