

R1/3

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FRV *Clupea*

Cruise 1305C

## **REPORT**

2-22 September 2005

**Loading:** Ullapool 01 September

**Half Landing:** Lochinver, 12 September

**Unloading:** Fraserburgh 22 September

## **Personnel**

Matt Gubbins	(In charge)	31 August – 22 September
George Slesser		31 August – 12 September
Jennifer Graham		2–12 September
Craig Robinson		2–12 September
Clare Greathead		12–22 September
Dougal Lichtman		12–22 September

**Out-turn days:** AE11s 17 days, AE1192 4 days

## **Equipment**

Zodiac inflatable  
2 outboard engines  
Seallogger 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 assessed against criteria as defined by the OSPAR Eutrophication Task Group and used for future eutrophication assessment of Scottish coastal waters.

CTD data from targeted sea lochs (during flood tide) 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 one hydrostation 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 copper and persistent organic pollutants.

## **Narrative**

Matt Gubbins and George Slesser joined *Clupea* late on 31 August to organize loading and setting up of the lab on 1 September. The remainder of the scientific staff boarded the vessel on the morning 2 September and *Clupea* departed Ullapool for Little Loch Broom. Survey work commenced in Little Loch Broom at 1400 with sediment grabs, and hydro sampling, including CTD casts over the sill during flood tide. Plankton sampling was also conducted but no shoreline or fish farm sampling had been programmed for this loch. *Clupea* anchored overnight in Little Loch Broom and completed grab sampling before steaming to Loch Ewe on 3 September.

Sampling in Loch Ewe was completed on the same day, with grab sampling, hydro sampling and plankton sampling completed at all scheduled stations. An additional hydrostation was sampled to coincide with the long term monitoring site for phytoplankton in Loch Ewe. This was to ground truth the spatial survey against long term changes measured weekly in the Loch. The Isle of Ewe fish farm was sampled by zodiac for sediments only using the hand held Van Veen grab. These samples were for contaminants analysis at FRS. *Clupea* steamed to Gairloch and anchored there overnight.

On 4 September, *Clupea* steamed to Loch Torridon and started survey work with CTD casts across the sill to the inner loch. These were sampled at peak ebb tide. Hydrostations in the upper loch were then surveyed by CTD and the zodiac launched to conduct shoreline sampling for macroalgae and shellfish.

Stations in the outer loch were then subject to CTD casts and plankton sampling, before *Clupea* steamed South to Loch Kishorn, arriving at 1800. The first seven hydrostations in this loch were surveyed by hydro sampling before *Clupea* anchored in the loch at 2000 for the night.

The Kishorn (South) fish farm was sampled for sediment and water by zodiac the following morning. After lunch the remaining hydrostations were sampled from *Clupea* and sediment grabs were completed while two scientific staff conducted shoreline sampling from the zodiac inflatable.

Sampling in Loch Portree commenced by 1700 on 5 September and all five stations were sampled by CTD and Day grab by the end of the day. After anchoring overnight in the Loch, fish farm and shoreline sampling was completed from the zodiac in the morning of 6 September and *Clupea* steamed for Loch Greshornish in North Skye.

On arrival at Loch Greshornish, plankton and hydro sampling were conducted across the inner sill at peak flood tide. The remaining grab and hydro samples were completed the following day. Hydro and plankton sampling was then conducted into neighboring Loch Snizort Beag (control no fish farms) and at low tide shoreline sampling for macroalgae and shellfish was completed in both lochs. The fish farm in Loch Greshornish was also sampled by Zodiac for sediment samples (for contaminants analysis) only. *Clupea* tied up alongside the pier at Uig overnight before crossing the Minch for Loch Seaforth on 8 September, arriving at 1000.

Hydrostations up Loch seaforth were sampled by CTD first and the most northerly station had to be sampled by zodiac inflatable, due to shallow water preventing passage of *Clupea*. Shoreline sampling followed by fish farm sampling at the Maaruig site completed the days work in Seaforth.

After anchoring overnight at the head of the Loch, grab sampling was completed and *Clupea* steamed North to Loch Odhairn. Sampling was delayed slightly due to the need to change CTD batteries, but after lunch all hydro sampling by CTD and plankton sampling was completed. The zooplankton 'bongo' net was lost overboard after snagging on a fish farm anchor chain but was retrieved shortly afterwards using the zodiac inflatable. The Outer Gravir fish farm was sampled by zodiac and shoreline sampling completed before anchoring overnight in the loch. Grab samples were conducted in Odhairn the following morning (10 September) and *Clupea* steamed to Loch Erisort/Leurbost to continue the programme of work.

Hydrostations, phytoplankton sampling and shoreline sampling were completed in both Loch systems on 10 September and grab samples were also conducted in Loch Leurbost. After anchoring overnight at the entrance to Loch Erisort, The fish farm at Erisort was sampled by zodiac and grab samples in Erisort were finished from *Clupea*. Passage was made for Lochinver arriving at 1730 for a scheduled crew change on 12 September.

Scientific staff and samples were changed/offloaded in the morning of 12 September and a decision was made based on a worsening weather forecast to abandon survey work in Badcall Bay in favour of steaming to Shetland. *Clupea* departed Lochinver at 1030 on 12 September and arrived in Scalloway, Shetland at 0500 on 13 September. 13 September was spent as a rest day.

Due to a SW gale, survey work was also cancelled due to weather on 14 September and *Clupea* remained moored in Scalloway harbour.

