



## Ministry of Food, Agriculture and Fisheries Danish Institute for Fisheries Research

# Cruisereport

## Dana Cruise 05 2004 Akustiksurvey i Norskehavet

**Department** HFI  
**Projectleader**  
**Projectno** 2313  
**Cruisearea** Norwegian Sea  
**Cruiseleader** Jørgen Dalskov, Arild Slotte  
**Ass. Cruiseleader** Arild Slotte, Niels Jørgen Pihl

**Port of departure** Hirtshals - 27-04-2004  
**Port of call** Bergen - 30-04-2004  
Bodö - 12-05-2004  
**Port of arrival** Hirtshals - 26-05-2004

### Crew

#### Del 1 (27/4-12/5)

Jørgen Dalskov, Denmark, 27/4-12/5, Togtleder  
Arild Slotte, Norway, 27/4-12/5, Assisterende Togtleder  
Ann-Christin Rudolphi, Sweden, 27/4-12/5  
Sytse Ybema, Netherlands, 27/4-12/5  
Niels Jørgen Pihl, Denmark, 27/4-12/5  
Jan-Otto Pettersson, Sweden, 27/4-12/5  
Maria Jarnum, Denmark, 27/4-12/5  
Peter V. Larsen, Denmark, 27/4-12/5  
Klaas Weber, Germany, 27/4-12/5  
Mogens Rokkjær Sørensen, Denmark, 27/4-12/5  
Bo Lundgren, Denmark, 27/4-30/4

#### Del 2 (12/5-26/5)

Arild Slotte, Norway, 12/5-26/5, Togtleder  
Niels Jørgen Pihl, Denmark, 12/5-26/5, Assisterende Togtleder  
Bram Couperus, Netherlands, 12/5-26/5  
Stina Bilstrup, Denmark, 12/5-26/5  
Maurice Clarke, Ireland, 12/5-26/5  
Bo Lundgren, Denmark, 12/5-26/5  
Frank I. Hansen, Denmark, 12/5-26/5

Dierdre Lynch, Ireland, 12/5-26/5  
Klaas Weber, Germany, 12/5-26/5  
Mogens Rokkjær Sørensen, Denmark, 12/5-26/5

## **Objectives**

The Norwegian spring spawning herring is a highly migratory and straddling stock carrying out extensive migrations in the NE Atlantic. After a major stock collapse in the late 1960's the stock has been rebuilt and varied from approximately 5 to 10 million tonnes of biomass during the 1990's. After spawning with main spawning areas in the Norwegian Fjord from 62aN to 64aN in February to March the herring migrates NE-wards towards the Norwegian Sea feeding grounds. In general, the main feeding has taken place along the polar front from the island of Jan Mayen and NE-wards towards Bear Island. During the latter half of the 1990's there has been a gradual shift of migration pattern with the herring migrations shifting north and eastwards. In 2002 and 2003 this development seems to have stopped and the herring had a more southerly distribution at the end of the feeding season than in 2001. After feeding, the herring have concentrated in August in the northern parts of the Norwegian Sea prior to the southern migration towards the Vestfjord wintering area (68,,aN, 15,,aE). During the winter 2002-2003 an unknown fraction of the stock wintered in the Norwegian Sea off Lofoten. In January the herring start their southerly spawning migrations.

Besides herring, abundant stocks of blue whiting and mackerel exploit the Norwegian Sea as an important feeding area. Blue whiting is the fish species that currently is supporting the largest fishery of the Northeast Atlantic. The main spawning areas are located along the shelf edge and banks west of the British Isles. The eggs and larvae can drift both towards south and towards north, depending on location and oceanographic conditions. The northward drift spreads juvenile blue whiting to all warmer parts of the Norwegian Sea and adjacent areas from Iceland to the Barents Sea. Adult blue whiting carry out active feeding and spawning migrations in the same area. Blue whiting has consequently an important role in the pelagic ecosystems of the area, both by consuming zooplankton and small fish, and by providing a resource for larger fish and marine mammals.

## **Progress**

The main objectives of this survey was to map the distribution and migrations of herring and other pelagic fish and to assess their biomass. Furthermore to monitor the hydrographic and plankton conditions of the Norwegian Sea and adjacent waters and describe how feeding and migration of herring and other pelagic fishes are influenced by this.

## **Achievements**

### **Materials and methods**

#### Acoustic data

This survey was coordinated with Norway as an international survey with participation of Norway, Island, Faeroe Island and EU, where the EU survey part was conducted by the Danish R/V Dana. The acoustic survey tracks of Dana is shown in all Figures 1-6.

Acoustic data was collected with EK60 using 38 kHz transducers, paravane mounted

or hull mounted depending on the weather conditions. During the fishery acoustic data was collected by the EK60 using the hull mounted 38 kHz transducer. Echo integration was conducted for 24 hours per day and the data will be scrutinized regularly during the survey by use of the Simrad BI500 software.

In connection with the acoustic monitoring of the Norwegian Spring Spawning herring and the blue whiting in the Norwegian Sea, calibration of the acoustic equipment (echo-sounders) had to be carried out. The calibration of the equipment took place in the area of i§Uggedalseidet", Norway, in the period 28/4-30/4. In addition the two 38 kHz transducers, also the hull mounted 18 and 120 kHz transducers were calibrated.

