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FRV *Scotia*

Cruise 0803S

REPORT

8-27 May 2003

Landings

Peterhead: 17 May 2003

Personnel

D G Reid	(In charge)
E G Jones	
P J Copland	
R Kynoch	
P J Barkel	
M Burns	
N S Collie	(8-17 May)
K Peach	
C G Davis	
I Penny	

Objectives

1. To develop and refine the twin trawling technique and collect data on the effects of groundgear choice on the selectivity of the GOV trawl.

2. To test rigging and set up changes on the performance of the single GOV.

3. To obtain quantitative information on fish populations in the mouth of the trawl, between the wings and as close to the doors as possible. The upgraded SM200 sonar mounted on the RCTV and new fibre-optic cable will be used.

4. Simultaneous video footage using the self-recording ccd cameras will be collected to give information on species identification. A stereo-pair configuration will be tested.

Out-turn days per project: MF0662 - 20 days

Narrative

Equipment was loaded in Aberdeen between 6 and 7 May. Staff joined the vessel on Thursday 8 May and following some delays to complete equipment checks *Scotia* sailed at 1400 hours. The first period (up to 17 May) was dedicated to experimental studies using the twin rigged GOVs. These were carried out in the Moray Firth off MacDuff. After a small number of test and shake down runs, a series of tows were carried out. The first set were carried out using ground gear B on both sides as a control. Following this the starboard net was fitted with ground gear A and a further series of tows carried out. Finally, the nets were switched and a further series of tows were completed. The fitting of a central pillar on the

trawl deck, flanges to the drums and improvements to the Methot winch all proved successful.

During this period the RCTV was converted for use with fibre optic links and with the new SIMRAD SM2000 sonar plus rotator. Trials of this set up proved successful, although there were some problems with the fibre optic lines (see Appendix 1). There was also damage to the video input board – requiring a replacement to be delivered at the half landing, and some problems with power supply. The new spooling gear on the TV winch appeared operable, though not optimal (see Appendix 2). The newly fitted, on board 3 phase generator appeared to work well, although there were two unexplained trips on the current breaker system. These did not affect operation and are under investigation by the ETO (see Appendix 2). An attempt was made to use the vessels 440V supply, but noise and interference problems were similar to those seen on the previous cruise, and this was discontinued.

Twin rig work was terminated on 16 May following the parting of the centre wire. It is believed this was the result of the gear coming fast. The centre wire was being run on the brakes as it is not currently integrated in the auto trawl system. Installation of a tension alarm and/or integration into the auto trawl system may help prevent a repetition of this event. The parting was filed as a "near miss".

There was also a transfer of some small pieces of video equipment to shore by small boat at MacDuff on the evening of 13 May.

The vessel steamed to Peterhead for the half landing on 17 May. A damaged net, large doors and the clump were put ashore, smaller doors and a replacement fibre optic board picked up.

After the half landing, the vessel returned to the Moray Firth to carry out initial trials with the RCTV, intending to continue to Orkney (59.2'N, 2.3'W) the following day. Due to weather, this was delayed for one day. Although all the RCTV systems initially appeared to be working on the fibre optic lines, a series of failures of the cables over the days up to 19 May resulted in the loss of all fibre optic lines. This prevented the use of the SM2000 (see Appendix 1). Work continued using the SeaBat and co-axial links. A series of tows were carried out using the SeaBat and RCTV to collect data on the behaviour of fish between the wings of the net. On 20 May, the power supply to the vehicle failed due to a short in the 3 phase cable runs. This required a shift to the backup cable. This also appeared to work for a further day, before faults in the co-axial link appeared. Before these could be properly diagnosed or fixed, the power supply again failed, probably also due to a short in the 3 phase link. This effectively terminated any further RCTV work.

For the remainder of the trip, the time was used to complete objective 2 and to collect stereo camera footage for later analysis and calibration. Tests were carried out on alternatives to the use of the kite on the GOV, and on the effect of using the different recommended sweep lengths specified in the IBTS manual but not normally implemented by FRS. The opportunity was also taken to establish operational mounting positions for ccd cameras to collect data to compare with sonar images from the RCTV. All this work was completed successfully.

Scotia returned and docked in Aberdeen harbour at 0600 hours on Tuesday 27 May.

