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FRV *Clupea*

Cruise 0800C

REPORT

29 May - 7 June 2000

Personnel

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Objectives

1. To study the performance of selective whitefish grids (Eurogrids) using 30 mm and 35 mm bar spacings, with particular reference to water flow and fish behaviour reactions.

2. To obtain underwater video film of grid performance when fishing the main commercial North Sea roundfish species, ie haddock, whiting, cod and saithe.

3. To undertake deck handling trials with centrally hinged grids.

Out turn costs per project: 10 days; C630

Narrative

Clupea left Fraserburgh on 29 May and steamed north to Orkney waters where work began off Copinsay on 30 May. Trials continued until 31 May, when damage to the cable of the RCTV (Remotely Controlled Television Vehicle) required that *Clupea* proceed to Kirkwall for repairs. Shore-based technicians arrived on the morning of 1 June, and repairs were completed that evening. Bad weather prevented the vessel sailing until the morning of 3 June, when trials were resumed in the Copinsay area. Work continued until the afternoon of 6 June, when *Clupea* made passage south. After unloading fishing gear and instrumentation at Fraserburgh on 7 June, scientific staff returned to Aberdeen.

Results

Sixteen hauls were carried out, on 14 of which the RCTV system was deployed. Eight hauls were made with each polyamide grid. The 35 mm version, complete with netting section, was provided by the Norwegian Institute of Marine Research, Bergen, and measured 1,300 mm by 750 mm. Bar thickness/bar spacing ratio was 14/35, giving 28.6% solidity. The 30 mm version was manufactured in Denmark to a design based on experimental work carried out at the DIFTA flume tank in Hirtshals. This grid had the same width of 750 mm, but was somewhat longer at 1,500 mm, with a bar thickness/spacing ratio of 15/30, ie 33.3% solidity. Both grids were installed in 100 mm (inside mesh) braided polyethylene netting sections 8 metres in length.

The Norwegian grid section was constructed in double 4 mm twine, whereas the Danish section used single 4 mm twine. Flume tank observations had suggested that thinner netting would improve water flow. The Norwegian grid was fitted into a netting circumference of 92 open meshes, giving a perimeter length per

mesh of 44.6 mm. The Danish grid was fitted into 100 open meshes, the maximum number permitted in whitefish cod-ends under current EU legislation, to give a similar perimeter length per mesh of 45 mm.

Both grid sections were mended directly on to the end of the tapered section of the trawl, with no intermediate extension piece, and a 6 metre long polyethylene cod-end (100 mm inside mesh with 4 mm double-braided twine) was attached to the after-end of each grid netting section. The trawl used was a hard ground rockhopper gear with cutaway lower wings and 69 m fishing circle. This was fished with 2.4 m Vee doors,110 m sweeps and 15 m spreaders. At a typical towing speed of 2.7 knots, headline height was measured at 4.8 m and wingspread 14 m, which for this type of trawl suggests an estimated swept volume of around 66 cubic metres per second.

Grid performance

In order to facilitate RCTV handling, hauls were towed either with or against the prevailing strong tides. Both grid systems were observed to remain well off the bottom without flotation during towing, but two 200 mm plastic floats were added to ensure the grids stayed upright while shooting. The two sections of the Norwegian grid appeared to adopt different angles of attack, with the upper section lying at a shallower angle than the lower. As the appropriate bracket to measure these angles using Scanmar had not then been received from Norway, an ad hoc system utilising FRS Marine Laboratory self-recording heel and pitch meters (instrumentation designed to measure otterboard performance) was developed. These instruments are limited to measuring ± 38 degrees from horizontal, but this range was adequate as the upper and lower sections were found to be adopting angles of 16 and 24 degrees respectively, much less than anticipated. Despite these shallow angles, the grid functioned well throughout the trials.

The Danish grid was installed into the netting section in Aberdeen using a fitting formula supplied by DIFTA. This stipulated that both selvedges should be attached to the grid some two thirds along the length of the grid, as opposed to the hinged centre as was the case with the Norwegian system. Although this proposed arrangement functioned well enough in flume tank trials, it proved totally impractical at sea when subjected to the strains of shooting and hauling. The grid was refitted with the selvedges centred and worked well thereafter. Both grid sections adopted a similar angle of attack, measured at 42 degrees using Scanmar equipment.

Water flow

As the maximum water velocity available to conduct trials at full scale with grid section and cod-end in the Hirtshals flume tank is 0.9 m/s, the opportunity was taken to measure water flow at more realistic towing speeds with regard to target species. Self recording flowmeters were fitted directly under the centre headline and immediately in front of the Danish grid. Several 'blocks' (periods of time during which engine RPM and propeller pitch are held constant) were carried out to examine the effect of towing speed variation on grid water flow. The results, expressed in flume tank terms, are tabulated below.

Block	Vessel speed over ground		Water velocity entering net	Water velocity entering grid
No	Knots	m/s	m/s	m/s
1	2.5	1.29	1.30	0.49
2	3.1	1.59	1.49	0.62
3	2.2	1.13	1.00	0.59
4	2.8	1.44	1.32	0.62

It can be seen that although water speed in the net mouth varies with towing speed, by the time the water reaches the grid it has slowed to a considerable degree, and the relationship has weakened substantially.

On the one haul when both flowmeter measurements were obtained with the Norwegian system, water speed at the net mouth was 1 m/s and 0.77 m/s at the grid. The latter velocity is appreciably higher than

that obtained in similar circumstances with the Danish system (Block 3). The Norwegian grid had, of course, a somewhat lower solidity and a much smaller projected area, but insufficient time was available to investigate this question further. However, water velocities in front of both grids were of the same order as similar measurements obtained during tank trials, which would appear to validate the use of flume tank techniques in full scale grid development work.

Fish behaviour observations

Of the four target species, only small haddock and whiting were encountered on the grounds. Underwater visibility was reasonably good up to 75 m water depth, and observations were concentrated on escape behaviour in and around the grid section. Some four hours of videotapes were obtained, and this material will be analysed in detail at the Laboratory. Preliminary indications are that escapes through the grid greatly outnumbered any attempts by the small roundfish to pass under the grid into the cod-end. The Norwegian system was constructed with 24 free meshes below the grid, whereas the Danish system had 15. It was felt that the latter might be prone to blockages by larger flatfish, weed, etc so towards the end of the cruise this number was increased to 20. Due to a mechanical malfunction of RCTV equipment however, no observations were made on this arrangement. The most striking images recorded were the substantial numbers of escapes from both systems through netting immediately ahead of the grid, where the meshes were forced open by the high perimeter length per mesh ratio. It is clear that any design for future selectivity experiments on haddock and whiting will need to take such escapes into account.

Deck handling

An important part of this project is the development of an easily handled user friendly grid system that can be hauled directly onto net drums, and Eurogrids are furnished with central hinges to facilitate this. One major concern is the strength of both the nylon grid material and steel hinges to stand up to commercial operating conditions. Both grids were equal to all demands made on them, though it must be said that weather conditions were for the most part benign. The Norwegian grid, which had been damaged on a previous selectivity experiment on the commercial trawler *Bliki* and had undergone temporary repairs, stood up to these trials without modification. A further 40 minutes of surface videofilm was shot recording hauling procedures and deck handling operations. Both this and the underwater video material will be used in presentations to fishermens' associations, and will also feature in a compilation videotape describing the Eurogrid project (EU contract FAIR - CT98 - 3536) to be submitted with the final report.

R D Galbraith
18 August 2000

Seen in draft: A Simpson, OIC