

R1/6

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**FRV CLUPEA**

Cruise 0897C

**REPORT**

12-28 May 1997

**Ports**

Loading: Ardrossan

Unloading: Ardrossan

Working: Rothesay 14-15, 20-21, 23-24 and 24-25 May; Ardrossan 16-17 May; Greenock 25-26 May

**Personnel**

|              |              |                       |
|--------------|--------------|-----------------------|
| D Saward     | SSO          | 12-28 May (in charge) |
| J McKie      | HSO          | 12-28 May             |
| Ms L Goodwin | SO           | 12-28 May             |
| S Forsyth    | Visitor      | 12-17 May             |
| A Beaton     | AO           | 14-17 May             |
| D Moore      | SSO          | 17-28 May             |
| C Shand      | HSO          | 17-28 May             |
| Ms L Hogarth | Fisheries K3 | 20-24 May             |
| O Kelly      | Fisheries K3 | 26-28 May             |

**Fishing Gear:** None

**Objectives**

1. To undertake a grab survey to collect seabed sediment samples from the Garroch Head sewage sludge disposal site, the former Garroch Head sewage sludge disposal site and adjacent control areas, for microbiological analysis on FRV *Clupea*, and physical and chemical analyses in the Marine Laboratory, Aberdeen (MLA).
2. To undertake corer and grab surveys to collect seabed sediment samples from the areas outlined in Objective 1, for additional physical, chemical and biological analyses on FRV *Clupea* and in MLA.
3. To undertake an Agassiz trawl survey to collect benthic epifauna samples from the areas outlined in Objective 1, for biological analysis on FRV *Clupea* and possible chemical analysis in MLA.
4. To undertake an underwater television survey to investigate the benthic epifauna in the areas outlined in Objective 1, for identification and enumeration of the predominant species in MLA.
5. To undertake a grab survey to collect seabed sediment samples from the Birch Point, Cloch Point, Rosneath and Rothesay dredged material disposal sites, for physical and chemical analyses in MLA.
6. To undertake an underwater television survey to investigate the levels of seabed debris at the Cloch Point and Rosneath dredged material disposal sites.
7. To undertake a grab survey to collect seabed sediment samples from the Holy Loch, for physical and chemical analyses on FRV *Clupea* and in MLA.

