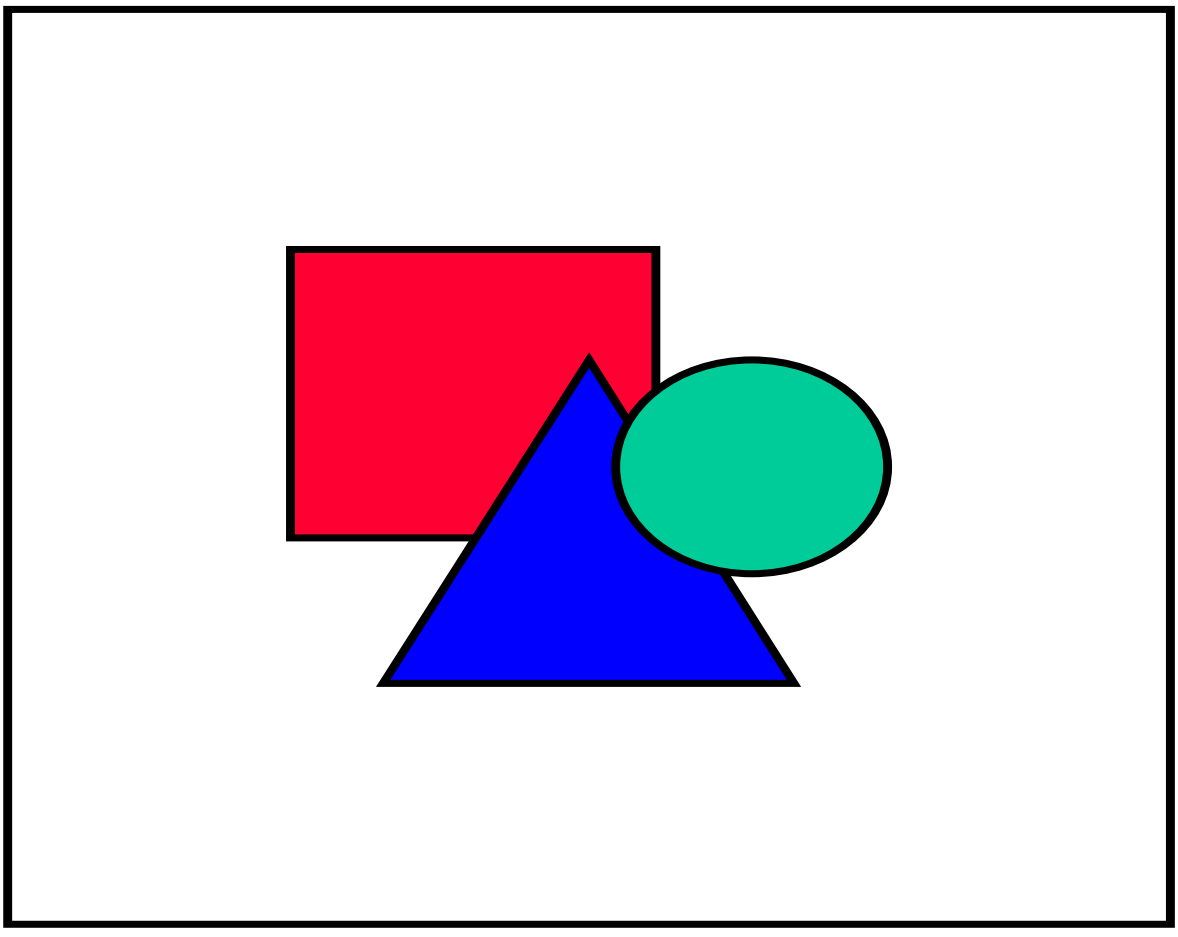
Improving Selectivity in Towed Fishing Gears

Investigating the use of double square mesh panel arrangements in pair trawls



Seafish Report no. SR540

December 2001

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Sea Fish Industry Authority
Seafish Technology

Improving Selectivity in Towed Fishing Gears

Investigating the use of double square mesh panel arrangements in pair trawls

Seafish Report No. SR540 December 2001

Summary:

This report describes work carried out with funding support from the Scottish Executive within the framework of the Industry Partnership Programme. It resulted from the introduction of legislation making square mesh panels (SMPs) mandatory in a number of UK fisheries. Industry reaction to the legislation suggested that a single specification did not suit all combinations of vessel and gear type. In particular there was a concern that relatively high powered pair teams were seeing no reduction in discards of haddock and whiting. The trials compared the catch data of a pair using a conventional SMP against that from a double SMP.

