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FRV *CLUPEA*

Cruise 1097C

REPORT

17 June to 7 July 1997

Personnel

S P R Greenstreet	SSO (in charge)
G S Begg	HSO
I D Tuck	HSO (26 June to 7 July)
F Armstrong	SO (17 to 26 June)
K J Peach	SO (26 June to 7 July)
S E B Davis	SO (17 to 26 June)
A R Weetman	ASO (26 June to 7 July)
R Li	Visitor

Cruise Objectives

To carry out an acoustic survey, backed up by pelagic trawling, to determine the biomass and distribution of pelagic fish in the inner Moray Firth and in an area off the Firth of Forth which included the Wee Bankie and Marr Bank. To assess the abundance and distribution of seabirds in both study areas using standard transect census techniques. To locate, in the Firth of Forth study area, the feeding sites of radio tagged kittiwakes, guillemots and shags breeding on the Isle of May.. To record the location of all marine mammals observed at sea. To map seabed sediment type using the acoustic system RoxAnn and to collect sediment samples to "groundtruth" the RoxAnn data. To determine spatial variation in the water temperature and salinity profile within each study area. To carry out a bottom trawl survey to determine the abundance, distribution and length composition of piscivorous demersal fish species in each study area. To collect stomach samples from piscovorous fish to determine spatial variation in their diet. To determine weight-length relationships for each fish predator species, and examine spatial variation in fish condition.

Out-turn days per project: 21 days C578

Narrative

The scientific equipment was loaded onto *Clupea* on 16 June at Fraserburgh. The scientific staff joined the vessel the following day and the ship sailed at 1130 hours, following a short delay whilst a problem with the variable pitch propeller was sorted out. *Clupea* made straight for the northern end of the east-most transect in the Moray Firth and commenced acoustic and seabird survey work at 1550 hours. No fishing was possible on this day because of the late departure from Fraserburgh. Over the following three days, the acoustic and seabird survey track in the Moray Firth study area, shown in Figure 1A, was completed. Concentrations of pelagic fish were sampled by pelagic trawl (Figure 1A), using an International Young Gadoid pelagic trawl PT154 with 6 mm cod-end, in order to determine fish species and size composition (to the 1/2 cm below). Otoliths were taken from samples of each pelagic fish species to allow the construction

of age-length keys and further samples of fish were weighed (to 0.2 g) to enable weight-length relationships to be determined. Acoustic survey work in the Moray Firth area was completed by 1255 hours on 20 June and *Clupea* immediately sailed to Fraserburgh where George Geddes replaced Andy Simpson as the skipper.

Clupea left Fraserburgh at 2230 hours and sailed for the Firth of Forth study area arriving at longitude 02°00'W on the most southerly but one transect at 0850 hours on 21 June. Acoustic and seabird survey work in this area commenced at this point while the vessel steamed west into the Firth of Forth. The remainder of the acoustic and seabird survey track shown in Figure 1B was surveyed over the following four days. Bad weather on 23 June prevented seabird survey east of longitude 01°40'W (-1.66°) on the transect at latitude 57°12.5'N (56.21°). Shortly thereafter, at longitude 01°27'W (-1.45°), the transect was abandoned and the next transect north picked up. An improvement in the weather permitted the resumption of seabird survey as the vessel steamed west from longitude 02°00'W (-2.00°). The sections of these two transects where no seabird density data could be collected were repeated the following day, and while both transects were extended east towards their originally planned end-points, both had to be shortened by six miles because of time constraints. Once again concentrations of pelagic fish were sampled by pelagic trawl (Figure 1B) and the catches were processed as previously described for the Moray Firth. Acoustic and seabird survey work in the Firth of Forth study area was completed by 1240 hours on 25 June.

With the exception of the first afternoon in the Moray Firth, all acoustic and seabird survey work was carried out between 0400 hours and 1600 hours; the time when sandeels were expected to be most active, and therefore most likely to be encountered in the water column rather than buried in the sediment. Instances where seabirds were seen to be carrying prey were recorded. Where possible, prey items were identified and their size estimated relative to the bird's bill length. In the Firth of Forth study area regular radio scans were made in an effort to locate individual radio-tagged guillemots, kittiwakes and shags breeding on the Isle of May, and so determine their feeding sites relative to each species' overall population "at sea" distribution map. All sightings of marine mammals at sea were recorded, whether as part of the seabird survey, or just simply opportunistic sightings. The species, number of individuals involved, time and position were noted.

