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FRV *Clupea*

Cruise 1206C

REPORT

28 August – 15 September, 2006

Loading: Fraserburgh, 28 August

Unloading: Fraserburgh, 15 September

Half Landing: Lochinver, 6 September

Personnel

Matt Gubbins	(In charge)
Jennifer Graham	
Clare Greathead	6 Sept – 15 Sept
John Beaton	28 Aug – 6 Sept
George Slessor	6 Sept – 15 Sept
Jo Wilson	28 Aug – 6 Sept

Project codes: AE11s 15 days, AE1192 5 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
3x phytoplankton hoses

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 and dissolved oxygen
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 made available for assessment against criteria as defined by the OSPAR Eutrophication Committee 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.

In addition zooplankton will be sampled by bongo net from 1-2 stations in each loch and fixed in ethanol and formalin.

Sediment samples from close to fish farms will also be taken to determine the levels of metals, organic carbon and persistent organic pollutants.

Surface chlorophyll a levels will be recorded by continuously recording fluorometer, within a tidal excursion close to two large open water fish farms during a 12 hour tidal cycle.

Narrative

Scientific staff boarded the vessel at 1000 on the 28 August and after securing scientific gear, *Clupea* sailed for the Beatrice field. Here two CTD casts were undertaken in the NE corner of the field to record dissolved oxygen levels in response to recent reports of dead invertebrates in trawls following an algal bloom in the area. These results were faxed back to FRS and passage was made west overnight to the North Minch.

Survey work commenced in Edrachillis Bay on the 29 August with CTD casts outside Badcall Bay and a survey by CTD of Calbha Bay. Due to weather conditions and obstructions at the entrance to Calbha Bay, *Clupea* was unable to enter, so the inflatable was launched to complete the survey using reverser bottles.

After steaming to Little Loch Broom, a CTD survey was conducted in the inner loch and a survey over the inner sill was completed during peak flood tide as planned. It was decided to survey the outer sill by CTD during the peak flood tide the following morning and the night was spent at anchor near Gruinard Island.

After completing the Little Loch Broom survey, *Clupea* steamed to Loch Ewe and completed a CTD survey, water and plankton sampling and took a single sediment grab sample for phytoplankton cyst determination before steaming to Loch Torridon. Another grab sample for cyst identification was taken from the upper basin of the loch and *Clupea* was anchored overnight. CTD survey work across the inner sill of Loch Torridon was completed during peak flood tide on the 31 August and water / plankton sampling completed in the outer loch prior to sailing to Loch Duich. A single CTD cast outside Loch Kishorn was conducted en route. At Loch Duich, CTD survey work across the sill was undertaken during peak ebb tide (flood tide times were not convenient). The vessel was moored overnight in Kyle of Lochalsh.

On the 1 September, *Clupea* steamed to Loch Nevis and completed CTD, water and plankton sampling prior to steaming to Bloody Bay in North Mull and anchoring for the night. From 08:00 to 20:00 on the 2 September the vessel was steamed around a grid pattern close to the Bloody Bay fish farm site to record surface chlorophyll values over a 12 hour tidal cycle using an on board fluorometer. The night of the 2 September was also spent at anchor in Bloody Bay.

After steaming to the Western Isles to sample stations outside Loch Skipport, A'Laip, Meanervagh and inside Loch Maddy (the long term phytoplankton monitoring station), survey work (CTD, water and plankton sampling) was conducted in Uig Bay prior to mooring alongside the pier overnight.

CTD, water and plankton sampling were conducted in nearby Loch Snizort Beag the following day and the inflatable was launched to collect macroalgae and mussel samples from the shoreline. Neighboring Loch Greshornish was then surveyed by CTD, including several stations across the sill at peak flood tide.

Clupea steamed to Loch Seaforth to conduct survey work by CTD / rosette sampler in the loch on the 5 September. The inflatable was launched to collect samples from the upper part of the loch (too shallow for *Clupea*) and sediments were collected by Day grab from positions close to a fish farm West of Seaforth Island. Single CTD casts were then conducted outside Lochs Shell and Odhairn, prior to steaming to Lochinver. The 6 September was spent as a rest day at Lochinver, during this time, scientific staff were changed and frozen samples were off-loaded for transport back to MLA.

Clupea departed Lochinver for Shetland at 0300 on the 7 September and arrived in Scalloway at 23:30. A single CTD cast and plankton sample was taken in Scalloway harbour (a long term phytoplankton monitoring site) on the morning of the 8 September before conducting survey work with CTD and plankton sampling in Seli Voe. Similar survey work was then completed in Weisdale Voe and outer Stromness Voe. The inflatable was launched to complete water sampling and undertake shoreline sampling in upper Stromness Voe.

