

R1/12

4SR Part 2 82

In Confidence - not to be quoted without reference to the Laboratory

FRV 'Scotia'  
Cruise 4/82 Part 2  
Report

23 April - 3 May 1982

### Objectives

1. To obtain and analyse samples for total soluble and particulate nitrogen from a number of sections in the central and northern North Sea.
2. To work standard hydrographic/chemistry/plankton stations on the same sections.
3. To study the depth distribution of the zooplankton standing stock using a Longhurst-Hardy Plankton Recorder.
4. To test plankton gear instrumentation.
5. To collect water at 56°32'N 2°20'W for radio-caesium monitoring.
6. To collect plankton from a number of areas for heavy metal analysis.

### Narrative

'Scotia' sailed from her berth in the Upper Dock at 1200 hrs on 23 April and went to Waterloo Quay to load the scientific equipment for the cruise prior to departing Aberdeen at 1800 hrs. The vessel proceeded to the measured mile where the EM log was calibrated following its being repaired during the half-landing.

Overnight the vessel steamed to a suitable area (57°25'N 1°02'E) for trials of the plankton sampler depth monitor; these commenced at 0900 but were shortly thereafter delayed for three hours while the monitor transducer cable, which had been found to be faulty, was replaced. On completion of the trials, a course was set for the inner Moray Firth where work on the central Moray Firth section commenced at 0915 on 25 April. Work on this section, and on the JONSIS section, and the central to northern North Sea section, continued more or less systematically until 0140 on 29 April when the survey was suspended due to adverse weather conditions.

At 2035 on the 29, work recommenced and between then and 0235 on 3 May the remaining programmed stations, plus an additional section from the Devil's Hole to Arbroath, were worked. However about three hours on the 1 and five hours on the 2 had to be spent dodging.

Some additional sampling was then carried out along the coast towards Aberdeen where, following flowmeter calibrations, the vessel docked at 1140 on 3 May.

### Results

With the exception of the zooplankton depth distribution samples, all samples were obtained successfully along the sections shown in the attached track chart. With some exceptions, all samples have now been analysed and some of the features revealed are described below.

## Temperature and salinity

Surface temperatures (uncorrected) ranged from  $7.69^{\circ}\text{C}$  on 26 April near the seaward end of the central Moray Firth section to  $5.79^{\circ}\text{C}$  on 30 April at  $3^{\circ}\text{E}$  on the central North Sea section. The lowest bottom temperature ( $5.03^{\circ}\text{C}$ ) was found at the station with the lowest surface temperature. This was one of a number of stations south of  $58^{\circ}\text{N}$  and east of  $0^{\circ}$  with bottom temperatures less than  $6^{\circ}\text{C}$  reflecting the extent of an area of low winter temperatures. The highest bottom temperature ( $7.58^{\circ}\text{C}$ ) was found at  $1^{\circ}40'\text{W}$  and  $1^{\circ}30'\text{W}$  on the JONSIS section and was probably due to the Orkney-Fair Isle inflow.

With the exception of the greater part of the JONSIS section and two stations in the centre of the central North Sea, all surface salinities were less than 35.0‰. Deeper in the water column, waters of a salinity of greater than 35.0‰ were rather more extensive.

## The spring bloom

The situation is best described for individual sections. The central Moray Firth Section. Nutrients had been reduced in the upper 20 to 30 m of the water column over the whole length of the section and at the point where the section deepened to become in excess of 60 m (about half way along the section), lower nutrient water extended to the bottom. This corresponded with the point at which the surface to bottom temperature gradient was at its lowest.

Along the seaward two-thirds of the section the distribution of the higher chlorophyll *a* values ( $>2\text{ mg m}^{-3}$ ) reflected the distribution of the low nutrient waters and like them extended to the bottom at the point where the section deepened beyond 60 m. Along the inner third of the section, the chlorophyll *a* values tended to be low (many  $<1\text{ mg m}^{-3}$ ); interestingly they often increased towards the bottom.

The JONSIS Section. Along the landward half of the section, nutrients were relatively high (eg nitrate averaged  $5.3\text{ }\mu\text{g}$  - at  $1^{\circ}$ ) and showed little variation with depth; along the seaward half of the section bottom waters were rich in nutrients (eg nitrate  $>8\text{ }\mu\text{g}$  - at  $1^{\circ}$ ), the surface waters generally poor. The Chlorophyll *a* distribution was consistent with the nutrients distribution. Inshore chlorophyll *a* values of from approximately  $0.5$  to  $1.5\text{ mg m}^{-3}$  extended from top to bottom of the water column while offshore the upper half of the water column had chlorophyll *a* concentrations as high as  $8.32\text{ mg m}^{-3}$ , the lower half concentrations of less than  $0.5\text{ mg m}^{-3}$ .

The Devil's Hole to Arbroath Section. Nutrient concentrations showed little variation with depth but were lowest inshore, highest offshore. The chlorophyll *a* concentrations showed the opposite gradient ranging from less than  $0.25\text{ mg m}^{-3}$  offshore to greater than  $2\text{ mg m}^{-3}$  inshore. Generally there was little variation with depth.