The aims were:

- To compare the catch compositions from a trawl fitted with a single square mesh panel to that of a similar trawl fitted with two identical panels in a double panel arrangement.
- To establish if improvements in discard reductions could be achieved for haddock and whiting by modifying square mesh panel arrangements within the scope of the current legislation.
- To determine whether the double panel configuration is a practical option suited to pair trawling operations.

Twelve days of sea trials were carried out working under commercial conditions as far as possible and collecting comparative catch data.

The main aims of the trials were achieved. The double panel arrangement did appear to reduce discards and show better size selection although a more significant improvement had been expected.

The pair trawling operation proved to be difficult as a means for conducting an alternate haul catch comparison exercise. Problems were encountered in achieving consistent hauls as a result of the scarcity of small haddocks.

The results indicate that there is potential for improving the level of discard reduction of haddock and whiting using a double square mesh panel arrangement in pair trawls. This can be achieved by using configurations that are allowable within the current fisheries regulations.

The double SMP arrangement had no detrimental affects on normal operating procedures, or the catch rates of marketable fish of the main target species.

The construction of the panels in the equivalent of 50 diamond mesh lengths also provides a certain amount of flexibility with regard to panel position. There is further scope for investigating optimum panel positions to suit specific species and/or fisheries conditions. This could easily be achieved by fishermen themselves, should the willingness be there.

1 Introduction

The project described in this report was carried out with funding support from the Scottish Executive within the framework of the Industry Partnership Programme.

The programme involves collaboration with industry and other R&D organisations to improve whitefish selectivity through the more effective use of technical conservation measures.

The work involves both the development of new ideas and an ongoing effort to improve the effectiveness of existing measures.

The use of square mesh panels as bycatch reduction devices (BRDs) has been investigated extensively over recent years in fisheries all over the world. They have been a mandatory requirement in UK *Nephrops* fisheries since the early 1990's. Recent changes to UK fisheries legislation (August 2000 and April 2001)* introduced regulations governing the requirement to fit square mesh panels to all demersal towed gears, except beam trawls.

Shortly after the introduction of these new regulations, information received from skippers operating in a number of different fisheries reflected their dissatisfaction with the performance of the panels. Reports ranged from indications that the panels were too efficient, in that they released too many marketable whiting from seine nets, to being of little benefit in the larger pair trawls where discard levels remained high.

This information, although mostly anecdotal, raised sufficient concern to prompt Seafish into investigating ways of optimising the performance of this technology in some of the areas of concern.

The first problem to be examined was that relating to pair trawl fisheries where excessive discarding of undersize haddocks was being reported.

The new square mesh panel regulations applying to whitefish nets are based on the existing requirements for *Nephrops* trawls and as such, the minimum panel requirements may not be sufficient to deal with the conditions encountered in pair trawl operations. Relatively high levels of discards of juvenile haddocks still remain a problem in some pair trawl fisheries.

Seafish gear technologists proposed a way of enhancing the performance of the square mesh panel technology whilst remaining within the scope of the current regulations. The aim was to improve whitefish selectivity simply by manipulating panel area and position.

A fishing trial was arranged with an established pair trawl team to evaluate the performance of a double square mesh panel arrangement in a typical mixed species, ground fish fishery with a seasonal predominance of haddocks. The exercise was conducted as an evaluation following normal commercial operating practices with a scientific evaluation of catches. The intention was to establish if simply modifying the existing panel arrangements could produce an improvement. If the principle could be demonstrated to be sound, then further exercises could be conducted to optimise panel configurations over a range of circumstances or fishing conditions.

