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Not to be cited without prior reference to the Marine Laboratory, Aberdeen

FRV *Clupea*

Cruise 0598C

**REPORT**

27 March - 9 April 1998

**Personnel**

A D McIntosh	HSO (In Charge)	27 March - 2 April
F M Brown	SO (In Charge)	2 - 9 April
E J Dalgarno	ASO	
C A Stewart	Ind Tech	
L Joyce	Visitor	2 - 6 April

**Objectives**

1. To sample sediments from a number of Voes in Shetland, Orkney and from north east coast of the Scottish mainland for PAH and veterinary medicines determination.
2. To collect wild mussels in Shetland Voes and elsewhere for PAH and other chemical determinations.
3. To collect CTD and nutrient measurements in the same locations as above.

**Out-turn days per project:** 7 days AE10n: 7 days BGM1**Narrative**

The vessel was loaded in Peterhead with all necessary sampling and scientific equipment and made passage for the west coast of Shetland, anchoring in Clift Sound at 0530 hours on 28 March. Sediments were collected for macrobenthos analysis at two sites off the Burra Haaf, and also at the Punds Voe and Burra Firth sites for PAH chemical analysis. No mussels were sampled from these areas due to the unsuitable nature of the coast. *Clupea* moved onto and anchored overnight in Aith Voe which was sampled on the morning of 29 March. The small boat was deployed and a search made for mussels along the coastline but none were found. *Clupea* moved onto Oina Voe and then to Ronas Voe where sediment sampling was successfully completed at both sites and a sufficient sample of mussels obtained from three sites within Ronas Voe.

Sand Voe, Whale Firth, Burra Firth and half of Basta Voe were successfully sampled for sediments during 30 March and after anchoring overnight the remainder of Basta Voe was sampled before moving to Mid Yell and Otters Wick, which had to be abandoned after seven samples due to the generally unsuitable nature of the substrate. Samples were obtained from Hamna Voe before going to Dury Voe from which two samples of mussels were collected before going to anchor for the night. The sediments from Dury Voe were successfully sampled on 1 April as were Dales Voe, Swinning Voe and Cat Firth but from which no mussel samples were obtained. *Clupea* then made for Lerwick where docking was completed by 1900 hours.

A McIntosh disembarked and returned to Aberdeen on 2 April. F Brown and L Joyce joined *Clupea* on 2 April but because of the impending severe weather, *Clupea* remained in Lerwick during Thursday. The weather conditions during Friday and most of Saturday prevented *Clupea* leaving Lerwick but passage was made overnight on 4 April to Orkney where sediment sampling resumed at 0930 hours on 5 April at Bay of Holland and Veantrow Bay. On the 6 April Bay of Kirkwall, Bay of Firth, Inganess Bay and Deer Sound were sampled with mussels being collected at Bay of Kirkwall. After Scapa Bay had been sampled in the morning of 7 April, L Joyce was disembarked in Scapa along with the CTD equipment, and sampling continued at Water Sound and completed in Long Hope Bay by 1600 hours when *Clupea* went to anchor for the night. On the morning of 8 April *Clupea* made passage for Fraserburgh where docking was completed by 1600 hours and all scientific equipment and samples were unloaded and returned to Aberdeen on 9 April.

## Results

The two stations occupied for macrobenthos provided 10 samples for analysis, the samples being treated according to standard protocols. All other sediment and mussel samples taken were treated according to standard protocols. A total of 369 sediment samples were taken from 17 Voes and Firths in Shetland and nine in Orkney. Adverse weather precluded the completion of the sampling programme on the east coast Scottish mainland.

These sediment samples will be analysed for PAH and veterinary medicines, particle size and total organic carbon determinations.

Mussels were collected from only two sites in Shetland and two in Orkney providing a total of seven samples for sensory assessment and hydrocarbon chemistry. The main reasons for not being able to collect further mussel samples were due to the state of tide at the time *Clupea* arrived at a particular site, the nature of the coast line being unsuitable for mussels and the adverse weather conditions prevailing making it too dangerous to launch the small boat.

At all the sites in Shetland, a CTD profile was taken and water sampled for nutrient analyses. L Joyce was shown how to operate the CTD equipment before disembarking in Orkney.

### *Sensory Assessment of Mussels*

The seven mussel samples were assessed by the taste panel using the MLA standard method. The results show that the Dury Voe (Grunna Voe) sample and the mussels from Long Hope were deemed to be tainted, based on the criteria used by the taste panel, whilst the sample from Bay of Kirkwall was suspect. The mean panel scores give a measure of the degree of tainting, the higher incidence of reported taint in the sample from Dury Voe (Grunna Voe) is confirmed by a panel mean of 1.9 which describes the taint as "moderate".

### *Chemical Analysis*

The samples from the head, middle and mouth of Ronas Voe contained 28.2 ng/g, 40.1 ng/g and 14.7 ng/g PAHs respectively. A similar concentration was determined for the mussels collected from Muckie Ness in Dury Voe. This data contrasts with the concentrations determined for the tainted or suspect mussels (Table 1).

**Table 1**

PAH concentration (ng/g wet weight) in mussels that were either tainted or suspect with respect to taint.

Site	[PAH] ng/g wet weight
Dury Voe (Grunna Voe)	7177
Bay of Kirkwall	1226
Long Hope	1537

Determination of the aliphatic hydrocarbon composition, including biomarker analysis, confirmed the presence of petrogenic hydrocarbons in the tainted or suspect mussels but showed them to be of different origins. The *n*-alkane GC-FID chromatograms of these three samples contained a UCM, with the Orkney mussels showing a pronounced bimodal distribution. In the case of Dury Voe (Grunna Voe), a pattern more typical of a slightly weathered diesel was observed with *n*-alkanes ranging from *n*C12 to *n*C25 and maximising at *n*C15.

