

**RV Håkon Mosby 28.03-11.04.2007**

**Distribution and abundance of Norwegian spring spawning  
herring larvae on the Norwegian shelf 28 March to 11 April 2007**

**by**

**Erling Kåre Stenevik and Laura Rey**

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

## **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 is 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 in the assessment of the spawning stock on Norwegian spring spawning herring. The index is part of a time series which started in 1981.

## **Participation**

The scientific members during the cruise were:

Kjell Bakkeplass, Julio Erices, Åse Husebø, Geir Landa (instrument) and Laura Rey (cruise leader).

## **Narrative**

Severe weather conditions during the survey significantly impacted the results. At times, the weather was too bad to conduct sampling operations and the vessel had to dock for five days waiting for better conditions. Therefore, there was not time enough to cover the whole area and the survey which normally covers the shelf from Møre to Tromsø had to end just north of Sklinnabanken. Hence, the total distribution of herring larvae was not covered. Details about the survey are found below.

The survey started in Bergen on 28 March at 12:00 UTC. The first station was taken at 62°07N, 04°52E on 29 March at 00:44 UTC. Because of bad weather the survey was interrupted for five days from 3 April at 08:03 UTC (64°20N, 08°42E). We continued at 64°40N, 10°10E on 8 April at 04:49 UTC. Because the short remaining time it was decided to skip the northern areas and try to get a good coverage of the southern spawning grounds. The survey therefore finished in Bodø instead of Tromsø which was the original plan. The last

station was taken at 65°55N, 11°23E on 10 April at 07:57 UTC. During the survey a total of 91 CTD and larval stations were conducted in addition to 30 WP II hauls for zooplankton biomass and species composition.

## 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 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 on standard depth to collect data on nutrients 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 not moving. 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 selected stations, 20 herring larvae (2a and older) was measured and preserved individually in liquid nitrogen for later analyses of larval condition.

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 and the other preserved on formaldehyde for later analyses of species and stage composition.

## Results and Discussion

Due to the reduced coverage, the herring larvae distribution was not covered completely. The spawning stock survey (Slotte and Tangen, 2007) which was conducted in February/March found relatively high concentrations of spawning herring north of the area covered on the larval survey. **Because of that, the larvae index calculated here is not representative for the total larvae abundance, but only for the area from 62°N to 66°N.** The index was therefore an underestimate of the larval abundance along the coast. The index, however, was still high ( $93.8 \cdot 10^{12}$ ) and the second highest in the time series going back to 1981 (Table I). Most of the larvae were in early first feeding stages (Table 2) and few older larvae were found. Very high concentrations of herring larvae were observed at the Møre spawning grounds. On one station in this area more than 30 000 larvae per square meter surface was observed, indicating that the spawning had been successful at the traditional spawning grounds. Only very few other fish larvae than herring were observed during the survey.

## 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 larvae index.

## 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.
- Slotte, A. and Tangen, Ø. 2007. Distribution and abundance of Norwegian spring spawning herring during the spawning season in 2007. IMR Cruise Report

Table 1. Total number of herring larvae found on the Norwegian shelf during the period 1981 to 2007 (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. The age of the larvae is estimated from the duration of the yolk sac stages and the size of the larvae.

Year	Index 1	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	19.9	73.0
1986	1.0		2000	19.8	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	3.7	18.8
1990	18.3	29.2	2004	56.4	215.1
1991	8.6	23.5	2005	73.91	196,7
1992	6.3	27.8	2006	98.9	389,0
1993	24.7	78.0	2007	93.8*	
1994	19.5	48.6			

\*Only representative for the area 62-66°N

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

Stage	1a	1b	1c	1d	2a	2b-2d	ubestemt
Age (days)	0-2	3-5	6-7	8-9	10-24	24+	6
Fraction (%)	0.03	1.61	6.57	58.24	33.43	0.12	0

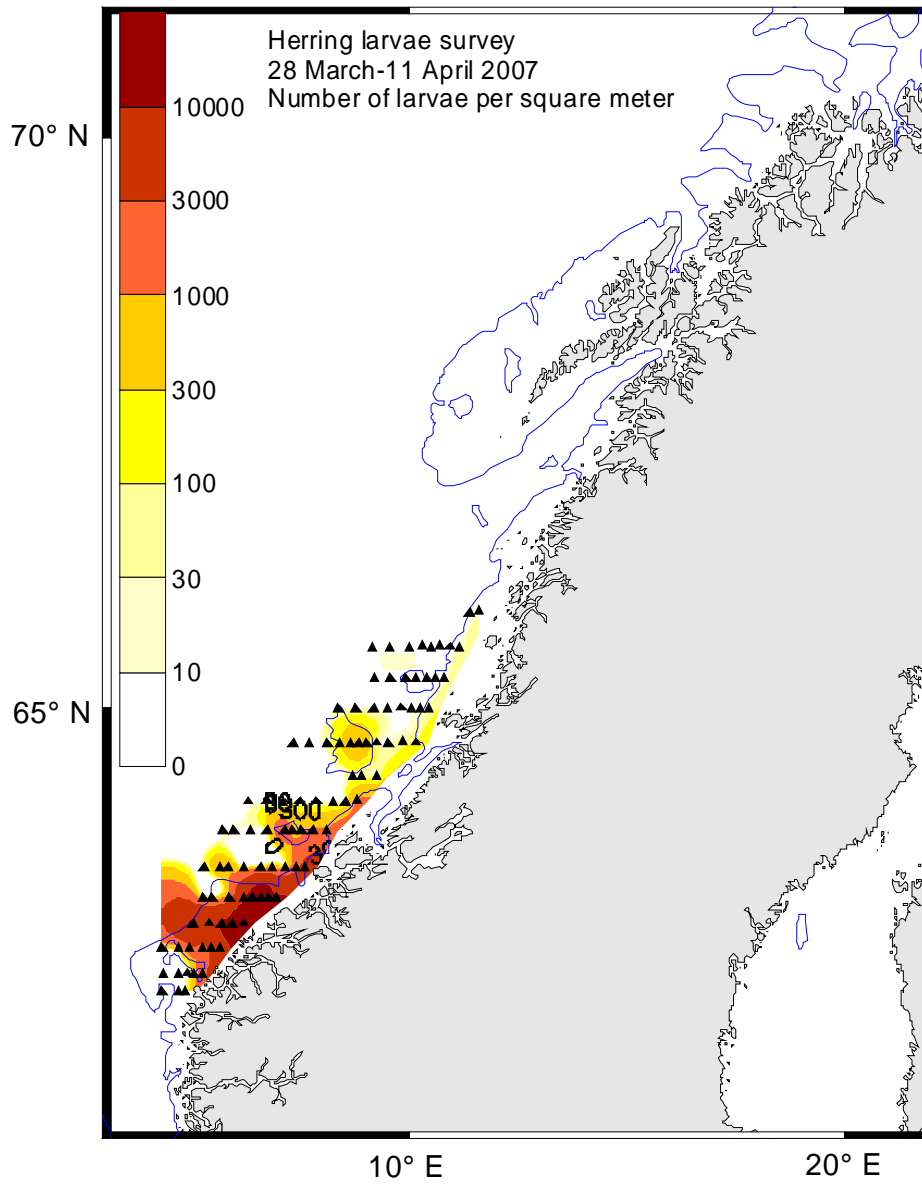


Figure 3. Cruise tracks and distribution of herring larvae on the Norwegian shelf. The 200 m isobath is also shown.