Clupea sailed for Montrose for the half-landing during the afternoon of 25 June, arriving at 1830 hours. The following day the pelagic trawling gear was replaced by the demersal gear, a Jackson Rockhopper demersal trawl BT158 with 10 mm cod-end. *Clupea* left Montrose at 0630 hours on 27 June.

In bad weather, *Clupea* steamed straight for the Firth of Forth where a single demersal station was fished. On 28 June bad weather again prevailed. *Clupea* initially sheltered by the Isle of May to allow radio tagged seabirds to be located, and to be in the best position to assess the sea conditions. However, by 1030 hours, with further deterioration in the weather forecast, *Clupea* steamed for Leith to enable repairs to the DGPS navigation system to be carried out. *Clupea* left Leith at 0550 hours the following day and steamed out of the Firth to fish four demersal stations. After lying offshore on position at the next station overnight, a further five demersal stations were fished on 30 June. Further bad weather on 1 July forced *Clupea* to spend the morning sheltered by the Isle of May, but an improvement in the afternoon enabled two further demersal stations to be fished. The next day six demersal stations were visited, four were fished successfully, one had to be abandoned because no suitable fishing ground could be found in the near vicinity, and on the final station the net was damaged to such an extent that no quantitative fish density information could be obtained. The lateness in the day of this final trawling operation also rendered the validity of the diet sampling information doubtful. Consequently, this station was fished again the following day, together with the three remaining

demersal stations in the Firth of Forth study area. The planned demersal station associated with the section of planned acoustic track which was not steamed (see above) was also abandoned. The locations of the demersal stations fished in the Firth of Forth study area are shown in Figure 2B.

Demersal trawl survey work in the Firth of Forth was completed by 1230 hours on 3 July and *Clupea* immediately sailed for the Moray Firth, arriving at the first demersal station at 0100 hours on 4 July. *Clupea* lay on station for the remainder of the night and recommenced fishing activities at 0930 hours, completing three stations before making for anchorage off Helmsdale. Five demersal stations were successfully fished during each of the next two days. The loss of time through bad weather in the Firth of Forth resulted in the two most south-westerly stations in the Moray Firth having to be abandoned. The locations of the demersal stations fished in the Moray Firth study area are shown in Figure 2A. All demersal fishing was carried out between 0400 hours and 1600 hours in order that the predator fish diet data be most closely related to the estimates of prey abundance determined from the earlier acoustic survey.

Length-stratified (using the ICES stomach sampling size strata for fish greater than 12 cm in length) sub-samples of whiting, haddock, cod, and saithe were taken from each demersal catch for dietary and condition factor analysis. Up to 30 fish per species and size stratum were examined and their feeding status assessed (feeding, regurgitated or not feeding) until 15 feeding fish had been encountered. All feeding and non-feeding fish were measured to the 1/2 cm below and weighed. Otoliths were collected for age determination and estimation of daily specific growth rates. Stomachs and hind guts were removed and retained for diet and food consumption analysis, and to determine the effect of variation in the weight of food in their stomachs and digestive tracts on weight-length relationships. Livers and gonads (where these were of any significant size) were removed and retained so that hepato-somatic and gonado-somatic indices could be determined, and the effect of these on variation in the weight-length relationships also investigated.

A SEABIRD CTD sampler and a Day Grab were deployed at each demersal fishing station in both study areas (Figure 3), one immediately before and the other immediately following each fishing operation. The CTD sampler was used to gather information regarding spatial variation in the salinity and temperature profile through the water column in each study area, while the Day Grab was used to collect sediment samples for particle size analysis to allow "groundtruthing" of the RoxAnn data.

Demersal fishing operations in the Moray Firth were completed by 1430 hours on 6 July and *Clupea* sailed for Fraserburgh where she arrived at 1800 hours. The scientific equipment was offloaded and Marine Laboratory staff left the ship at 1100 hours on 7 July.