8. To undertake an underwater television survey to investigate the levels of seabed debris in the Holy Loch.

**Out-turn Days Per Project:** 17 days, BEB1

### **Narrative**

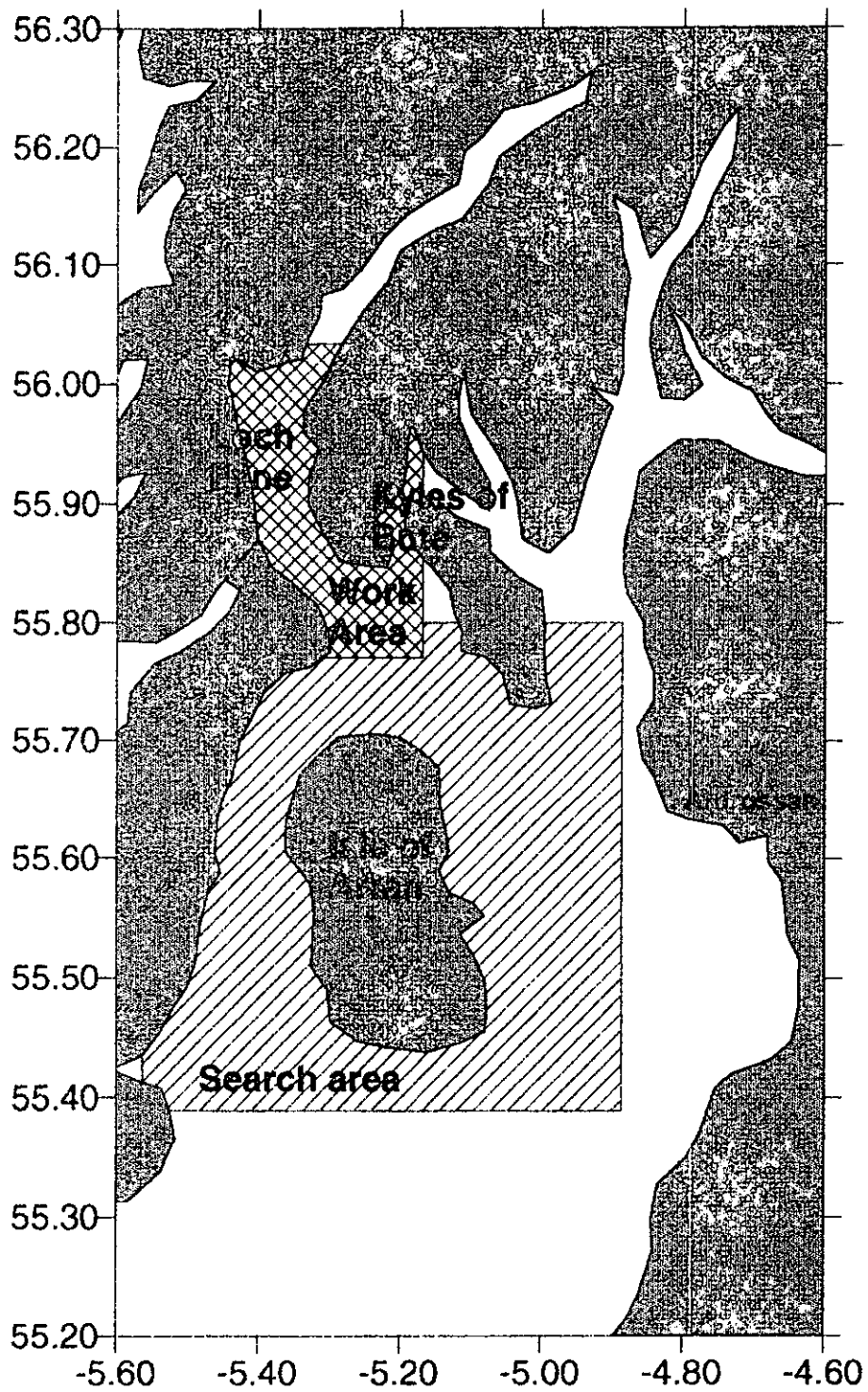
Scientific staff joined the vessel at Ardrossan during the evening of 11 May, and completed loading operations. Scientific equipment was set up later that evening, and during the morning of 12 May. C Shand then returned to Aberdeen. Departure from Ardrossan was delayed until 0800 hours on 13 May, because of bad weather. The vessel then proceeded to the Garroch Head area to commence the grab survey outlined in Objective 1. Sampling was suspended during the afternoon of 13 May, and the vessel proceeded to an anchorage in Kilchattan Bay. The vessel remained at anchor until 0800 hours on 14 May, and then returned to the Garroch Head area to continue the grab survey outlined in Objective 1. During the afternoon of 14 May, the vessel proceeded to Rothesay to allow A Beaton to join the vessel. En route, a grab survey was undertaken at the Rothesay dredged material disposal site, as outlined in Objective 5. A Beaton joined the vessel at 1800 hours on 14 May, and the vessel remained at Rothesay until 0800 hours on 15 May. The vessel then returned to the Garroch Head area, to complete the grab survey outlined in Objective 1. Sampling was completed during the afternoon of 15 May, and the vessel proceeded to an anchorage in Lamlash Harbour. The vessel remained at anchor until 0800 hours on 16 May. Whilst at Kilchattan Bay, Rothesay and Lamlash Harbour, the Garroch Head sediment samples were processed for enumeration of faecal coliforms and streptococci. On the morning of 16 May, the vessel proceeded to the Birch Point dredged material disposal site to undertake the grab survey outlined in Objective 5. Upon completion of the Birch Point sampling, the vessel proceeded to Ardrossan to exchange scientific equipment, and to allow D Moore and C Shand to join the vessel and A Beaton and S Forsyth to disembark. Scientific equipment was unloaded and loaded during the evening of 16 May. D Moore and C Shand joined the vessel at 0830 hours on 17 May, and A Beaton and S Forsyth disembarked immediately to return to Aberdeen. The vessel remained at Ardrossan until 1000 hours on 17 May, and then returned to the Garroch Head area to commence the corer, grab, Agassiz trawl and underwater television surveys outlined in Objectives 2, 3 and 4. Upon arrival in the survey area, the television sledge was deployed to investigate underwater visibility at the centre of the sewage sludge disposal site. Underwater visibility was very poor, and the grab survey was commenced as outlined in Objective 2. Sampling was suspended during the evening of 17 May, and the vessel proceeded to an anchorage in Millport Bay. En route, the television sledge was deployed at a location to the west of Little Cumbrae to test the camera and lighting systems. Again the underwater visibility was very poor, and further tests were undertaken whilst at anchor in Millport Bay. It was confirmed that the iris of the underwater television camera was faulty, but the problem appeared to have been corrected. The vessel remained at anchor until 0800 hours on 18 May, and then returned to the Garroch Head area to commence the underwater television survey outlined in Objective 4. The television sledge was deployed near the centre of the sewage sludge disposal site, but the iris fault had not been corrected. The camera was replaced, and the survey recommenced. Survey operations were suspended during the evening of 18 May, and the vessel returned to the anchorage in Millport Bay. The vessel remained at anchor until 0800 hours on 19 May, and then returned to the Garroch Head area to continue the underwater television survey outlined in Objective 4. The underwater television survey was suspended at 1300 hours on 19 May, when sewage sludge dumping operations resumed after the weekend, and the grab survey was continued as outlined in Objective 2. Sampling was suspended during the evening of 19 May, and the vessel returned to the anchorage in Millport Bay. En route, the television sledge was deployed to re-test the original camera. The iris fault had not been corrected, and the test was terminated. The vessel remained at anchor until 0800 hours on 20 May, and then returned to the Garroch Head area to commence the corer and Agassiz trawl surveys outlined in Objectives 2 and 3. Survey operations were suspended during the evening of 20 May, and the television sledge was deployed to re-test the original camera. The iris fault had been corrected, and the underwater television cameras were exchanged. The vessel then proceeded to Rothesay to allow L Hogarth to join the vessel. L Hogarth joined the vessel at 1800 hours on 20 May, and the vessel remained at Rothesay until 0800 hours on 21 May. The vessel then returned to the Garroch Head area to continue the corer, Agassiz trawl and underwater television surveys outlined in Objectives 2, 3 and 4. Survey operations were suspended during the evening of 21 May, and the vessel proceeded to an anchorage in Stravanan Bay. The vessel remained at anchor until 0800 hours on 22 May, and then returned to the Garroch Head area to continue the corer, grab,