(Square-Mesh Panel Council Reg. (EC) No 850/98. The Sea Fish (Specified Sea Areas) (Regulation of Nets and Other Fishing Gear) (Scotland) Order 2000 No.227) and The Sea Fish (Specified Sea Areas) (Regulation of Nets and Other Fishing Gear) Order 2001 No.649).

2 Background

The current UK regulations governing the use of square mesh panels in white fish trawls are basically the same as those for the *Nephrops* fisheries. The only significant difference is their relative positions within the net.

The panel's primary function in a *Nephrops* trawl is that of species selection, i.e. to release round fish bycatch species such as haddock, whiting and pout without affecting the target catch. The panel is required to perform a different function when it is incorporated into whitefish nets. The role is switched to one of size selection of the targeted round fish species. In both situations the aim is to reduce discarding of finfish.

These differences in roles can influence the effectiveness of the panels. If the minimum regulation requirements are used in *Nephrops* trawls they may be adequate to deal with the relatively small bycatch component of the catch. In whitefish nets however, the panel is expected to perform its function on almost the entire catch. In this situation, the minimum requirement may not be sufficient to produce the desired reduction in discards.

In pair trawling operations, the scale of the gear, towing speeds and the quantities of fish encountered all combines to further reduce the effectiveness of the panel in its basic configuration.

One or more of the following can influence the performance of any square mesh panel: mesh size, twine diameter, panel size and position. It is suspected that the reported ineffectiveness of square mesh panels in pair trawls is attributable to the size (area) and position of the panels. All these parameters are controlled through regulation by imposing minimum allowable cases. There is however, flexibility to introduce improved options to suit pair trawling operations.

During the capture process, fish passing down the extension of the trawl are presented with an escape opportunity as they are forced past the square mesh panel. Their opportunity to escape is influenced by the time they spend in the region of the panel and competition for available escape gaps, i.e. open square meshes. This is dictated to a certain degree by the speed at which they are pushed back down the net as a result of the towing speed and the catch rates that are encountered. In general terms the panel will provide more opportunity for escape at lower towing speeds and lower catch rates. Similarly, for a given towing speed, the opportunity for escape should increase with an increase in panel area.

Observations suggest that fish respond more actively to a sudden change in conditions, as experienced by the fish passing from within the diamond mesh section of the extension to the region of the panel. Any prolonged exposure may result in the fish becoming 'acclimatised' to the panel and hence lessening the escape response. For this reason, multiple square mesh panels should be more effective, particularly if separated by sections of diamond mesh.

Seafish chose to investigate modifications to panel size and position as an option for improving performance in pair trawls. This was done by using a double square mesh panel arrangement with the individual panels being almost twice the stipulated minimum length and each panel being separated by a similar length of diamond mesh.

3 Aims and Objectives

The overall objective of the programme within which these trials took place was to improve the selectivity of demersal towed fishing gears. The principal mechanisms for achieving this are improvement of existing technical conservation measures and the development of new ones.

The aims of this exercise were:

- To compare the catch compositions from a trawl fitted with a single square mesh panel to that of a similar trawl fitted with two identical panels in a double panel arrangement.
- To establish if improvements in discard reductions could be achieved for haddock and whiting by modifying square mesh panel arrangements within the scope of the current legislation.
- To determine whether the double panel configuration is a practical option suited to pair trawling operations.

4. Materials and Methods

4.1 Approach

This work was initiated in response to concerns raised by fishermen who were still experiencing significant numbers of discards in their fisheries. Such feedback is essential if partnerships between industry and the scientific community are to work effectively at producing technical solutions to industry problems. The fishermen's acceptance of the problem is the first step towards finding a solution. Working with fishermen that have a genuine interest in resolving a problem greatly improves the chances of success. This is a major consideration when selecting skippers to carry out these trials.