Results

The twin rigging experiments (Objective 1) were completely successful. Improvements to the vessel set up were very successful. Initial examination of the data suggest that there was a significant impact of the choice of ground gear on the selectivity of the net for flatfish. The

net using ground gear A caught approximately three times more flatfish than ground gear B. The data will be analysed further and full results reported. Twin rig work was terminated on 16 May following the parting of the centre wire. It is believed this was the result of the gear coming fast. The centre wire was being run on the brakes as it is not currently integrated in the auto trawl system. Installation of a tension alarm and/or integration into the auto trawl system may help prevent a repetition of this event. The parting was filed as a "near miss".

GOV rigging changes (Objective 2) mainly concentrated on the effect of different sweep lengths, changes in the adjuster chain length and the use of an alternative kite arrangement. A series of repeat tows with 60 and 100 m sweeps were carried out. Trawl surveillance data were recorded and the catch processed to test from performance changes. The data will be fully analysed after return to the laboratory, however, preliminary indications suggest that there is little impact on either gear geometry or catch composition. The alternative kite (using floats only) was tried successfully. The arrangement appeared to provide similar trawl geometry and catch composition, and was much easier to deploy. The adjuster chain was set to the correct configuration for the ground and provided good ground contact. During the half landing, the opportunity was taken to rig a new GOV on the pierside in collaboration between the crew and scientific staff. Extra care was taken in doing this and a number of small irregularities were observed in the set up and corrected. This net was then used for the subsequent work. A number of other issues relating to trawl QA were recorded and will be the subject of analysis after the cruise.

A series of RCTV deployments were carried out to examine and quantify the fish behaviour in the area between the wings of the net (Objective 3). These were carried out using the SeaBat system due to the loss of fibre optic comms to the SM 2000. Preliminary indications were that the fish were concentrated mid way between the wings, with little activity close to the wings. The fish were often observed as aggregations at different heights off the seabed; level with the opening, at the headline height and higher than the headline. In addition, there were regular observations of individual fish close to the seabed, again concentrated close to the seabed. These data were recorded digitally and on video disk for further, quantitative analysis in the laboratory. Due to the cable failures it was not possible to replicate these observations in the area between the doors.

The stereo camera frame was successfully deployed on the net during the early RCTV deployments, and some simultaneous data were collected (Objective 4). The footage will be analysed to provide species ID and length frequency data. The CCD cameras were also tested in a number of positions around the gear. This was intended to compliment the operation of the RCTV in the area in front of the gear. Fish observed on the RCTV sonar could then be observed directly as they enter the net. To this end cameras were mounted on the headlines in the wings looking both forward and backward in the net. The forward looking unit confirmed the absence of many fish in the wing area. In separate deployments a camera was also mounted on the centre headline looking back into the net. On this camera it was possible to see fish entering the net and then escaping through the top panel. A further mounting on the top of the net and further back gave a very good view of this escape area from the outside and again escaping fish could be seen. Post analysis in the laboratory will quantify this behaviour and relate it to the catch from the cod end.

Twin Rigging – 23 complete tows

- 10 fully instrumented tows with Scanmar and load cells on the GOVs. Ground gear B on both nets.
- 11 fully instrumented tows with Scanmar and load cells on the GOVs. Ground gear B on port net and A on starboard.

- 2 fully instrumented tows with Scanmar and load cells on the GOVs. Ground gear A on port net and B on starboard.

RCTV-Seabat observation tows with single rigged GOV – Ground gear B

- 1 qualitative RCTV tow with Seabat and SM2000
- 5 RCTV- Seabat @ groundgear with catch data (some with standard kite, some with "float kite"). Two of these were "low light" tows.
- 3 RCTV-Seabat @ groundgear with stereo camera system at taper of net.
- 2 RCTV – Seabat @ wings with stereo camera frame (1 was foul as net came fast).
- 5 RCTV – Seabat @ wings only (no camera data). Three of these were "low light" hauls.
- A total of 17 RCTV deployments

CCD camera tows

- Three hauls completed with the stereo camera system only for length frequency and species ID.
- 14 hauls with net cameras mounted in various positions to record:

  fish being herded at the wings
  fish escapes over the headline
  fish escapes in the main body of the net as far as taper
  float kite performance

- A total of 17 net and camera deployments

Single GOV Performance Trials – 34 complete tows

- 10 hauls with Exocet kite and standard setup.
- 5 hauls with float case A - 4 x 11" float in a square configuration at headline centre plus 1 x 8" & 11" on quarter both wings.
- 11 hauls with float case B - 6 x 11" floats at headline centre and last two sets of 5 floats at each wingend repositioned closer to the wing end.
- 4 hauls with 110 m long sweeps and Exocet kite in ~120 m water depth.
- 4 hauls with 47 m long sweeps and Exocet in ~120 m water depth.

