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FRV *Clupea*

Cruise 1003C

REPORT

5-23 June 2003

Personnel

S P R Greenstreet	SIC, 5-18 June
H M Fraser	
M Robertson	SIC, 18-23 June
I M Gibb	5-18 June
F Armstrong	5-18 June
N Jacob	13-18 June
F Burns	18-23 June

Cruise Objectives

1. To investigate variation in sandeel population age structure at different locations on the Wee Bankie and Marr Bank from samples collected using the Sandeel dredge.

2. To carry out a demersal trawl survey to determine the abundance and distribution of whiting, haddock and cod, the main fish predators of sandeels. At each trawl station the length frequency of all fish species caught will be determined. Sub-samples of the three gadoids will be weighed to determine length-weight relationships. Otoliths will be taken to determine age composition. Stomach samples will be collected to establish diet and food consumption rates, and livers and gonads will be removed to determine Hepato- and Gonado- Somatic Indices. (Any sandeels and clupeid fish caught during the demersal trawling will be worked up to determine length frequency distributions, length-weight relationships and age composition). Muscle tissue samples will also be collected for fatty acid and nitrogen isotope ratio analysis.

3. To determine spatial variation in water temperature and salinity across the Wee Bankie/Marr Bank study area using a Seabird CTD sampler. Approximately 44 vertical dip stations will be sampled utilising the demersal trawl stations and additional locations mid-way between the trawl stations.

4. To undertake an acoustic survey of sandeels and clupeid fish in the water column using 38 and 120 kH. Concentrations of fish will be sampled using the pelagic trawl. Species composition and length frequency distributions of fish caught will be determined. Sub samples will be weighed and their otoliths removed to establish length-weight relationships and age composition.

5. To conduct a RoxAnn survey of the substrate in the study area to investigate variation in the sandbank structure between this and previous cruises.

6. To conduct a survey of seabirds using the study area, to determine their abundance and distribution, using standard census methods.

7. To record all sightings of marine mammals (number of animals, species if possible, and their location) observed during the course of the cruise.

8. To conduct a hydrographic survey along a transect offshore of Stonehaven. At pre-selected locations the Seabird CTD sampler and the dual Bongo net will be deployed using a vertical dip. Water samples will be collected for salinity, nutrient and phytoplankton analysis. The 1 m plankton net will be deployed using a double oblique tow between selected stations along the transect.

Out-turn Days Per Project: MF0463 19 days.

Narrative

The scientific equipment was loaded on board *Clupea* on 3 June. Helen Fraser, Mike Robertson, Finlay Burns and Nick Jacob joined *Clupea* at Fraserburgh at 0900 h BST on the morning of 5 June and the vessel sailed at 1015 h. Equipment in the laboratory was set up whilst the vessel was on route to the Stonehaven hydographic and plankton sampling transect. *Clupea* arrived at the outer station of the transect at 1530 h. At each station the CTD, with its associated Fluorometer and Transmissometer, was deployed to obtain full water column profiles. A vertical dip was made with a dual bongo net fitted with 200 μm and 95 μm filters for phyoplankton and small zooplankton. Water samples were collected from approximately 10 m above the seabed, 2 m below the water surface, and at a variable depth in midwater for chlorophyll, salinity, silicate and nutrients analysis. A surface 10 m water column sample was collected by hose for phytoplankton analysis. A 1 m net was deployed, using a single oblique tow, to sample larger zooplankton. Sampling at seven stations along the transect was completed by 1930 h (Fig. 1), and the vessel sailed for Montrose, arriving at 2200 h. Simon Greenstreet and Iain Gibb joined the vessel later that evening.

Clupea departed Montrose at 0700 h on 6 June to commence demersal fishing operations and to sample the grid of CTD stations. This work continued over six days. The vessel anchored off St Andrews on the night of 6 June, off St Abbs on the nights of 7 and 8 June, off the Isle of May on the night of 9 June and off St Andrews on the nights of 10 and 11 June. A total of 19 demersal stations were fished (Fig. 2). The total numbers at length (to the ½ cm below for herring, sprats and sandeels, and to the 1cm below for all other species) of all species in each catch was determined. Samples of herring, sprats and sandeels were weighed to the nearest 0.1 g to determine length-weight relationships and otoliths were collected to determine age at length keys. Samples of whiting, haddock and cod were weighed to the nearest 0.1 g to determine length-weight relationships and otoliths were collected to determine age at length keys. Stomach samples were also taken to determine diet and daily food consumption rates. Livers and gonads were extracted to establish Hepato-Somatic and Gonado-Somatic indices. Samples of dorsal muscle tissue were collected from whiting, haddock, cod, herring, sprats and sandeels for fatty acid and nitrogen isotope ratio analyses.