The trials were conducted as a catch comparison exercise following normal commercial operating practices. The exercise was designed to limit interference with normal haul by haul procedures whilst at the same time trying to maintain an acceptable degree of scientific rigour with regard to the collection of catch data.

All codends and extensions, including the square mesh panels, were provided by Seafish to ensure comparability for these sections of the gear. The trawls used for the trials were as near identical as could be established. Historical information showed that both vessels/gears performed comparably as indicated by landings data.

The same sampling procedures were used on each vessel of the pair. These were carried out by two Seafish representatives on each vessel. The experimental gear (double panel arrangement), was swapped between vessels at approximately the halfway stage of the trip. This was to limit the effects of any bias that may have been present in the vessel/skipper arrangements.

In most situations, because of the quantities of fish involved, best estimates of total catches were used to establish raising factors for catch comparisons. Every effort was made to ensure that these gave accurate estimates of overall catches.

4.2 Vessel details

The Peterhead based pair trawling team of MFVs *Courageous* and *Treasure* were selected for this work.

The vessels are almost identical, both being built in the same Danish yard to the same plans**.** The team concentrates its operations in the Norwegian Sector of the North Sea targeting the predominant ground fish species, cod, haddock, whiting, saithe and flatfish. The average trip length is 10 days.

Vessel Details:

Registered Length	23.76m
Depth:	3.99m
Tonnage:	177t
Main Engine:	Caterpillar D398 developing 465kw

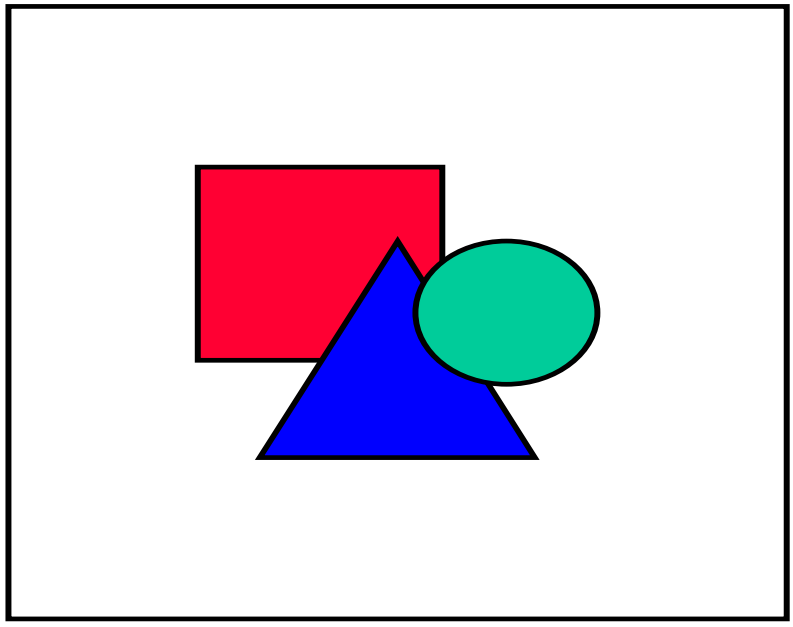

Figure 1: Pair trawling team of MFVs *Courageous* and *Treasure*

4.3 Gear details

Both vessels carry two sets of gear. The nets on each vessel are as near identical as it is practically possible to establish, being manufactured to the same specifications by the same net makers. They consist of:

- Fine ground trawl manufactured by Falcon Fishing, fished with 60-fathom sweeps (Figure 4).
- Rockhopper trawl manufactured by Jackson trawls, fished with a 30-fathom sweeps.

The wire arrangement used for the pair trawling operation consisted of 4 coils of 40mm combination seine rope (4 x 220m) + 274m (150 fathoms) of 26mm wire + 366-640m (200-350) fathoms of main warp, depending on depth. The trawls used for this trial were the fine ground nets rigged with 37m (20 fathoms) of single sweep (with rubbers) + 74m (40 fathoms) of bridles.