Simon Greenstreet
22 August 1997

Seen in draft: A Simpson

Figure 1. Acoustic and seabird survey track. Mid points of five minute survey periods are shown (open circles show positions where no sea-bird data were gathered). Squares show locations of pelagic trawl samples.

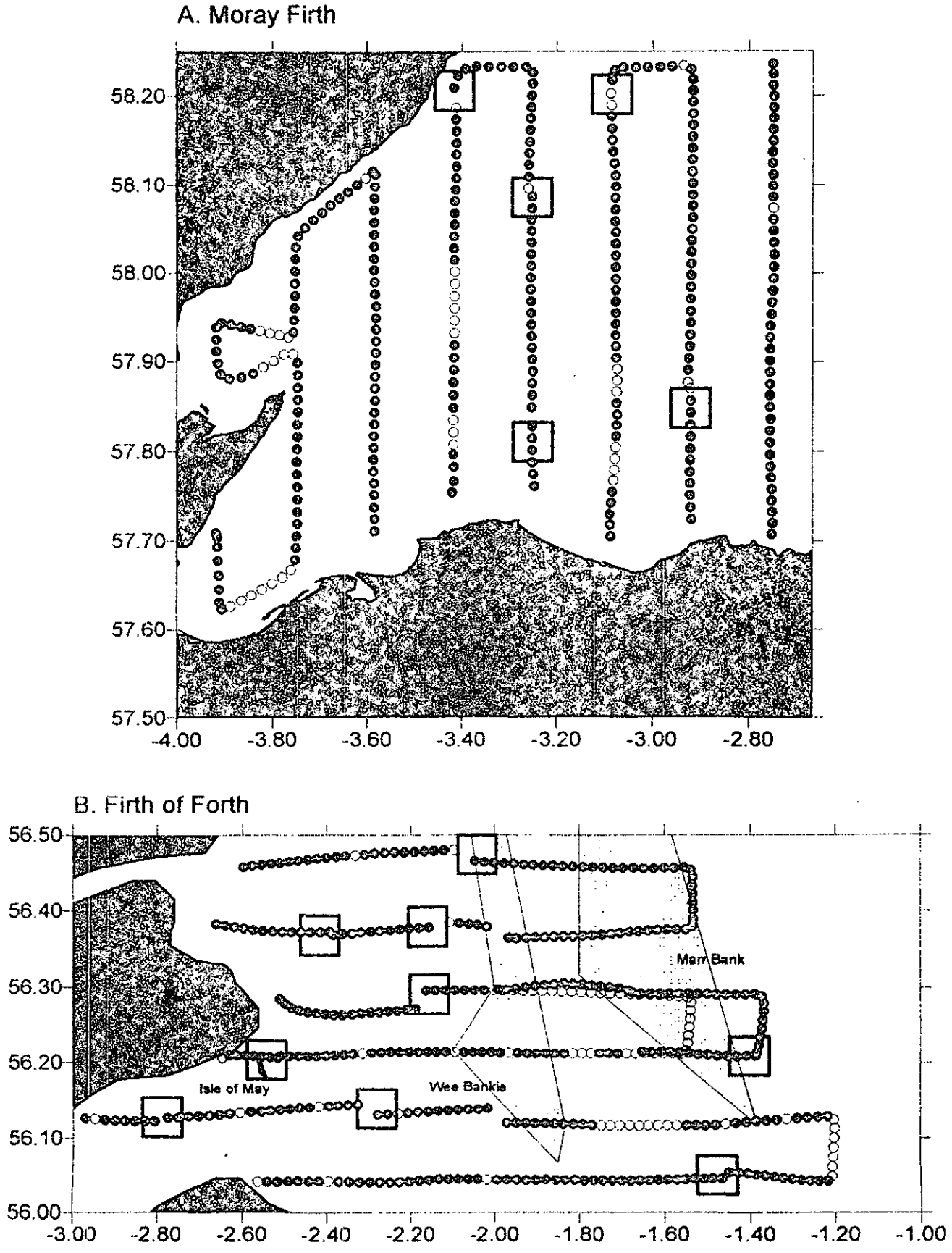

Figure 2. Positions where demersal trawl samples were obtained. Haul numbers are shown.