At each demersal fishing station, and at locations approximately mid-way between the fishing stations, the CTD and flurometer was deployed. In all 44 deployments were made covering the main CTD station grid (Fig. 3). After the last two demersal fishing stations and the main CTD grid were completed on 11 June, *Clupea* went on to re-sample some CTD stations that had been sampled several days previously. On 12 June, a transect of CTD stations approximately 4 km apart, running east from Fife Ness, was sampled. This transect again included CTD stations that had been sampled earlier. The purpose of repeating stations was to determine the extent to which the hydrographic conditions had changed over the intervening period. The transect was also intended to reveal finer-scale spatial variation in water column structure over the Wee Bankie and Marr Bankie with data collected within

as short a period of time as possible. On completion of the demersal fishing and CTD sampling work, *Clupea* sailed for Montrose for an equipment and scientific staff exchange. On 13 June the demersal fishing gear was exchanged for pelagic gear; Nick Jacob left the vessel, and Eric Armstrong joined.

Clupea departed Montrose at 0400 h on 14 June to commence acoustic survey of sandeels and clupeids in the water column, and survey of seabirds and marine mammals at sea in the study area. The six main transects (Fig. 4) were surveyed over the next four days, starting at the most northerly transect and working south. Acoustic data were integrated over five minute periods. The centre points of all such periods of acoustic survey are shown in Figure 4. Concentrations of fish in the water column were sampled by pelagic trawl to determine species and length composition (Fig. 4). The total catch of each species at length was determined. Clupeids and sandeels were measured to the ½ cm below and, as previously, length stratified samples of each species were weighed (to 0.1 g) to establish weight-length relationships. Otoliths were also taken from these length-stratified samples to determine age at length. The vessel anchored off St Andrews on the night of 14 June, off the Isle of May on the night of 15 June, off Dunbar on the night of 16 June, and off Gullane Bay on the night of 17 June. A calibration of the acoustic equipment was carried out whilst lying at anchor through the night of 17 June.

Survey of seabirds at sea was undertaken over all the track shown in Figure 4. Data were aggregated over the same five-minute periods of acoustic integration to allow direct comparison of predator abundance and prey density. Standard survey techniques were employed, incorporating as far as possible, recent developments to allow greater description of bird behaviour at sea. The numbers, identity and locations of all marine mammals observed at sea were also recorded. RoxAnn data were also routinely collected throughout the entire duration of the acoustic survey. These data were averaged in 10s time-bins over the track indicated in Figure 4. These data will be used to generate maps of seabed characteristics for comparison with previous maps. These data will help to determine the distribution and location of suitable sandeel habitat, and to examine the stability of such habitats.

Clupea sailed for Montrose on the morning of 18 June for a final change of scientific staff. Simon Greenstreet, Eric Armstrong, Iain Gibb and Finlay Burns all left the vessel and Collin Millar joined. The vessel remained at Montrose during the day of 19 June to change over to a nocturnal working regime, sailing at 1800 h. Only one dredge station could be sampled that night because of poor weather conditions, so the vessel anchored in St Andrews Bay. The following night the sea-state had declined considerably by 2000 h and *Clupea* sailed to sample four dredge stations on the main Wee Bankie and Berwick's Bank, before anchoring for the day off St Abbs. On the night of 21 June the remaining three dredge stations were sampled and the vessel then steamed for Fraserburgh, arriving at 1230 h on 22 June. The locations of the eight dredge stations are shown in Figure 5. At each station the dredge was deployed twice, towing in opposite directions. The total catch in each sample was quantified, sub-samples measured to the half cm below to determine length frequency distributions, weighed to the nearest 0.1 g to determine length-weight relationships, and had otoliths collected to establish age at length relationships.

The scientific equipment was unloaded during the morning of 23 June and scientists left the ship by 1100 h.

S Greenstreet
17 October 2003

Seen in draft: A H Nicol, OIC in absence of A Simpson

Figure 1. Hydrographic and plankton sample locations along a transect off Stonehaven.