Agassiz trawl and underwater television surveys outlined in Objectives 2, 3 and 4. The grab survey was completed during the afternoon of 22 May, and the underwater television survey was continued. Survey operations were suspended during the evening of 22 May, and the vessel returned to the anchorage in Millport Bay. The vessel remained at anchor until 0830 hours on 23 May, to await the delivery of additional oxygen sampling bottles loaned by the University Marine Biological Station, Millport. The vessel then returned to the Garroch Head area to complete the corer and Agassiz trawl surveys outlined in Objectives 2 and 3. The corer and Agassiz trawl surveys were completed during the late afternoon of 23 May, and the vessel then proceeded to Rothesay to allow L Hogarth to disembark. The vessel remained at Rothesay until L Hogarth disembarked at 0800 hours on 24 May, and then returned to the Garroch Head area to complete the underwater television survey outlined in Objective 4. The underwater television survey was terminated during the afternoon of 24 May, completing the Garroch Head survey programme outlined in Objectives 1, 2, 3 and 4. The vessel then returned to Rothesay, en route to survey areas in the upper Firth of Clyde. The vessel remained at Rothesay until 1200 hours on 25 May, and then proceeded to the Cloch Point dredged material disposal site to undertake the grab survey outlined in Objective 5. Upon completion of the Cloch Point sampling, the vessel moved to the Rosneath dredged material disposal site to undertake a similar grab survey, as outlined in Objective 5. Sampling was suspended during the evening of 25 May and the vessel proceeded to Greenock to allow O Kelly to join the vessel. O Kelly joined the vessel at 0845 hours on 26 May, and the vessel departed Greenock at 09:00 hours to return to the Rosneath dredged material disposal site to complete the grab survey outlined in Objective 5. Grab sampling was completed during the early afternoon of 26 May, and the underwater television survey was commenced as outlined in Objective 6. The underwater television survey was terminated during the evening of 26 May, and the vessel proceeded to an anchorage in the Holy Loch. The vessel remained at anchor until 0800 hours on 27 May, and then commenced the grab survey outlined in Objective 7. Grab sampling was completed during the morning of 27 May, and the underwater television survey was commenced as outlined in Objective 8. The underwater television survey was terminated during the evening of 27 May, and the vessel returned to Ardrossan, docking at 2115 hours. O Kelly disembarked at 0800 hours on 28 May. Scientific equipment was demobilised during the morning of 28 May, and unloading and loading operations were completed during the early afternoon. Scientific staff disembarked at 1500 hours on 28 May, to return to Aberdeen.