NB: Some of these hauls were also used for camera and RCTV observations. Some additional test tows were carried out which have not been logged.

Summary

Total number of hauls – 76
Time lost to bad weather – nil

Time lost due to ships equipment failure – 3-4 hours (winch and generator problems)
Time lost due to survey equipment failure – approximately one and a half days (cable problems).

I would like to compliment and thank the master and crew of the *Scotia* for their willing cooperation in all the work during this survey. Particularly during the twin rigging, the work load was high and carried out diligently by the crew.

Dave Reid
13 June 2003

Seen in draft: Captain Peter Barrett, OIC *Scotia*

APPENDIX 1

Report on Fibre Optic Telemetry Systems

The 27 mm dia cable was wound onto the TV winch on *Scotia* on 7 May. On connection it was found that one of the 4 available fibre optic lines had failed. It was identified as line B. Tests continued of the remaining available fibre optic lines. Operation of the remaining three lines in the cable, both fibre passes in the winch slipring and all six connections to the container hold was confirmed by use of the fibre optic boards diagnostic indicators and a SIT TV signal.

It was quickly established that SIT TV and Seabat video signals could be easily transmitted from the underwater pod to the surface unit with no significant noise or interference. Adjustment of input levels for the TV system was required, as the signal levels were high compared to those normally encountered with copper systems. This may have been due to the fact that there is little or no loss through fibre optic transmission lines. Unfortunately a combination of mis-interpretation of board functions and a mistake in plug wiring resulted in damage to the telemetry lines from surface to underwater pod which were to be used to control Seabat and Simrad SM 2000 multibeam systems. The RS 422 uplink for the SM 2000 data however was found to be operating and the vehicle was deployed for the first time with the following configuration:

SIT Video	Fibre Optic video up link 1
Seabat Video	Fibre Optic video up link 2
Seabat telemetry	Copper conductors
SM 2000 data	Fibre optic RS 422 uplink channel
SM 2000 telemetry	Copper conductors
Rotator	Copper conductors
RCTV telemetry	Copper conductors

The quality of the video pictures was very good, as was the SM2000 data link, but the SM 2000 would freeze for periods of time. Tests using the SM2000 deck lead confirmed that it did not exhibit this fault on short cable lengths. A total of two deployments were successfully made using this arrangement. A second fibre line failed at this point. This happened with the vehicle still on deck, having been tested in the hanger, unplugged and moved to the aft deck for deployment. It was discovered that line A had failed on retest of the system. The underwater pod was rewired to use the remaining two lines (C and D) and another deployment on the twin trawl gear was carried out.

At the half landing a replacement video input board was delivered and a deployment was carried on the single GOV trawl with the following configuration:

SIT Video	Fibre Optic video up link 1
Seabat Video	Fibre Optic video up link 2
Seabat telemetry	Fibre Optic RS 232 downlink 2
SM 2000 data	Fibre optic RS 422 uplink channel
SM 2000 telemetry	Fibre Optic RS 232 downlink 1
Rotator	Copper conductors
RCTV telemetry	Copper conductors

Video pictures were again of high quality. The SM2000 worked at its maximum rate of 10 MBPS. Ping rates of up to 20 pings per second were achieved with excellent picture quality and fast menu response from the head. This confirmed the suspicion that the problems in the earlier deployments were likely to have been due to speed restrictions in the telemetry signals used to trigger the head for each pulse. Unlike the Seabat, which can

operate with no telemetry signals after having been started, the SM2000 head needs confirmation from the surface processor that data from each ping has been received and also an instruction to generate the next ping. This requires quick and reliable telemetry, which the copper lines could not achieve. Outputs of all the systems on board the RCTV during this deployment were recorded as video and DVD formats.

Unfortunately as the RCTV was being deployed again the fibre systems failed. This happened just as the vehicle had entered the water, in what was a trouble free deployment in good weather. Failure was traced to the loss of both remaining fibre optic lines. Retesting the system established that all four lines had failed between the underwater pod and the input to the winch slip rings. As yet it is not possible to say if these failures are in the cable, the underwater connectors or the in-line connectors used within the housing and the slip rings. Testing of such systems requires specialised equipment, which is not yet available to us.

Some damage had been previously noted to the sheath of the fibre optic tail to the underwater connector. It appears that this may have been caused by the tail being tied to something and stretched at some point and should be investigated further. There is similar damage to an adjacent connector tail.

