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FRV *Clupea*

Cruise 1300C

## REPORT

11-20 September 2000

### Personnel

Mike Breen	(In charge)
Graham Sangster	
Rob Kynoch	
Neil Collie	
Peter Barkel	
Barry O'Neill	(11-15 September 2000)
Emma Jones	(16-20 September 2000)

### Objective

To assess the performance of a new cod-end cover design for sampling live fish escaping from trawl cod-ends for use in survival experiments. The performance of the new cover design was compared with the original survival cover design with respect to:

1. Their effects upon the trawl, in terms of drag and gear geometry;
2. The respective hydrodynamic regime within each cover; and
3. The behaviour of captive fish within the covers, in terms of swimming performance and reactions to visual stimuli and changes in water flow.

**Out-turn costs per Project:** 10 days MF06q

### Narrative

Installation of equipment was carried out between 4-8 September 2000 while FRV *Clupea* was in Fraserburgh harbour. All personnel joined the vessel on the morning of 11 September 2000 and FRV *Clupea* departed Fraserburgh harbour at 1000 GMT. The vessel then steamed to the Moray Firth and arrived on site at 1330 GMT. All fishing tows were performed at the same site (57°49'N 2°53'W to 57°49'N 2°59'W); which was known to be clean ground, had good underwater visibility (~15-20 m) and was well populated with juvenile gadoids. At night, the vessel steamed inshore and anchored in either Spey Bay or in the lee of Burgh Head depending on the prevailing wind and sea-state.

FRV *Clupea* returned to Fraserburgh on the evening of 15 September 2000 to transfer personnel, landing at 1700 GMT. The vessel departed Fraserburgh at 0500 GMT 16 September 2000 and was on site again at 0800 GMT.

On 17 September 2000 the RCTV cable, whilst being deployed, became fouled in its supporting block; damaging both cable and block. The haul was terminated and the vessel returned to

Fraserburgh, landing at 1330 GMT, to exchange RCTV cables and repair the damaged block. The opportunity was also taken to make repairs and alterations to the new cover while in harbour.

The vessel departed Fraserburgh again at 0500 GMT on 18 September 2000 and was on site at 0830 GMT. While attempting to deploy the RCTV during the first haul on the 18 September 2000, the cable again became fouled in the block, damaging the block for a second time. It became apparent that this replacement cable had been previously damaged and repaired by taping over the split sheathing. It was this taped area that had jammed in the block causing the damage to the block on this second occasion. The cable was not damaged further but clearly could not be used safely in combination with the damaged block. The RCTV was not deployed for the remainder of the cruise. All subsequent hauls (#162 - #164) had to be performed without direct observations, although a self recording mini-TV system was deployed to obtain some fish behaviour observations from the interior of the cover.

FRV *Clupea* returned to Fraserburgh on 19 September 2000, landing at 1600 GMT. The vessel was unloaded the following day (20 September 2000), with personnel leaving the vessel returning to Aberdeen at 1200 GMT.

## **Results**

A total of 15 hauls were completed during these trials. Whilst the number of productive hauls was limited by problems with the RCTV and other equipment failures, all the main objectives for the cruise were achieved.

### **New cover design - general performance and handling**

This was the first time this new cod-end cover design had been used in full scale. It was shown to be a practical design which performed as anticipated, following trials on a model in a flume tank. That is, it substantially reduced the internal water flow at the rear of the cover without having any adverse effects on the performance of the trawl. In addition, the cover remained hydrodynamically stable over the full operational range of towing speeds (2.0-3.5 kts). However, the size of the metal cage supporting the cover liner and gate at the rear of the cover made it awkward to handle on deck and would prove limiting in rough weather. This cage will be reduced in size for future designs.

### **The effects of cod-end covers on trawl performance**

The geometry of the trawl, namely headline height, door spread and wing spread, was monitored using Scanmar equipment. In addition, the total drag of the gear at the vessel and at the net (wing ends) were measured using deck tension meters and load-cells, respectively. A total of six reciprocal tows were performed using this instrumentation. These yielded full descriptions of net geometry and drag, over a range of towing speeds (2.0-3.5 kts), for the trawl alone, the trawl with original cod-end cover attached and with the new cover attached (see Table 1).

Clearly the attachment of cod-end covers had little impact on the gear's towing speed, headline height or wing spread. However, it did significantly increase drag, particularly at the net, which resulted in a substantial decrease in the door spread. Surprisingly, the new cover design had less of an impact upon the gear performance, with respect to all measured parameters, than the original cover design. It was expected that the new cover design would have a greater drag and thus was more likely to deform the trawl shape. The reasons for this unexpectedly low drag are unclear.

## **Water flow in and around the trawl cod-end and covers**

Complete descriptions of the flow in around the cod-end and the original cod-end cover were obtained over a range of towing speeds (2.0-3.5 kts). Only a partial description of the water flow in the new cover design was achieved, however, because of equipment failures. Figure 1 summaries these results at a typical operational towing speed (1.4 m/sec), where: P2 is at the head of the cover; P3 above the cod-end; P6, P7.5 and P8 are ~5.5 m, ~8.5 m, and ~9.5 m behind the cod-end respectively; and P10 is 0.5 m ahead of the end of the cover.

It is clear that attaching a cover to the cod-end of a trawl significantly influences the flow in and around that cod-end. Moreover, in the original cover design there is still a substantial flow in the rear of the cover which is potentially injurious to any fish captive within the cover. Both these observations have important implications on the interpretation of escape mortality data obtained using this original cover design.

## **Behaviour of captive fish within the cod-end covers**

Direct observations of the behaviour of captive fish within both codend covers were recorded on video tape using the RCTV (6.5 hours) and a self recording mini TV system (8 hours). The fish seen in the covers consisted predominantly of juvenile gadoids, in particular haddock. Fish escaping from the cod-end were seen to pass freely into the following cover, despite the reduced flow in this region. In both covers, fish fell back towards the rear of the cover, occasionally swimming into the flow while holding position for short periods before falling back further. At the end of the original cover, large numbers of fish collected and were seen swimming strenuously to maintain station in the flow. The majority of these fish were orientated towards the oncoming flow. A considerable number of fish were also seen to collect on the rear most netting of the cover, held there by the oncoming flow. Conversely, at the end of the new cover, fish were seen to be swimming freely with random orientations, clearly not experiencing any significant flow.

Mike Breen  
15 December 2000

Seen in draft: A Simpson, OIC

**Table 1**

Gear Performance Parameters at a typical operational towing speed (1.4 m/sec) with and without Cod-end Covers attached.

	Net Speed (m/sec)	Headline Height (m)	Door Spread (m)	Wing Spread (m)	Total Drag at Vessel (kg)	Total Drag at Net (kg)
Trawl Only	1.37	5.25	41.54	11.96	2711.8	1672.5
Old Cover	1.45	5.37	37.31	11.31	2828.4	1869.8
New Cover	1.41	5.29	38.53	11.82	2749.1	1817.1

Figure 1

Water Flow, at 1.4 m/s towing speed,  
in and around Codend, New & Old Covers