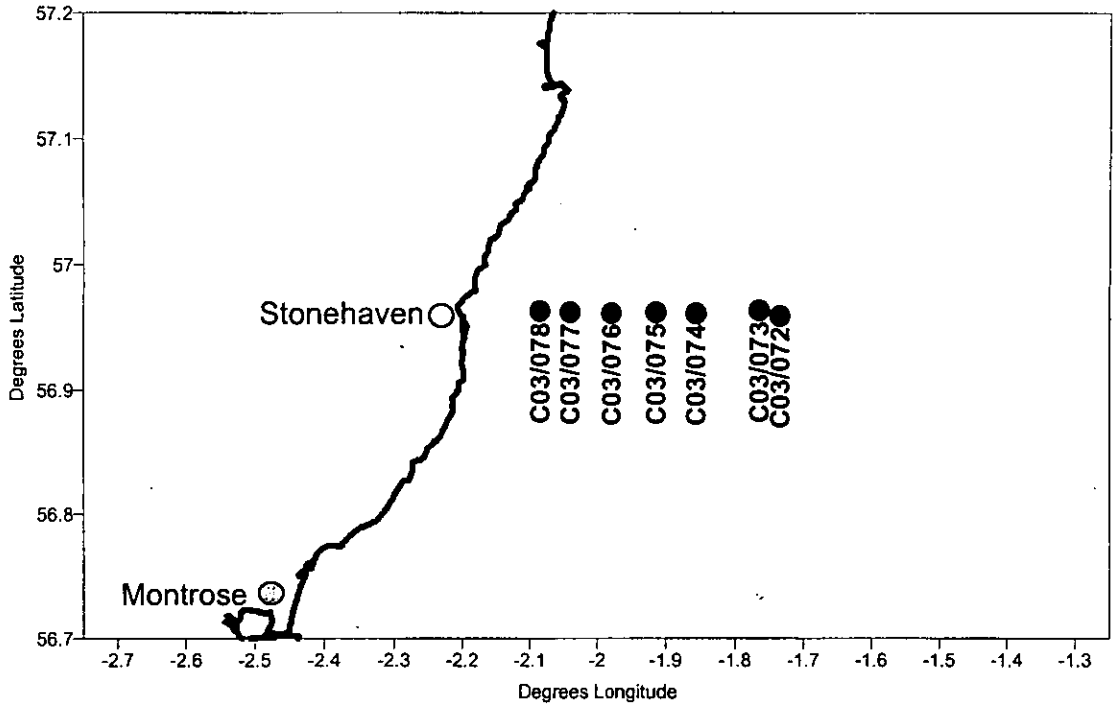

Figure 2. Locations of demersal trawling stations.

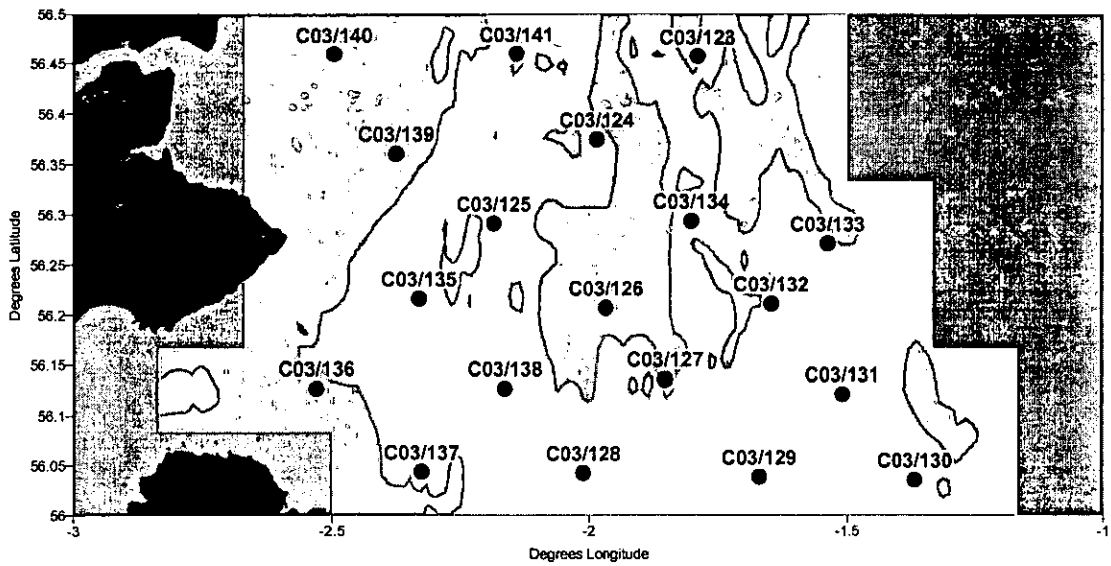

Figure 3. Locations of CTD/Flurometer/transmissometer dips. (+) show locations of stations on main CTD grid, (x) show repeat stations and high resolution transect over the banks.

