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RV *Dana* (Danish Institute for Fisheries and Marine Research)

Cruise 5/96

REPORT

Marine Laboratory Aberdeen Charter cruise 1296H (6-12 May 1996)
DIFMR Cruise 5/96 (12-22 May 1996)

Personnel

M Heath	PSO (SOAEFD) (in charge)
B McKenzie	(DIFMR)
A Visser	(DIFMR)
I Jenkinson	(DIFMR)
L Christensen	(DIFMR)
L Pedersen	(DIFMR)
M Sorensen	(DIFMR)
J Dunn	(SOAEFD)
C Hall	(SOAEFD)
D Basford	(SOAEFD)
A Gallego	Contract (SOAEFD)
M Bailey	Contract (SOAEFD)
C MacKay	Sy-Tech Research, Sidney, Canada
D Boon	University of Wales, Bangor

Objectives

To track and sequentially sample a patch of larval haddock.

Narrative

Dana sailed from Hirtshals on 4 May and rendezvoused with *Scotia* in Lerwick on the morning of 6 May. Sampling equipment, container laboratory and personnel were transferred from *Scotia* to *Dana* and both vessels sailed in the afternoon of the same day. *Scotia* returned to Aberdeen for the end of cruise 0796S, and *Dana* continued sampling the grid survey stations not completed by *Scotia*.

By midday 8 May, the grid survey had been completed and the abundances of haddock larvae in all the sampled estimated. A location for commencement of the patch tracking programme was selected, and the drifting buoy rig was successfully deployed. The vessel then commenced a six hourly repetitive sampling regime whilst tracking the drift buoy. The sampling schedule was successfully adhered to for 10.5 days, and the buoy recovered early in the morning of 19 May. Following a small scale grid survey of larval fish abundance around the recovery position of the buoy, the vessel made a passage to Aberdeen, docking at 1300 hours on 20 May. After unloading SOAEFD gear and personnel *Dana* returned to Hirtshals, arriving on 22 May.

Results

The combined results of MIKT sampling by *Scotia* and *Dana* delineated a concentrated patch of larval haddock approximately 30 km in diameter to the east of the Shetland Islands (Fig. 1). The centre of density was calculated from the data, and the drift buoy deployed at that location. Over the following 10.5 days the weather conditions varied from gale force winds of 15-20 m/s to flat calm. However, the strict six hourly sampling regime was maintained without any intermissions.

During each six hour sampling cycle data on the vertical distribution of fish larvae were collected with an opening and closing MIKT, plankton were sampled with nets of a three different mesh sizes and with an Optical Plankton Counter (OPC). CTD data were collected from lowered and towed deployments, and the dissipation of turbulence in the water column was measured with a free-fall shear probe. Irradiance, wind speed, water velocities by ADCP, and a range of other parameters were continuously monitored aboard the ship. As far as possible, data and fish larvae catches were worked up aboard the ship to enable decision making regarding the sampling programme, and also for quality control. Specimens of larval haddock extracted from the samples were preserved for otolith microstructure analysis and for biochemical analysis.

The variations in weather conditions experienced during the tracking study were near perfect for the purposes of the investigation, which were to determine the effects of short term variations in hydrographic and meteorological conditions on the growth and survival of haddock larvae. The data on vertical distribution alone constitute an outstanding set of data being made up of 10.5 days of uninterrupted regular sampling at 6 h intervals from three depth layers (Fig. 2). Clear patterns in the vertical distribution are present in that the larvae moved towards the surface during daylight and descended at night, and were deeper in the water column during storm events than in calm weather. However, the role of changes in stratification and the abundance and distribution of planktonic food will require more detailed analysis of the data and samples.

During the 10.5 days, the buoy moved relatively slowly southwest from its release position east of Shetland, and was recovered some 10 miles east of Sumburgh Head (Fig. 3). Although the buoy was certainly subject to wind drag, analysis of the tidal excursions shows that the water currents at the drogue depth (40-50 m) were the main factor controlling its movements.

At the start of the study the water column was only weakly stratified. However during the calm spell in the middle of the tracking period stratification quickly developed, and was then broken down during the storm which followed. An intense phytoplankton bloom accompanied the onset of stratification, and during a flat calm period on 12 May, surface slicks of aggregated phytoplankton were observed. Phytoplankton concentrations quickly declined with the breakdown of stratification.