The mussel sample from Dury Voe, which was found to be tainted and had a PAH concentration of 7176 ng/g, was taken from an area where fish farm service boats were moored offshore. The sample collection area was close to a small jetty that may, at high water, be used by these boats. The most likely source of contamination is hydrocarbon materials associated with the boats servicing the fish farms in the immediate area. The aliphatic hydrocarbon profile would suggest that the source is of diesel fuel oil.

The mussel sample from Bay of Kirkwall, which was found to be tainted and had a PAH concentration of 1,226 ng/g, was taken from a beach on the south east side of the Bay. The fact that this area is subject to marine traffic accessing the harbour at Kirkwall would probably explain the sensory assessment result which is confirmed by the PAH value determined. The aliphatic hydrocarbon profile is relatively typical of a weathered crude oil.

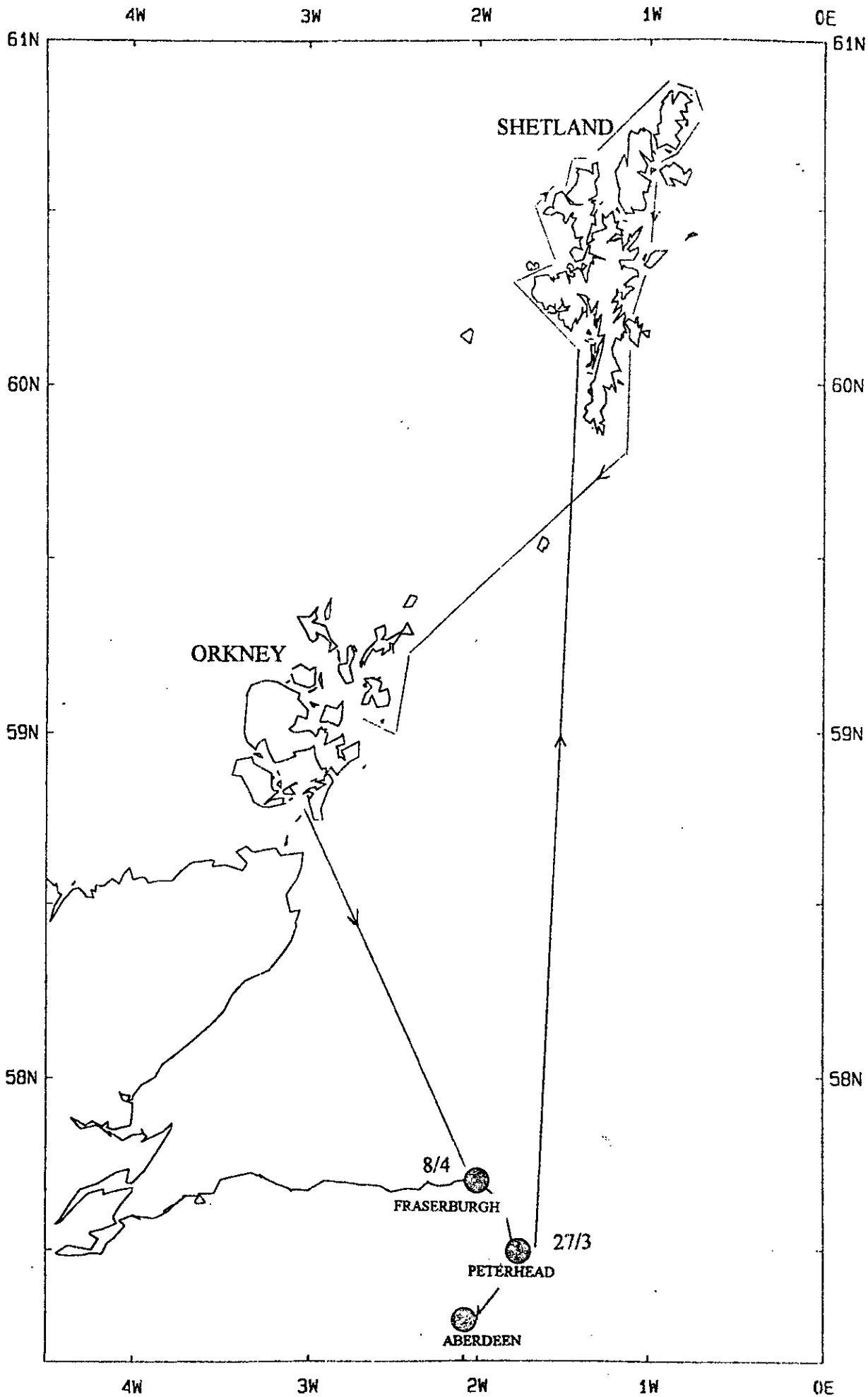
The mussel sample from Long Hope, which was found by the taste panel to be suspect and had a PAH concentration of 1,537 ng/g, was taken from the piles supporting the pier. The aliphatic hydrocarbon profile is relatively typical of a weathered crude oil.

The limited sampling of mussels that was possible during this exercise has undoubtedly not provided a fully representative estimation of the quality of mussels around Shetland and Orkney, both in term of sensory assessment and PAH concentration. To address this question properly, a shore based exercise would need to be mounted where a greater number of locations, and sites within these locations, were sampled.

Alistair McIntosh  
20 May 1998

Seen in draft: Sandy Nicoll, OIC *Clupea*

Track Chart - 0598C



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Sampling locations - Shetland - 0598C

1 30W

0 30W

