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FRV *Clupea*

Cruise 1204C

REPORT

11–30 August 2004

Loading: 6 August, Fraserburgh
Unloading: 20 August, Lochinver
30 August, Fraserburgh

Personnel

Matt Gubbins	In charge
Colin Sellar	Safety Officer
George Slesser	11–20 Aug
Jennifer Graham	11–20 Aug
Pippa Sammes	20–30 Aug
John Beaton	20–30 Aug

Out-turn days: 17 days AE11p, 3 days AE1192

Gear

SB15 (Sealogger) CTD / Rosette sampler
2 x Day grab
Zodiak inflatable and 2 outboard engines
2 x Phytoplankton sampling hoses
>1600 nutrient and silicate sample bottles
Second freezer for lab

Objectives

To conduct a 'late summer' 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 will be undertaken by measuring the following parameters at multiple stations in each loch:

1. CTD
2. Nutrients (inc. silicates)
3. Chlorophyll *a*
4. Dissolved oxygen
5. Phytoplankton
6. Shoreline macroalgae
7. Organic carbon in sediments
8. Algal toxins in wild shoreline mussels

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 2002 and will be used to inform estimates of internal mixing within sea lochs / voes to improve laboratory models to predict nutrient enhancement from aquaculture.

Narrative

Scientific staff boarded *Clupea* at 1020 on 11 August and the vessel departed Fraserburgh at 1500 for the Western Isles, arriving in Loch Shell at 1100 on 12 August. Environmental survey work commenced with water and sediment sampling from the zodiak in close proximity to the Loch Shell (outer) fish farm, followed by shoreline surveys for macroalgae and collection of shellfish. Sediment and phytoplankton sampling was undertaken from *Clupea* in the evening and the night was spent at anchor in the loch.

Survey work in Loch Shell was completed the following day with CTD and water sampling from *Clupea*. After steaming to Loch Skiport, CTD data and water samples were taken at 11 stations and phytoplankton samples taken from 6 stations in the loch. On 14 August, survey work was completed in Loch Skiport by sampling water and sediments near the fish farm at Ornish and macroalgae and shellfish from 6 shoreline sites in the loch. Grab samples in the loch were then taken from *Clupea* before steaming to Loch Greshornish in North Skye. Similar survey work was completed in Loch Greshornish on 15 August and *Clupea* moored alongside the pier in Uig Bay for the night.

Loch Snizort Beg was surveyed on 16 August (water sediment and plankton sampling from *Clupea*) and the zodiak was used to survey shoreline macroalgae and collect mussels for algal toxin analysis. Shoreline sampling in Uig Bay and water/sediment samples along a transect from the Uig Bay fish farm were also collected later that day. After a night at anchor in the bay, survey work was completed by sediment and water/CTD sampling at all hydrostations in Uig Bay.

Shoreline sampling by zodiak in Loch Torridon was also conducted on 17 August, but strengthening Easterly winds prevented completion of a fish farm transect survey at the Camas an Leim site in the upper loch. Winds were still too strong for safe zodiak work near the fish farm on 18 August, so a single hydrostation was sampled by CTD/rosette from *Clupea* at 100 m from the farm. Survey work (grab and CTD sampling) was completed in Loch Torridon and *Clupea* then steamed to Loch Ewe, anchoring behind Isle of Ewe. Shoreline sampling was completed from the zodiak in Loch Ewe before spending the night at anchor.

A fish farm transect survey was conducted by zodiak at the Naast site on the morning of 19 August, which, followed by CTD/rosette and grab sampling from *Clupea* completed survey work in Loch Ewe. *Clupea* then made passage for Lochinver, arriving at 1930. 20 August was spent as a scheduled rest day in Lochinver, and a change of two scientific staff was effected at midday.

Departure from Lochinver was delayed until 1700 on 21 August due to a strong but decreasing Northerly swell. *Clupea* arrived in Shetland at 1200 on 22 August and anchored in Whiteness Voe to enable zodiak survey work in nearby Stromness Voe, which is too restrictive for *Clupea* to enter. Water, sediment, phytoplankton and shoreline sampling was conducted from the zodiak in Stromness Voe and a transect survey from the Stromness fish farm at the mouth of the Voe was also completed.