#### Hydrographical and zooplankton data

At approximately each 60 nmi a plankton sampling using a WP2 net was carried out as a vertical haul from 200m depth to the surface. The plankton sample was split into two parts, one part was placed on formaldehyd, whereas the other was sorted into three groups of zooplankton based on size for biomass estimation. The biomass samples were dried in an onboard heater and brought back to Denmark for weighing.

In connection with the plankton sampling a hydrographical profile using the Seabird CTD sonde was carried out from 0-1000 m depth. All together Dana carried out 43 combined CTD and WP2 stations (Figure 1).

Once a day two water samples were taken from the surface respectively from the bottom for calibration of the CTD sonde. Temperature and salinity shall also be monitored from the surface continuously during surveying with use of R/V Danas metrological station along with information on wind direction, wind speed etc.

#### Biological data

During the survey fishery was carried out regularly on acoustic registrations to verify the species scrutinized and to give information about the size composition to be used in the biomass estimation. A Fotö midwater trawl was used either at the surface or pelagic down to 400 m depth. A total of 63 trawl stations were carried out during the survey, well spread over the surveyed area, but more frequent in areas with high fish densities (Figure 2).

All trawl hauls shall be sorted into species. All catches were weighted by species, and all fish species were length measured. For herring and blue whiting representative samples following parameters were measured on 50 fish from each catch: length, weight, sex, maturity and age, from scales of herring and otoliths of blue whiting. Scales and otoliths were brought to Norway for age reading. In addition to the 50 fish, up to 150 fish were length measured to get a better overview of the size distribution.

Fishery were recorded into the DFU-database, and all data were checked for errors. The data were also put into the PGNAPES formats.

#### Biomass estimation

A biomass estimate was not carried out based on Danas data alone, but included as part of the data from all four vessels involved in the surveying. The final estimate methodology is presented in the coming PGNAPES report.

### Timing of the survey

R/V Dana departed Hirtshals, Denmark Tuesday 27 April at 15:00 hours and arriving at Uggedalseidet 16:15 hours. At 10:00 hours on 30 April we finished with the calibration and started toward Bergen and were moored there at 13:00 hours. Dana left Bergen at 18:00, after shifting of some crew, for starting the survey. The echo integration was started at 21:30 hours 30 April. At 11 May 17:00 hours Dana arrived in Bodø for shifting of crew, and left again at 20:00 hours the next day. At 10:45 hours 22 May we stopped surveying and headed for Hirtshals where we arrived and thereby finished the survey at 25 May at 22:00 hours.

### Results

#### Distribution and density of herring and blue whiting

Herring schools were recorded in most of the surveyed area, but it appeared in denser registrations in the east close to the Norwegian coastal area, off Vesterålen (Figure 3). The blue whiting was found so to say all over the area, a little denser in some areas than others, but not as pronounced as in herring (Figure 4). The SA-grid values to be used in the biomass estimation also demonstrates this (Figures 5-6).

#### Size and age distribution

These data are not prepared yet, but it was clear that young fish, and especially the 2002 year class predominated in the east, close to the coast.

#### Hydrographic conditions and zooplankton biomass

The frontal area between cold arctic water and warmer Atlantic water was apparent at all depths from the surface and down to 200 m (Figure 7). It seems that the herring was more abundant in the Atlantic water masses than in the frontal area, especially in the northern part of the surveyed area. The zooplankton data are not prepared yet.

### **Discussion**

#### Scrutiny problems

Due to bad weather and bubble noise, it was impossible to scrutinize the upper 50 m in some areas and periods. A comparison of the herring distribution versus the wind speed (Figure 3), suggests that many schools in the upper 50 m may have been lost due to this problem.

In the two northernmost transects it appeared not to be possible to make a clear distinction between herring and blue whiting schools. Experience from previous years has shown that herring is found mainly in the upper 50 meters of the water column in small school amidst a more or less dense plankton layer. Blue whiting was found in a lower layer (150-400 m) in less dense schools mixed with mesopelagic fish species and zooplankton. This year, in the northern part of the area covered by FRV Dana, trawl information revealed some herring in this mesopelagic layer as well. There was no clear way of distinguishing the schools of blue whiting and herring by their properties in the echograms. The trawl hauls targeted at schools in this layer, were

very small (tens of kg) and contained mixtures of blue whiting and herring. Only in one occasion the information from the echosounders suggested that the trawl actually caught part of these schools. Based on reports from the Faroese and Norwegian research vessels, reports from fishermen and the sparse trawl information, schools in the upper boundary of this layer with comparatively high sA values were assigned to herring, whereas the remaining recordings in the same layer were assigned to blue whiting and mesopelagics.

However, in the one occasion mentioned above when the trawl information was thought to reflect the school composition, the schools were dense and high up (c. 150 m), the catch consisted of blue whiting. This caused considerable confusion amongst the scrutinizers. The targeted schools were in close vicinity of a CTD station (Figure 8), which showed that the temperature at 150m, where the schools were found, was approximately 2° Celsius. Hydrographic data from the ships inlet, showed a sudden drop of the temperature in western direction, right before encountering the schools. At the same time the plankton density seen on the echogram decreased markedly (Figures 9 and 10). On the basis of this trawl information and the two trawl hauls thereafter, which contained no herring, in the remaining transect (72°35'N, in western direction), any schools deeper than 50 m were assigned to blue whiting. This is in harmony with previous surveys for Norwegian springspawners in May, when no herring was found in water of less than 2° Celsius.

## Comments

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