Survey work in Shetland commenced on 15 September with hydro/plankton sampling of the long term monitoring station in Scalloway Bay, followed by fish farm sampling from the zodiac inflatable at the Brei Geo offshore fish farm in Sandsound Voe.

Grab samples and shoreline sampling were completed in Sandsound Voe, but failure of the hydro winch readout display prevented further CTD casts on 15 September. *Clupea* returned to Scalloway to attempt repairs of the hydrowinch. Repair required replacement parts that were unavailable so the hydro wire was marked off for distance to facilitate deployment of the CTD.

Following request from Environmental Protection group the zodiac was used to sample *Littorina* gastropods from the shoreline in Scalloway Bay and Clift Sound. This sampling was in response to the recent diesel spill from the coastguard vessel Anglian Sovereign and would inform advice regarding contamination and taint of harvested molluscs in the area of the spill. This sampling was completed on the morning of 16 September with additional samples being collected from Burwick and Scalloway Bay. These were then shipped back to FRS by courier from Scalloway, before proceeding with survey work in Sandsound Voe. Hydro sampling was completed in Sandsound Voe on the evening of 16 September (including stations across the sill at flood tide) and *Clupea* then steamed round Sumburgh Head, anchoring in shelter overnight, before completing passage to Laxfirth Voe in the morning of 17 September.

Some hydro sampling, plankton sampling and grabbing was conducting in Laxfirth Voe, but strong winds prevented use of the inflatable boat so fish farm and shoreline sampling were abandoned. Instead survey work using *Clupea* was conducted in Dury Voe and hydro, plankton and grab sampling were completed on 17 September. Poor light prevented shoreline sampling being completed that evening, so this was finished on 18 September along with fish farm transect sampling from the inflatable.

*Clupea* steamed to Sullom Voe and completed hydro and plankton sampling before mooring overnight alongside the pier in the Voe. Sediment samples were not programmed for this loch and poor weather prevented shoreline sampling.

Whalefirth Voe was surveyed on 19 September. The positioning of a buoy in the middle of the loch prevented access to the upper loch in *Clupea*, so the zodiac was launched to complete sampling of sediments and hydrographic parameters. Shoreline sampling was also conducted including collection of 1000 *Nucella lapillus* for use in a QUASIMEME imposex ring test.

In strong Westerly winds *Clupea* steamed for Balta Sound on Unst and tied alongside the pier overnight. On 20 September survey work in Balta Sound was completed including shoreline sampling, transect sampling at the fish farm by zodiac and hydro, plankton and grab sampling from *Clupea*.

At 1530 all sampling had been completed and *Clupea* steamed to Fraserburgh, arriving in the afternoon of 21 September. Scientific staff and gear were offloaded on the morning of 22 September.

## Results

Sixteen of the scheduled 17 sea lochs in the cruise programme were surveyed. Survey of Badcall Bay was prevented due to the need to use a good weather window to steam to Shetland. Poor weather also prevented small boat survey work in Laxfirth Voe. The lochs surveyed and the sampling conducted in each loch is shown in the Table below.

The long term monitoring sites at Loch Ewe and Scalloway 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.

Sixteen 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 Seaforth, Odhairn, Erisort/Leurbost, Sandsound and Sullom Voe were identified as positive for Amnesic Shellfish Toxin by lateral flow immunochromatography (Jellett MIST Alert™). Paralytic Shellfish Toxins were not detected in any plankton samples during the cruise.

Hydrostations across the sills of Little Loch Broom, Torridon, Greshornish and Sandsound Voe were sampled by CTD during full flood tide (except loch Torridon – full ebb tide) to provide data to inform estimates of internal mixing of sea lochs (ROAME AE1192).

A sample of >1000 *Nucella lapillus* was collected from Yell Sound (Whalefirth Voe) to provide QUASIMEME with reference material for an intercalibration test for imposex (contract C324).

Mussel and *Littorina littorea* (periwinkle) samples from a shellfish farm and 8 shoreline sites around Scalloway were collected and shipped back to Aberdeen by plane from Lerwick for sensory assessment and PAH chemistry to inform advice regarding the diesel spill from Anglian Sovereign.

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  
9 January 2006

Seen in draft: A Nicol, on behalf of A Simpson, OIC *Clupea*

Loch	Hydro-stations	Farm transect	Phyto-samples	Toxic phyto-samples	Zoo-samples	Macroalgae sites	Sediment samples
Little Loch Broom (2-3/09)	12	No	6	2	1	0	8
Loch Ewe (03/09)	8	Sediments only	6	2	1	0	7
Loch Torridon (04/09)	13	No	6	2	1	0	0
Loch Kishorn (05/09)	13	Yes	4	2	1	6	13
Loch Portree (5-6/09)	9	Yes	5	2	1	6	9
Loch Greshornish (6-7/09)	11	Sediments only	6	2	1	6	10
Loch Snizort Beg (07/09)	10	No	6	2	1	6	0
Loch Seaforth (8-9/09)	14	Yes	6	2	1	6	8
Loch Odhairn (9-10/09)	11	Yes	6	2	1	6	11
Erisort/Leurbost (10-11/09)	20	Yes	12	3	2	6	18
Sandsound Voe (15-16/09)	16	Yes	6	2	1	6	12
Laxfirth Voe (17/09)	5	No	5	2	1	0	4
Dury Voe (17-18/09)	14	Yes	6	2	1	6	12
Sullom Voe (18/09)	11	No	6	2	1	0	1
Whalefirth Voe (19/09)	9	No	6	2	1	6	0
Baltasound (20/09)	10	Yes	6	2	1	6	9