Rotator

This unit was installed to allow multibeam sonar heads to be moved to the most suitable angle to view the gear during deployments. Its adjustable stop limit switches ensure that the unit cannot rotate too far and damage cabling. The rotator was controlled from the surface by use of switching relays to change rotation direction. This technique meant that only low control currents were required to be sent down the cable as the integral power supplies in the fibre optic housing provided the 1 amp current required to drive the motor itself. The unit worked very well and seemed to be reliable. Some interference on TV and Seabat pictures was noted while the motor was running. The sweep range was 180 degrees.

Performance

The fibre system operated beyond our expectations, providing clear, noise free video signals. Reliable, high-speed transfer was available for digital data and control telemetry. The RCTV operators were impressed by the video quality and clarity. They are now convinced that fibre optics are the way forward for their gear and behaviour work.

The SM 2000 cannot operate to any significant length down conventional conductors.

If it is to be used for research work then optical paths will be required. Similarly data quality for the Seabat is markedly lower, with difficulty in getting clear images on copper conductors. The damage to the board was unfortunate but the cause has been identified and provision for an external opto-isolator board is to be made to prevent a recurrence of this type of damage. We are assured that the damaged board can be repaired.

APPENDIX 2

TV Winch

The winch's new spooling gear was commissioned during the in port period. Initially the 27 mm fibre optic cable was used. With this cable diameter the spooling proved to be adequate but not ideal. It was necessary to keep a continual watch on the winch during heaving operations to ensure that there wasn't a build up of cable. It was soon apparent that any recovery speed in excess of 30 m/min couldn't be relied upon to produce good spooling. (NB. Specification from spooling speed 15-25 m/min). Any discontinuity in the previous layer could cause the system to reverse direction. At any speed above creep it is very difficult for an operator to react fast enough to use the over-ride control effectively. The siting of the control handle also makes it difficult for the operator to see the cable adequately over the whole barrel width. During all operations with the 27 mm cable it was noted that the automatic adjustment was almost continually in use. The remote control box for the spooling gear was never used during the cruise as the original camera view provided was very poor, although this has now been improved. Also there was unease about using the system without having an overview of vehicle position, cable out and locations of deck crew.

The 25 mm cable proved to spool perfectly with no manual interventions required. This was at cable recovery speeds varying from 20 to 45 m /min during normal operations.

Construction of the spooling gear makes replacing cables very time consuming with unnecessary dismantling required to get access to other nuts and bolts. This problem could be easily rectified without any major redesign of the winch. The ship's engineers have expressed some concerns about the material used for some key components and their likely reliability and also the quality of the engineering. The engineers should be contacted directly for their views.

3 Phase Generator

This was used throughout the cruise for all deployments. The system current breakers tripped on two occasions for no apparent reason. Once during system switch off and again at system power up. The ETO monitored the generator for periods during the cruise and loads of around 7 Amps per phase were seen in normal deployments. The ETO can provide further details of observed current loads if required. At no time did the system fail whilst in use. The supply provided seemed adequate and no significant noise interference was noticed. The question of fitting an ELCB unit to the generator is to be pursued by the ETO. An attempt was made to use the ships 440 Volt supply during a deployment on copper conductors but the RCTV transformer could be heard to "sing" and interference was at once apparent on the TV and Seabat pictures.

Imagenix Sonar

An attempt was made to use the new scanning sonar during the cruise. Interference from the RS485 lines, which control the RCTV rotors, proved too severe to allow it to be used. This is probably because the Imagenix uses the same format for its data transfer through the cable. The system performed slightly better on a processing PC supplied by Seatronics than on a standard Dell with external RS485-RS232 converter supplied by the ML. The Seatronics PC had an internal card. The older analogue Mesotech system also exhibited strong interference patterns on the display with the vehicle telemetry lines in use.

Cable Performance

27 mm Dia

The fibre optic cable was used for 15 deployments, initially using fibre and then copper conductors, before it failed. It was noted that the DC amplification in the Seabat cable compensation unit had to be increased significantly from its previous settings to get an acceptable picture. The SIT TV picture was also thought to be of poorer quality than might have been expected for a new cable. Both these signals use co-axial lines. The Imagenex sonar would not operate reliably down this cable, when the vehicle telemetry was in use, with either of the available top end processors. The Mesotech scanning sonar did operate on this cable, but the severe interference would have made the display unusable in practice. A partial short on the 3 phase power lines, 6 (phase) and 2 (phase) forced replacement of the cable.