The Central to Northern North Sea Section and the Central North Sea Section. The interpretation of the data obtained for these sections is complicated by the distance between stations (approx 30 nm) and by the fact that the spring bloom had probably occurred some time before the survey; subsequent grazing by the zooplankton and wind induced mixing had tendency to mask any likely simple relationship between nutrient concentrations and chlorophyll. As for the landward part of the central Moray Firth section, the chlorophyll *a* values were sometimes higher towards the bottom.

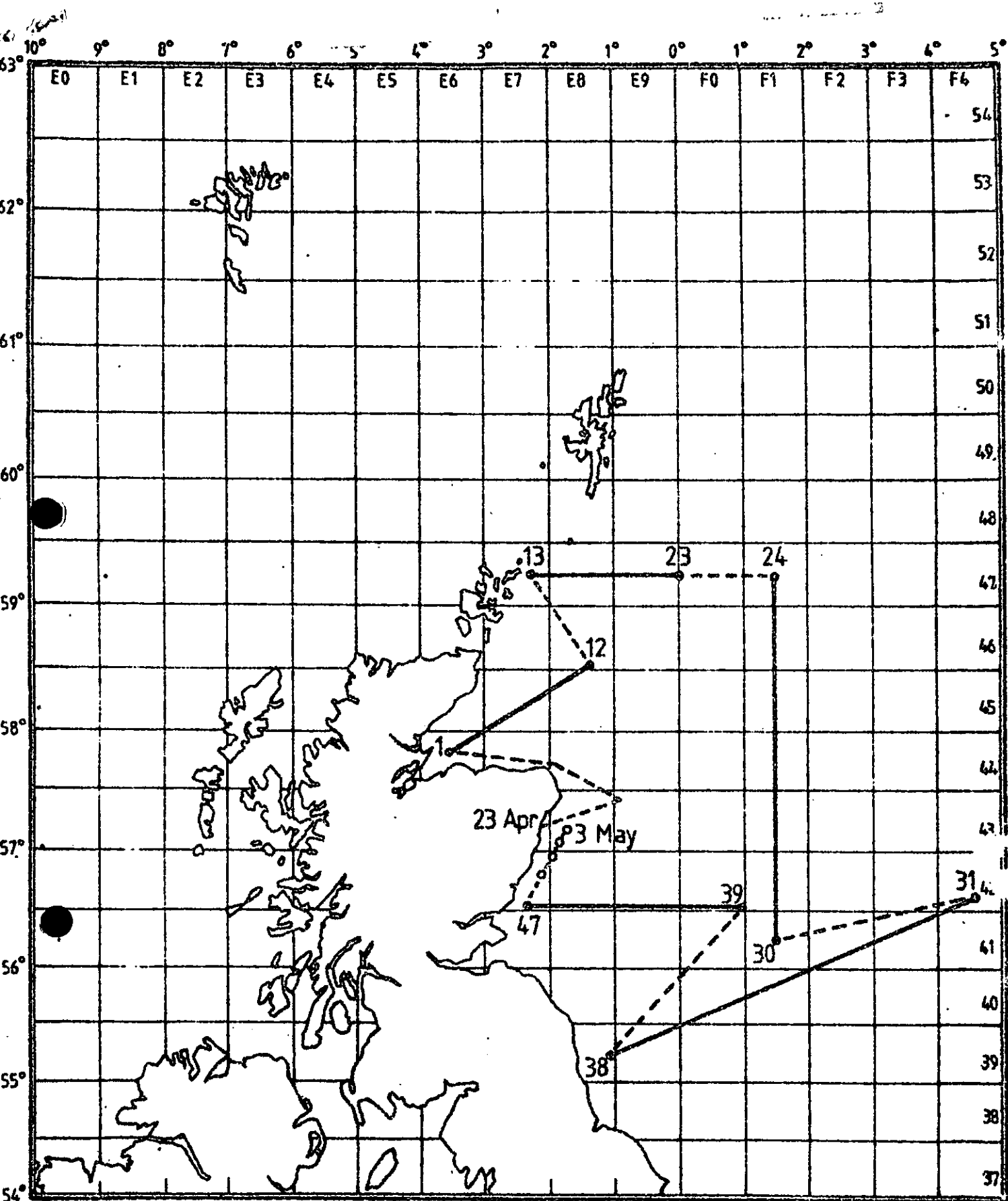
## Plankton Gear instrumentation

The IOS depth monitor worked well when used to determine sampler depth. Trials of laboratory designed instrumentation (which uses a reflected signal to measure distance off the bottom) indicated a number of features which would have to be taken into account

account before this additional instrumentation could be used reliably.  
Encouraging progress has since been made and further experience of the system  
will be obtained during the larval herring cruises in September - October 1982.

J A Adams  
4 Oct 1982

Seen in draft J W Gillon



— Lines of hydrographic and plankton stations  
 • Plankton stations

FRV Scotia Cruise 4/82 Pt.2 23 Apr.-3 May 1982