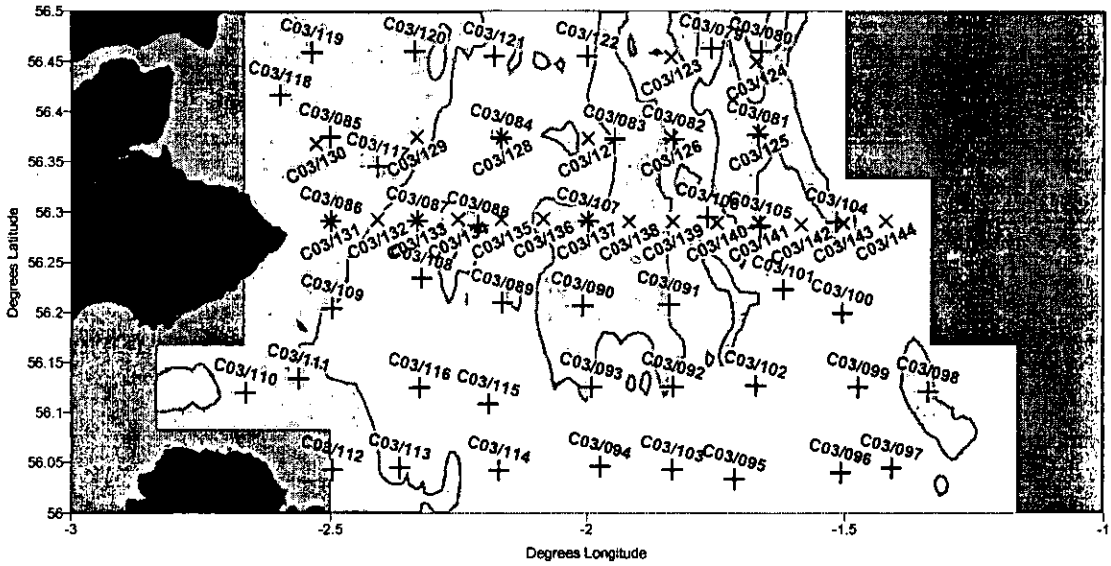

Figure 4. Acoustic survey and seabird survey track. Circles indicate the centre points of the five-minute acoustic integration periods. Filled circles show where seabird survey was undertaken. The positions of pelagic trawls are indicated.

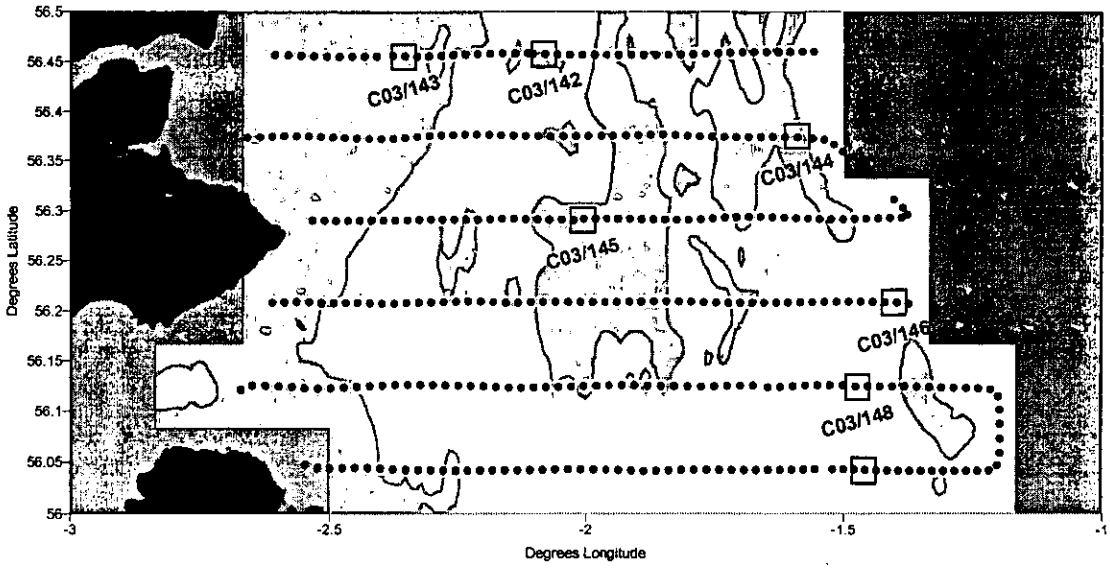

Figure 5. Positions of Sandeel Dredge samples.