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FRV *Clupea*

Cruise 0605C

REPORT

25 April – 14 May 2005

Loading: Fraserburgh 25 April
Unloading: Fraserburgh 14 May
Half Landing: Lochinver, 4 May

Personnel

Matt Gubbins	(In charge)	25 April – 14 May
Dougal Lichtman		25 April – 14 May
Jennifer Graham		25 April – 14 May
Clare Greathead		25 April – 4 May
Lesley Stobo		4–14 May
Antoine Keruzoré	(Student)	4-14 May

Out-turn days: AE11s 17 days, AE1192 3 days

Equipment

Zodiac inflatable
2 outboard engines
SB 15 Sealogger CTD/Rosette
2 Day grabs, 1 wooden table
2nd freezer for wetlab
80 L unleaded fuel
Zooplankton 'bongo' net
3 x phytoplankton hoses

Objectives

a) To conduct a 'spring' survey of a suite of sea lochs/voes impacted to varying degrees by nutrient releases from fish farming activity. This survey forms part of an ongoing programme of work to assess the potential for eutrophication arising from nutrient 'hotspots' linked to aquaculture. This is undertaken by measuring the following parameters at multiple stations in each loch:

1. CTD, dissolved oxygen and transmission
2. Nutrients (inc silicates)
3. Chlorophyll a
4. Phytoplankton

5. Shoreline macroalgae
6. Organic carbon in sediments
7. Algal toxins in wild shoreline mussels, phytoplankton and water

These determinands will be assessed against criteria as defined by the OSPAR Eutrophication Task Group and used for future eutrophication assessment of Scottish coastal waters. Data will also be compared to that collected during previous cruises and will be used to inform estimates of internal mixing within sea lochs/voes to improve laboratory models to predict nutrient enhancement from aquaculture.

b) Zooplankton to be sampled by bongo net from two hydrostations in each loch and fixed in ethanol and formalin.

c) Sediment samples to be obtained by Day grab from 12 lochs and retained for phytoplankton cyst analysis by Phytoplankton Ecology group.

d) Passive sampler for water-borne contaminants to be deployed at four separate sites in Shetland for 8-12 hours to trial new sampling methodology.

e) Water samples for radioisotope analysis will also be taken from CEFAS collection sites in the Pentland Firth and Minch on an ad hoc basis when steaming between survey areas. Sampling is via the non-toxic supply into 25L carboys and 1L polybottles.

Narrative

Scientific staff boarded *Clupea* at 0930 on 25 April and the vessel departed for the West coast at 1130. After resting at anchor overnight in Loch Eriboll, *Clupea* arrived at Badcall Bay, the first area to be surveyed, on the morning of 26 April. Due to insufficient clearance from rocks and fish farm equipment, *Clupea* was unable to enter the inner Bay area. Two hydrostations outside the Bay were therefore sampled from *Clupea* before the Zodiac was launched to sample the remaining four hydrostations and six shoreline sites in the Bay. Due to the extra time taken to sample hydrostations by Zodiac, sampling a transect at a fish farm was abandoned due to lack of time and *Clupea* anchored in Clashnessie bay for the night.

Survey work in loch Ewe was commenced on 27 April. Six of the hydrostations were sampled for CTD, nutrients and plankton (including discrete depth plankton samples for Phytoplankton Ecology group) and the Zodiac was used to sample shoreline sites for macroalgae and mussels and conduct a 4-station transect from the fish farm at Isle of Ewe. *Clupea* anchored near Isle of Ewe overnight before completing survey work in Loch Ewe by sampling the remaining hydrostations using the CTD and collecting sediment samples by Day grab from all hydrostations in the Loch. The long term phytoplankton monitoring site was also sampled by CTD, 10 m integrated hose and phytoplankton net, to allow the Loch Ewe data to be put in context with the weekly time series collected at this site.

The Loch Ewe survey was completed by 1000 on 28 April and *Clupea* steamed to Loch Torridon under worsening weather conditions. All hydrostations in Torridon were sampled by CTD/rosette and phytoplankton hose and 3 grab samples taken before strong Southerly winds prevented further work. *Clupea* steamed to Gareloch and moored alongside the pier for the night.

The Torridon survey was completed on 29 April by conducting a fish farm transect survey at the Marine Harvest 'Camas an Leim' site and taking the rest of the grab samples. The wind was still strong and prevented shoreline sampling for macroalgae by Zodiac. *Clupea* then steamed to Loch Kishorn, arriving by 1730 and sampling the first seven hydrostations by CTD and phytoplankton hose before berthing at Kyle of Lochalsh overnight.