## Results

1. Grab sampling was undertaken at a total of 55 sampling stations in the vicinity of the Garroch Head sewage sludge disposal site, the former Garroch Head sewage sludge disposal site and the adjacent control areas. Sixty-two Day grab deployments were made, and 55 seabed sediment samples collected.
  - a) Fifty-four of the seabed sediment samples were sub-sampled for microbiological analysis. Sub-samples were removed from the surface of the sediment using a sterile spatula. The sub-samples were processed on FRV *Clupea*, and faecal coliforms and streptococci enumerated. Processed material was also stored in a refrigerator, for enumeration of *Clostridium perfringens* spores in MLA. Faecal coliforms were detected in 16 of the 54 sediment samples; and faecal streptococci were detected in 41 samples. Either faecal coliforms or streptococci were detected in a total of 43 samples. The levels of faecal coliforms were low in five of the 16 positive samples; intermediate in seven samples; and high in four samples. All but one of the positive faecal coliform samples were collected from the area adjacent to the sewage sludge disposal site, and the majority of the positive samples were collected from an area to the east of the site. The levels of faecal streptococci were low in 33 of the 41 positive samples; intermediate in seven samples; and high in only one sample. Positive faecal streptococci samples were collected from throughout the survey area, but the majority of the samples containing intermediate or high concentrations of faecal streptococci were collected from the area to the east of the sewage sludge disposal site. The patterns of distribution of intermediate or high concentrations of faecal coliforms and streptococci were similar, but not identical; and the highest concentrations of both organisms were found in an area to the east of authorised disposal site.
  - b) All of the seabed sediment samples were sub-sampled for particle size and heavy metal analyses. Fifty five core sub-samples were taken for particle size analysis; and 55 surface scoop sub-samples were taken for heavy metal analysis. The sub-samples were deep frozen for analysis in MLA.