CTD casts, water and plankton sampling were undertaken in Sandsound Voe, including multiple CTD casts over the sill of the Voe on the flood tide. After mooring overnight in Scalloway, Day grab samples were taken from close to the Brei Geo fish farm in Sandsound Voe and single CTD casts were conducted outside Gruting Voe and Vaila Sound. *Clupea* then steamed to Ronas Voe, where a full CTD survey was conducted with water and plankton sampling and the inflatable was launched to collect shoreline macroalgal samples and a bulk sample of mussels to act as a reference material for BAM group (mussels were expected to be PSP positive in this area). The vessel was anchored in Ronas Voe overnight and steamed to Whalefirth Voe for survey work on the 10 September.

Clupea was used to conduct CTD, water and plankton sampling in the outer part of Ronas Voe and the inflatable launched to complete the survey in the upper Voe past an underwater obstruction. Tides were not suitable for shoreline sampling, so survey work (CTD, water, plankton) was then conducted in Sullom Voe before anchoring in Swinister Voe overnight.

The 11 September was spent measuring surface chlorophyll levels with a deck mounted fluorometer while steaming a grid, 1 tidal excursion in size, around the Djubawick fish farm just off Basta Voe for a 12 hour tidal cycle.

Basta Voe itself was surveyed by CTD and water / plankton samples collected on the 12 September. A single CTD cast was conducted off Baltasound and after steaming back to Mainland Shetland, Collafirth was surveyed by CTD / rosette. Day grab samples of sediment were taken from close to the Collafirth fish farm and the inflatable boat was launched to conduct shoreline sampling before a second night was spent at anchor in Swinister Voe.

On the 13 September, survey work was started in Vidlin Voe, but was abandoned due to extreme fog. Dury Voe was subject to full CTD survey and water / plankton samples were collected from multiple stations. A single CTD cast was taken from outside Dales Voe and survey work was completed with sampling in Laxfirth Voe. Here, CTD casts and water samples were taken in the outer Voe and the inflatable was launched to sample stations past an obstructing fish farm. Shoreline mussels were also sampled from the inflatable for algal toxin analysis.

After 2 hours moored at Lerwick, *Clupea* steamed back to Fraserburgh on the night of the 13 September, arrived in Fraserburgh on the 14 September and was unloaded on the morning of the 15 September.

Results

Full surveys by CTD were conducted in 22 lochs as shown in the table below. In addition, survey work at peak tides was conducted over the sills of Little Loch Broom, Lochs Torridon, Duich (ebb), Nevis, Greshornish and Sandsound Voe.

Single stations outside the following lochs / voes were also sampled: Badcall Bay, Kishorn, Skiport, A'Laip, Meanervagh, Shell, Odhairn, Gruting, Vaila, Balta Sound and Dales Voe. Single stations inside Loch Maddy and Scalloway harbour were sampled to compare phytoplankton data to the long term time series established in these areas.

Samples collected during this cruise are still being analysed and data will be made available in due course.

Matt Gubbins
06 December 2006

Sediment samples close to fish farms for contaminants analysis were sampled by Day grab in Lochs Duich, Seaforth, Sandsound Voe and Collafirth Voe.

Loch	Hydro-stations	Farm transect	Phyto-samples	Toxic phyto-samples	Zoo-samples	Macroalgae sites	Sediment samples
Calbha Bay 29/08	4	N	1	1	1	0	2
Little Loch Broom 29-30/08	14	N	5	2	2	0	0
Loch Ewe 30/08	9	N	5	2	2	0	0
Loch Torridon 30-31/08	11	N	6	2	2	0	1
Loch Duich 31/08	9	Sediments	5	2	2	0	5
Loch Nevis 01/09	10	N	5	2	2	0	0
Uig Bay 03/09	2	N	2	2	2	0	0
Loch Snizort Beg 04/09	9	N	5	2	2	6	0
Loch Greshornish 04/05	11	N	5	2	2	6	0
Loch Sheaforth 05/08	9	Sediments	5	2	2	0	5
Seli Voe 08/09	5	N	3	1	1	0	0
Weisdale Voe 08/09	9	N	5	2	1	0	0
Stromness Voe 08/09	6	N	5	2	1	5	0
Sandsound Voe 08-09/09	8	Sediments	4	2	0	0	5
Ronas Voe 09/09	11	N	5	2	0	6	0
Whalefirth Voe 10/09	11	N	5	2	0	0	0
Sullom Voe 10/09	7	N	5	2	0	0	0
Basta Voe 12/09	8	N	5	2	0	0	0
Collafirth Voe 12/09	9	Sediments	5	2	0	6	5
Vidlin Voe 13/09	7	N	3	1	0	0	0
Dury Voe 13/09	10	N	5	2	0	6	0
Laxfirth Voe 13/09	8	N	3	2	0	0	0