Similar survey work was conducted in Weisdale Voe on 23 August and Gruting Voe on 24 August. On 25 August *Clupea* made passage to Ronas Voe and after sampling one

hydrostation for CTD, grab and phytoplankton, the zodiak was launched for shoreline sampling and a transect survey at the outermost farm in the Voe. Water sampling by CTD/rosette from *Clupea* was completed at all hydrostations and the night of 25 August spent at anchor in Ronas Voe. The following day, grab sampling from *Clupea* was completed at all hydrostations and the vessel steamed to Whalefirth Voe on Yell.

Whalefirth Voe was surveyed from *Clupea* (CTD/rosette, grab samples, plankton samples) and shoreline algal surveys and shellfish sampling undertaken from the zodiak. Due to a poor weather forecast, passage was then made to Collafirth, where *Clupea* moored alongside the pier for the night.

On 27 August, survey work was undertaken in Sullom Voe. Sampling of hydrostations for water, sediment and plankton samples was completed, however, shoreline sampling in Sullom Voe was not completed due to time constraints resulting from a worsening weather forecast. Passage was therefore made to the more sheltered Basta Voe, where water, sediment and plankton sampling in the Voe were completed from *Clupea*.

After a night spent at anchor in Basta Voe, the zodiak was launched to conduct a transect survey from the Basta Voe (North) fish farm and to undertake shoreline sampling at 6 sites in the upper Voe. *Clupea* then departed Basta Voe at midday on 28 August and after an overnight passage, returned to Fraserburgh on 29 August, for unloading on the morning of 30 August.

Results

The lochs surveyed during the cruise are shown below:

Details on the scope of each loch survey are summarised below:

Loch	Hydro-stations	Farm transect	Phyto-samples	Toxic phyto-samples	Zoo-samples	Macroalgae sites	Sediment samples
Loch Shell (12-13/08)	11	Y	6	2	2	6	14
Loch Skiport (13-14/08)	11	Y	6	2	2	6	15
Greshornish (14-15/08)	10	Y	6	2	2	6	14
Snizort Beg (16/08)	9	N	6	2	2	6	9
Uig Bay (16-17/08)	5	Y	5	2	2	6	9
Loch Torridon (17-18/08)	12	Y	6	2	2	6	16
Loch Ewe (18-19/08)	8	Y	6	2	2	6	12
Stromness Voe (22-23/08)	7	Y	5	2	2	6	11
Weisdale Voe (23-24/08)	9	Y	6	2	2	6	13
Gruting Voe (24/08)	11	Y	6	2	2	6	15
Ronas Voe (25-26/08)	11	Y	6	2	2	6	15
Whalefirth Voe (26/08)	11	N	6	2	2	6	10
Sullom Voe (26-27/08)	12	N	6	2	2	0	12
Basta Voe (27-28/08)	10	Y	6	2	2	6	14

Rapid screening of phytoplankton samples by immunochromatography revealed that paralytic shellfish toxins may have been present in phytoplankton samples from Basta Voe and Gruting Voe and were also present in mussel samples from Basta Voe. Amnesic shellfish toxins (ASP) may have been present in phytoplankton from 11 of the 14 lochs surveyed, but were only present in shellfish from Weisdale Voe and Basta Voe. Samples from Weisdale Voe were above the sanitary threshold for ASP. Lipophilic toxins (e.g. DSP) were present in many of the shellfish samples taken during the cruise, but only exceeded the sanitary threshold in Loch Snizort Beg.

Results from CTD calibration, nutrient, silicate, chlorophyll, dissolved oxygen, phytoplankton, macroalgae, and sediment analysis (organic carbon) in the laboratory are underway and will ultimately be included in a report for SEERAD WED and OSPAR.

A health and safety audit report for cruise 1204C has also been prepared, based on an assessment conducted by the safety officer during the cruise. This is currently available as an FRS report.

Matt Gubbins
18 October 2004