The sampling gear performed outstandingly well during the cruise. In particular the opening and closing MIKT system developed at MLA functioned flawlessly thoughout the cruise despite being subjected to a demanding regime of usage. Similarly the OCEAN sampler (multiple small mesh plankton sampler) functioned without any problems whatsoever. However, the performance of the Hydrosphere GPS data telemetry system installed on the drifting buoy was very disappointing. This should have transmitted the buoy position to the vessel every 10 minutes throughout the tracking period, but failed

almost completely. Were it not for the efforts of the ships' officers and the availability of an exceptionally good radar system on the *Dana*, the tracking programme would have been very difficult. In fact, the vessel was able to obtain good quality latitude and longitude fixes on the buoy by radar to a range of three miles in all but the worst of weather conditions. Fortunately also, the independent self-recording GPS system installed on the buoy functioned perfectly, so a comprehensive record of the rigs' movements was available after recovery of the system.

Another major disappointment was the performance of the ADCP system on *Dana*. The plan, developed and tested 12 months earlier on RV *Challenger*, had been to model the water currents in the patch at 24 hour intervals from the ADCP data and estimate the discrepancy between the buoy trajectory and that of the larvae due to windage on the buoy and shear in the water column. The discrepancy would then have been used to orientate the sampling relative to the drift buoy. In fact, the 600 kHz ADCP on *Dana* proved wholly inadequate for this purpose, even though the water depth (120 m) was within the operation range of the system. The system suffered serious signal degradation even in calm weather. More seriously though, a careful analysis of the data appeared to show a systematic bias in the north-south velocity components which completely invalidated the purpose for which the data collection was intended. The origin of the bias could not be established during the cruise. In the absence of this aspect of the programme, the orientation of the sampling relative to the buoy was simply to maintain a position upwind of the buoy. Fortunately, the small scale grid survey carried out at the end of the drift tracking period confirmed that the buoy was still located near the centre of the patch haddock larvae.