2. Corer sampling was undertaken at a total of 26 of the Objective 1 grab sampling stations. Sixty Craib corer deployments were made, and 52 core samples were collected. Additional grab sampling was undertaken at a total of 19 of the Objective 1 grab sampling stations. Seventy-four Day grab deployments were made, and an additional 57 seabed sediment samples were collected.
  - a) Two core samples were collected at each selected sampling station. Samples of the water overlying the core samples were removed for determination of water temperature, salinity and dissolved oxygen concentration. Eh measurements were taken at selected depths in the core samples, to compare the Eh profiles. Temperature, salinity and Eh measurements were made on FRV *Clupea*. Dissolved oxygen samples were preserved as appropriate, and stored for analysis in MLA.
  - b) Three additional grab samples were collected at each selected sampling station. Grab samples collected in the vicinity of the Garroch Head sewage sludge disposal site were washed through a 1 mm mesh sieve. Grab samples collected from in the vicinity of the former sewage sludge disposal site were washed through a 0.5 mm mesh sieve. The benthic infauna remaining in the sieves were transferred to sample buckets or jars and fixed in a 10% solution of formalin in sea water. The samples were then stored for analysis in MLA.
3. One Agassiz trawl of approximately 10-15 minutes duration was undertaken in the vicinity of the 26 Objective 2 corer sampling stations. The benthic epifauna present in the trawls were identified and enumerated on FRV *Clupea*, to compare the epifauna populations. Organisms of particular interest, and organisms that could not be identified on FRV *Clupea*, were transferred to sample jars and fixed in a 10% solution of formalin in sea water. The organisms were then stored for biological analysis in MLA. Very few commercially exploited organisms were caught in the trawls, and it was not possible to obtain sub-samples for chemical analysis in MLA
4. One towed sledge underwater television transect of two hours duration and seven transects, each of one hour duration, were undertaken in the vicinity of the Garroch Head sewage sludge disposal site. Four additional transects, each of approximately 30 minutes duration, were undertaken in the vicinity of selected Objective 2 corer sampling stations at that site. A further 10 towed sledge underwater television transects, each of approximately 30 minutes duration, were undertaken in the vicinity of selected Objective 2 corer sampling stations at the former sewage sludge disposal site and control areas. The tape records were retained for analysis in MLA.
5. Grab sampling was undertaken at a total of 68 sampling stations in the vicinity of the Birch Point, Cloch Point, Rosneath and Rothesay dredged material disposal sites. Eighty six Day grab deployments were made, and 81 seabed sediment samples collected. Sixty eight core sub-samples were taken for particle size analysis; and 68 surface scoop sub-samples were taken for heavy metal analysis. Thirteen additional surface scoop sub-samples were taken from replicate samples collected at the Cloch Point dredged material disposal site, for PCB congener analyses. All of the sub-samples were deep frozen for analysis in MLA.
6. Six towed sledge underwater television transects of varying duration were undertaken in the vicinity of the Cloch Point dredged material disposal site. Two additional transects, each of approximately 45 minutes duration, were undertaken in the vicinity of the Rosneath dredged material disposal site. The tape records were retained for analysis in MLA. A contemporary assessment of the records, undertaken during the survey, indicated that debris was present on the sea bed in both the dredged material disposal sites.
7. Grab sampling was undertaken at a total of 20 sampling stations in the Holy Loch. Twenty-three Day grab deployments were made, and 20 seabed sediment samples collected. Eh measurements were taken at a depth of 4 cm in all of the sediment samples, to compare the redox potential in the near-surface sediments. The Eh measurements were made on FRV *Clupea*. Twenty core sub-samples were taken for particle size analysis; and 20 surface scoop sub-samples were taken for heavy metal analysis. All of the sub-samples were deep frozen for analysis in MLA.



Areas of the Clyde estuary used for data collection for EK500 and Reson Seabat Systems on RV CLUPEA 3 - 10 June 1997

redox potential in the near-surface sediments. The Eh measurements were made on FRV *Clupea*. Twenty core sub-samples were taken for particle size analysis; and 20 surface scoop sub-samples were taken for heavy metal analysis. All of the sub-samples were deep frozen for analysis in MLA.

8. Seven towed sledge underwater television transects of varying duration were undertaken in the Holy Loch. The tape records were retained for analysis in MLA. A contemporary assessment of the records, undertaken during the survey, indicated that moderate quantities of litter and debris were present on the sea bed throughout the Loch, and that large quantities of debris were present in areas adjacent to the locations occupied by the former US Navy Base facilities. In the latter areas, the levels of debris were similar to, or greater than, the levels observed in other dock or anchorage areas. Elsewhere, the levels were similar to, or less than, the levels observed in the vicinity of some dredged material disposal sites.

Derek Seward  
11 June 1997

Seen in draft: A Simpson