Hydrostations, shoreline sampling and a fish farm transect survey were completed in Loch Kishorn on 30 April before steaming to anchor overnight in Uig Bay in preparation for surveying nearby Loch Snizort Beg (no fish farms, control site) the following morning.

In order to catch low tide on 1 May, shoreline sampling fror macroalgae and mussels in Snizort Beg was conducted by Zodiac first, followed by sampling all hydrostations from *Clupea* by CTD/rosette, plankton hose/nets and Day grab for sediment. At 1400, the survey was completed and *Clupea* steamed across the Minch to Loch Skiport on South Uist, collecting a water sample from the non-toxic supply for radio-isotope analysis off Neist Point en-route (Station 99). On arrival at Loch Skiport, 8 of the 9 hydrostations were sampled by CTD/rosette and for plankton before anchoring in shelter at Usinish Bay for the night.

The Loch Skiport survey was completed on 2 May by using the Zodiac to sample the final hydrostation in the upper loch, take shoreline samples and conduct a fish farm transect at the Oronsay farm. The remaining grab samples at hydrostations were also taken from *Clupea* before departing North for Loch Shell. The long term phytoplankton monitoring station at Loch Maddy was sampled by CTD/Rosette and plankton hose/net en-route.

After anchoring in Loch Shell overnight, the Loch Shell survey was undertaken on 3 May, comprising CTD/rosette, plankton and Day grab sampling of 11 hydrostations, shoreline sampling by Zodiac for macroalgae and mussels at six sites and a transect survey at the 'Pairc West' fish farm. On completion, *Clupea* steamed across the Minch to Lochinver, via a second water sampling site in the middle of the Minch (site 97) for radio-isotope analysis. *Clupea* berthed at Lochinver at 2000.

4 May was spent at rest in Lochinver and a change-over of scientific staff and equipment was effected. Clare Greathead dis-embarked and Lesley Stobo and Antione Keruzoré boarded. Frozen samples were also unloaded to relieve freezer space.

At 0400 on 5 May *Clupea* departed for Shetland, arriving in Scalloway at 2300 after collecting another water sample from the non-toxic supply at a position NW of Orkney (Site 91) for radio-isotope analysis. On arrival in Scalloway, the passive sampler was deployed overboard for the night to obtain a sample of water-borne contaminants in Scalloway harbour for later analysis at MLA.

On 6 May, survey work was commenced in Shetland. *Clupea* steamed to Gruting Voe from Scalloway, but strong NW winds and swell had made the narrow entrance to the Voe impassable. Work was conducted in Weisdale Voe instead. Failure of the depth read-out display on the hydro-winch prevented deployment of the CTD, so Day grab samples were taken and the Zodiac launched to conduct a transect survey at the 'Hoy' fish farm. Only one shoreline site for seaweed and mussels was sampled in Weisdale Voe because the strong winds had restricted the number of safe landing sites. At 1600 *Clupea* steamed to Scalloway to effect repairs to the hydrographic winch read-out display.

Sediment samples were taken from Sandsound Voe on 7 May and after correcting some minor problems with the AFM module of the CTD, hydrostations in Weisdale Voe were sampled by CTD/Rosette and for plankton. Weather conditions were too extreme to continue work into Sandsound Voe as it was becoming difficult to maintain station for long enough to deploy the CTD. Weather on the following day had not improved and prevented work so the day was spent moored at Scalloway.

Survey work was completed in Sandsound Voe on 9 May, including a fish farm transect survey at the 'Brei Geo Offshore' site and sampling of the long-term phytoplankton monitoring station. Strong N winds and a lack of safe landing sites prevented any shoreline sampling. The entrance to Gruting Voe was now navigable due to the change in wind direction and hydrostations were sampled by CTD/rosette, grab and plankton hose/net before *Clupea* anchored in the Voe for the night (the passive sampler was deployed overnight in Gruting Voe). Shoreline sampling and a transect survey were completed using the Zodiac the following morning and passage made to Laxfirth Voe. Only five hydrostations could be sampled from *Clupea* in Laxfirth due to experiencing substantially shallower water than was indicated on the Admiralty chart. Three hydrostations towards the top of the Voe were therefore missed. After anchoring overnight outside Laxfirth Voe, the Laxfirth survey was completed by shoreline sampling and a transect survey at the Laxfirth fish farm using the Zodiac.