M Heath
7 June 1996

Figure 1

Scotia 0796 and Dana 0596 29 April - 8 May 1996

Haddock larvae abundance

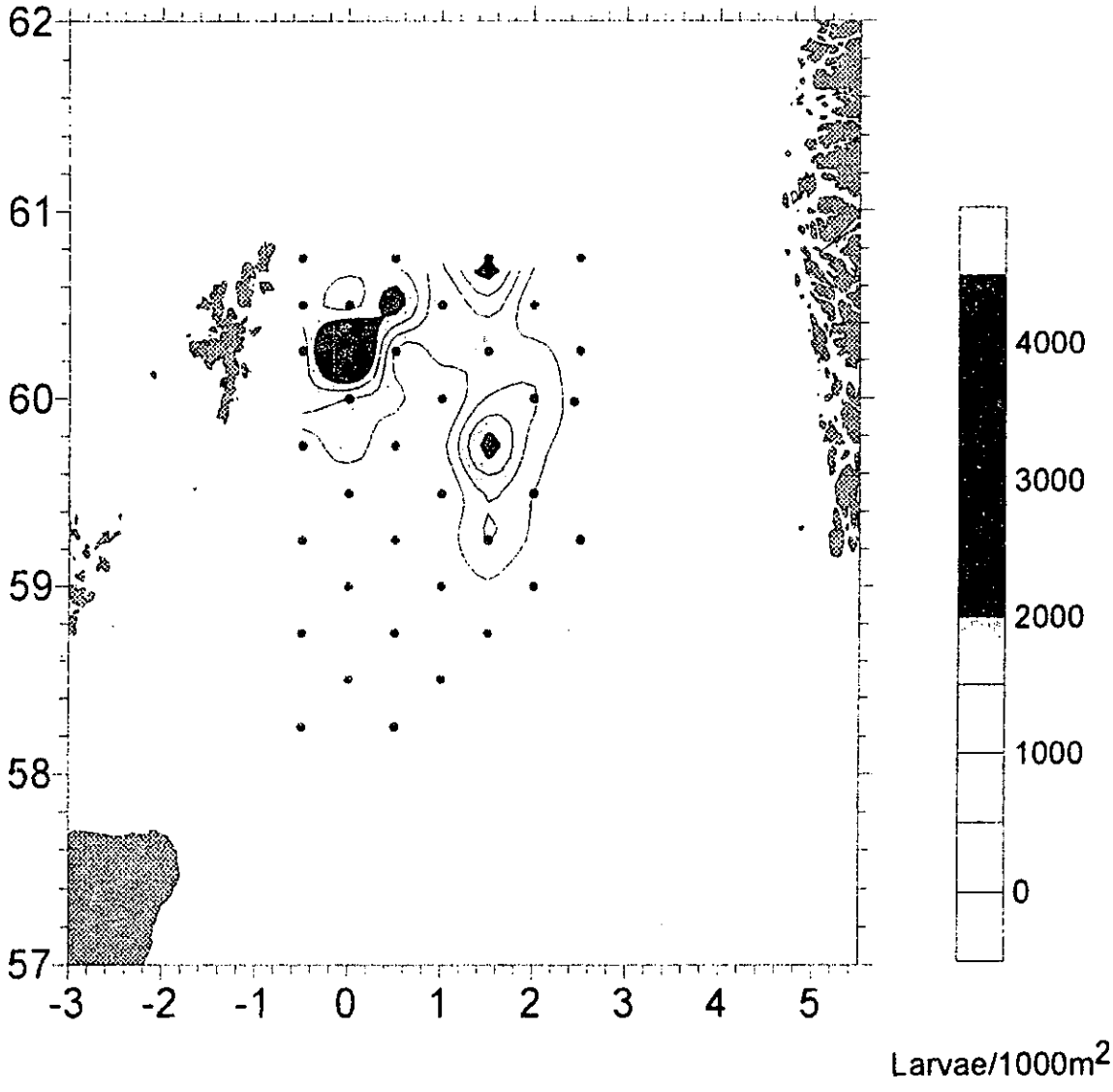

Figure 2

Dana 05/96 drift study 8-19 May 1996

Haddock larvae vertical distribution

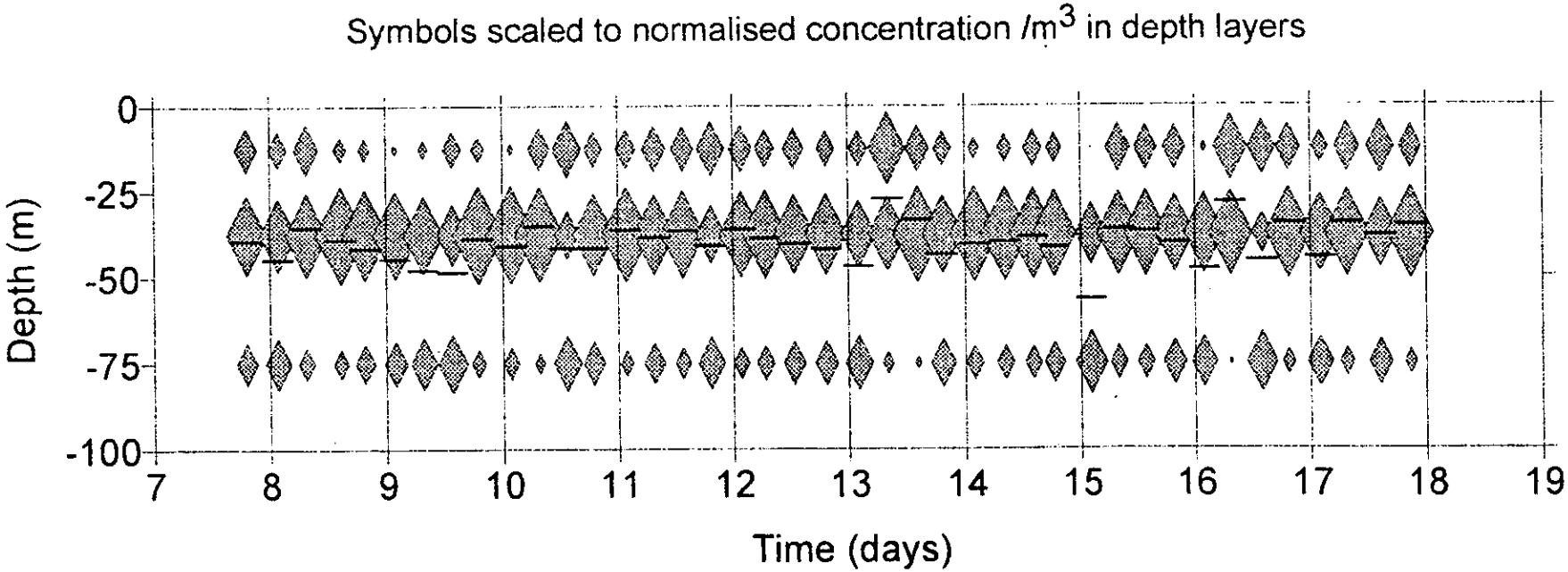

Figure 3

Dana 5/96 drift buoy track (8 - 19 May 1996)