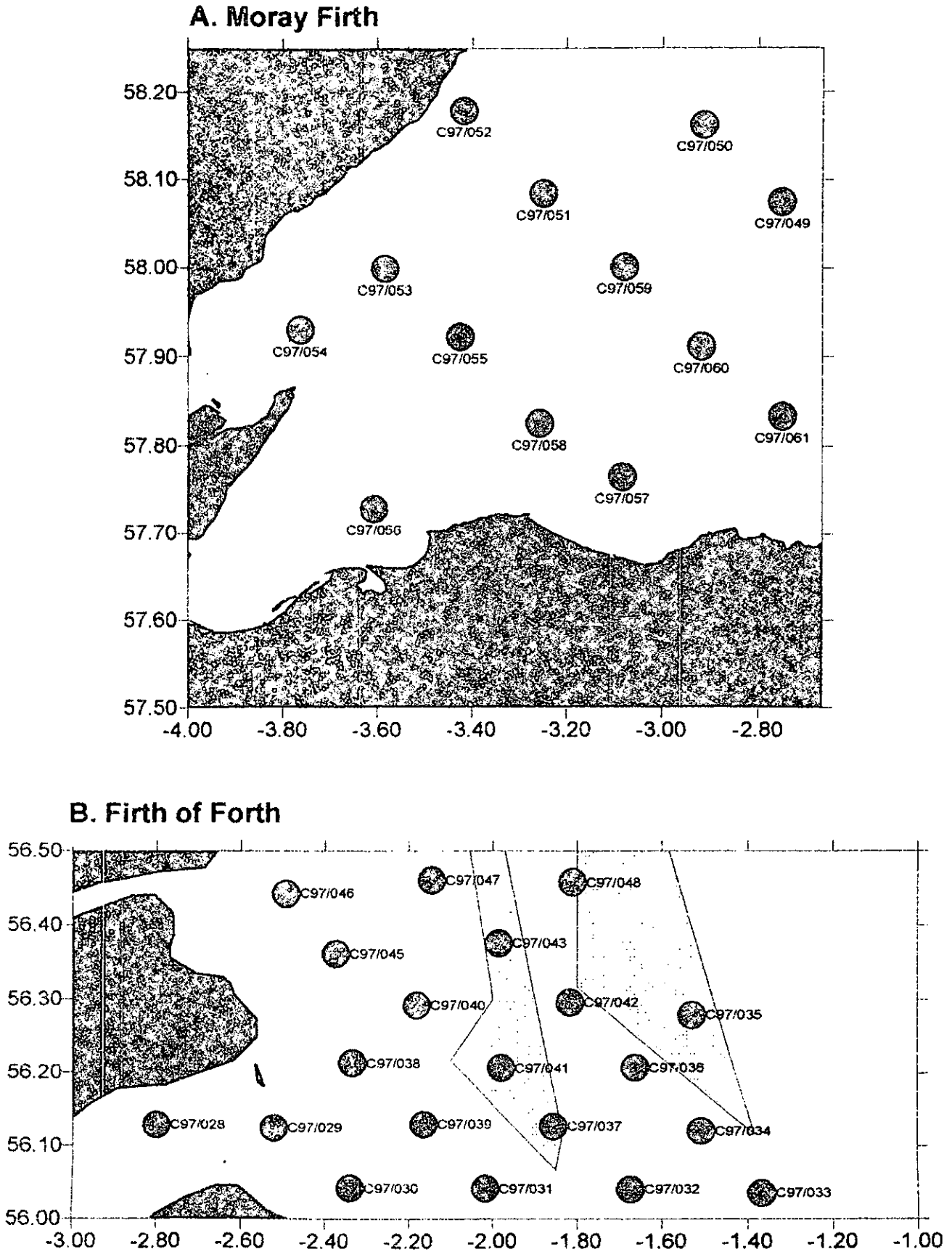

Figure 3. Positions where the CTD sampler (stars) and Day grab (squares) were deployed