25 mm Dia

This cable is the one that was suspected of having a partial fault when last used on *Clupea*. The cable was cut back by 30 m and re-terminated during the in port period but no fault had been found even before re-termination. The cable was used for four deployments before a fault on the Seabat coax line began to appear. The cable would work well until paid out to its working length of 310 m (approx). At this point the picture would begin to flicker. The TV picture seemed unaffected. The Seabat picture would improve again on hauling back.

The Imagenex sonar was tried with this cable and worked well with the Seatronics processor but only intermittently with the ML unit. The Mesotech system was not tried on this cable. A partial short on the 3 phase power lines, 7 (neutral), 6 (phase) and 3 (phase), forced abandonment of RCTV deployments for the remainder of the cruise.

The cable was deployed a total of seven times.

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FRV *Scotia*

Cruise 0803S, Part II

REPORT

28-31 May 2003

Personnel

David Bruno (In charge)
Alistair McIntosh
Wendy MacDonald
Mary O'Dea
Elaine Moore
Pamella Steenson
Stuart Wallace
Katy Adamson
Bryan Johnston
Stephen O'Neil

Fishing Gear

BT 101 (48' Aberdeen trawl) with tickler chain and small mesh cod end.

Objectives

To perform a check monitoring fish disease survey off the Moray Firth, a reference area (east of Orkney), Bell Rock, St Abbs and at several areas in the vicinity of Marr bank and Wee Bankie. Tissues will be collected from common dab for mixed function oxidase activity and PAH bile metabolites. Grab samples will be obtained from each station and analysed for PAH. A variety of species will be sampled to test as vectors for IPNV and the role of wild marine and freshwater fish in the maintenance and spread of this disease. The distribution and prevalence of this virus will be determined and the genetic relatedness of isolates will form future work. Cod, haddock, turbot, halibut and whiting will be sampled for bacteriology, parasitology and virology to record base line pathogens to model possible interactions with farmed salmonids in terms of disease transfer. *Lepeophthirus salmonis* negative plankton samples will be collected and used to 'spike' with known amounts of *L.salmonis* copepodids to determine the lower detection limits of molecular techniques.

Procedure

FRV *Scotia* will work in the Moray Firth, east Orkney, Bell Rock and St Abbs areas obtaining fish samples by trawling. The cruise will start and terminate in Aberdeen.

Out turn days per project: 2.7 days AE11a; 1.3 days AE08o

Narrative/Results

FRV *Scotia* sailed from Aberdeen on 28 May at 0840 hours and commenced trawling in the vicinity of the Beatrice oil platform during the afternoon, and worked south east of Fair Isle

early on 29 May. Sampling was started Bell Rock late on 29 May followed by St Abbs Head. Additional stations were included at Wee Bankie and Marr Bank before docking in Aberdeen 0600 hours on 31 May.

A total of 10 trawls were successfully completed and 8139 common dab, *Limanda limanda* examined for disease by standardised ICES methods and a full data set for the intermediate fish length groups achieved for the long term monitoring positions. The livers from fish >25 cm were examined for tumour development. All cod caught were examined for pseudobranch lesions. Fifty haddock equal to or greater than 26 cm were sampled from individual hauls and examined for vertebral deformities. Histological samples and tissues placed in liquid nitrogen were taken from gill X-cell lesions for future work.

Within each area, 20 common dab (10 male, 10 female) were sampled for mixed function oxidase function activity, PAH bile metabolites and PAH concentration in liver and flesh. A sediment sample was taken from three points along the trawl tract. The sediment will be analysed for PAH. In addition, sediment was sampled for oestrogenic chemical residues at Bell Rock and St Abbs head.

A total of 1889 fish were sampled to determine the prevalence of infectious pancreatic necrosis virus (IPNV) from 11 fish species. The genetic relatedness of isolates will form future work. Fish kidney was pooled from 10 fish, one sample was placed in RNA later for molecular analysis and a duplicate sample placed in liquid nitrogen. Additional cod and haddock were sampled for VHSV, IHNV and IPNV, bacterial infection and then frozen for parasitology examination.

Plankton samples were collected and will be used as negative material for later work to determine the lower detection limits of molecular techniques for *Lepeophthirus salmonis* copepodids.

All the main objectives of the sampling programme were successfully achieved thanks to the excellent cooperation of the officers and crew of the FRV *Scotia*.

David Bruno
2 June 2003

Seen in draft: Captain Peter Barrett, OIC *Scotia*