Clupea arrived at Sullom Voe at 1300 on 11 May and hydrostations were sampled by CTD/rosette and for plankton. The Zodiac was launched for shoreline sampling and Day grab samples were taken from *Clupea*. The night was spent alongside the pier at Collafirth and another contaminant sample was taken using the passive sampler deployed overboard.

Whalefirth Voe was surveyed on 12 May by deploying the CTD/Rosette and plankton samplers from *Clupea* at 10 hydrostations. Grab samples of sediment were also taken from the same sites after the Zodiac was deployed for shoreline sampling. The survey was complete by 1230 and *Clupea* steamed for Ronas Voe, arriving at 1400.

The Ronas Voe survey commenced with CTD/rosette and plankton sampling at hydrostations working into the Voe. At low tide the Zodiac was deployed for shoreline sampling, while *Clupea* continued taking grab samples working back out of the Voe. The Zodiac was also used to conduct a transect survey at the Ronas fish farm. *Clupea* then departed for Fraserburgh at 2100.

A final water sampling site east of Fair Isle (site 90) was collected from the non-toxic supply en-route to Fraserburgh. *Clupea* arrived back in Fraserburgh at 1730 on 13 May and the scientific staff and samples were unloaded on the morning of 14 May. The remainder of the scientific equipment was unloaded on the morning of 16 May.

Results

14 of the scheduled 16 sea lochs in the cruise programme were successfully surveyed. Surveys in Loch Meanervagh and Brindister Voe were not completed due to time lost to weather and steaming. The lochs surveyed and the sampling conducted in each loch is shown in the Table below.

Loch	Hydro-stations	Farm transect	Phyto-samples	Toxic phyto-samples	Zoo-samples	Macroalgae sites	Sediment samples
Badcall Bay (26/04)	6	N	6	2	1	6	6
Loch Ewe (27-28/04)	13	Y	9	2	2	6	12
Loch Torridon (28-29/04)	15	Y	12	2	2	0	12
Loch Kishorn (29-30/04)	14	Y	10	2	2	6	14
Snizort Beg (01/05)	9	N	9	2	2	6	9
Loch Skiport (1-2/05)	15	Y	11	2	2	6	15
Loch Shell (3/05)	15	Y	11	2	2	6	15
Weisdale Voe (6-7/05)	13	Y	9	2	2	1	13
Sandsound Voe (9/05)	16	Y	12	2	2	0	16
Gruting Voe (9-10/05)	15	Y	11	2	2	6	15
Laxfirth Voe (10-11/05)	10	Y	6	2	2	6	10
Sullom Voe (11/05)	12	N	12	2	2	6	12
Whalefirth Voe (12/08)	10	N	9	2	2	6	11
Ronas Voe (12/08)	15	Y	11	2	2	6	15

In addition, four stations were sampled for radio-isotope analysis of surface sea water (AE001) and the samples are awaiting collection for analysis by CEFAS Burnham:

Station Number	Latitude	Longitude	Date	Time
99	57º25.4'N	6º53.43'W	01/05/05	16:10
97	58º02.64'N	5º59.55'W	03/05/05	19:30
91	59º29.95'N	2º59.17'W	05/05/05	16:30
90	59º30.62'N	1º52.34'W	13/05/05	04:00

The long term monitoring sites at Loch Ewe, Loch Maddy, Scalloway and Sandsound Voe were sampled for phytoplankton to allow 'ground-truthing' of the data collected during the cruise against the long term time series of data collected at these sites.

Seventeen sediment samples from a variety of the areas surveyed were kept under seawater in the cool and dark for later analysis of phytoplankton cysts by phytoplankton ecology group.

Phytoplankton samples from Lochs Ewe, Torridon and Kishorn were identified as positive for Amnesic Shellfish Toxin by lateral flow immunochromatography. Plankton samples from Loch Shell, Sandsound Voe and Laxfirth Voe tested positive for Paralytic Shellfish Toxin using the same technique (Jellett MIST Alert ™).

Hydrostations at the mouths of all Lochs/Voes were sampled twice by CTD, at different tidal states to assist with estimations of internal mixing rates in these lochs to improve sea loch nutrient modelling (project AE1192).

Water, phytoplankton, sediment and shellfish samples are awaiting analysis at MLA and will contribute towards an overall assessment of the surveyed areas for OSPAR planned for 2006.

Matt Gubbins
20 June 2005