One vessel from the pair was selected to operate the trawl incorporating the double panel arrangement (MFV *Treasure*) and the other fished with a single panel for the first half of the trials. This arrangement was then swapped over to the partner vessel at a convenient stage, approximately halfway through the trials. The codends and extensions in both nets were constructed in nominal 110mm mesh. Actual average measurements by wedge gauge were 113mm for the codend netting and 94mm for the square mesh panel netting. Codend twine diameters were 4mm (double).

Details of the standard and the double square mesh panels are shown in Figures 3, 4 and 5. The square mesh panel for the control net was 5.7m in length and positioned less than 12m from the codline. The test arrangement consisted of two panels, each covering 50 diamond meshes and producing approximately 5.7m of square mesh coverage. Only one of the panels is required to satisfy the regulation with regard to position. The first panel was approximately 11.4m from the codline. A 50-mesh extension section separated the two panels.

Current legislation stipulates that square mesh panels '*shall be constructed of knotless netting or of netting constructed with non-slip knots'*. The double panels were constructed from knotless PE Ultracross™. This material is used to ensure that there is no knot slippage which otherwise results in mesh distortion. Mesh sizes were nominally 90mm for all panels.

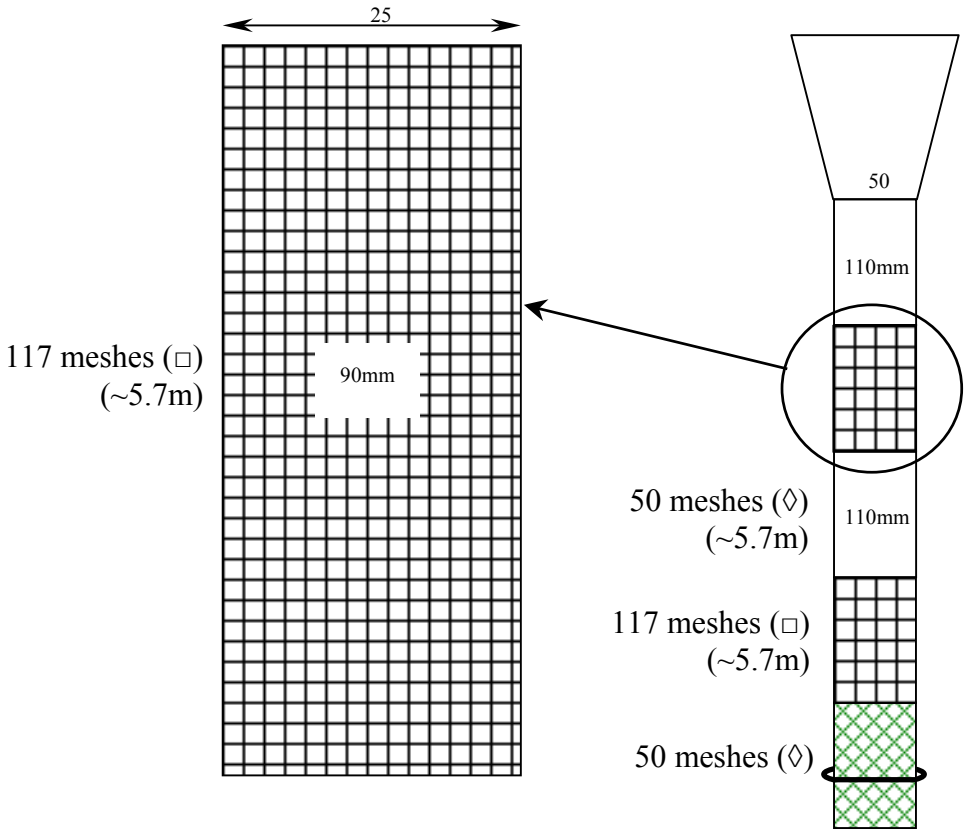

Figure 2: Double square mesh panel arrangement.

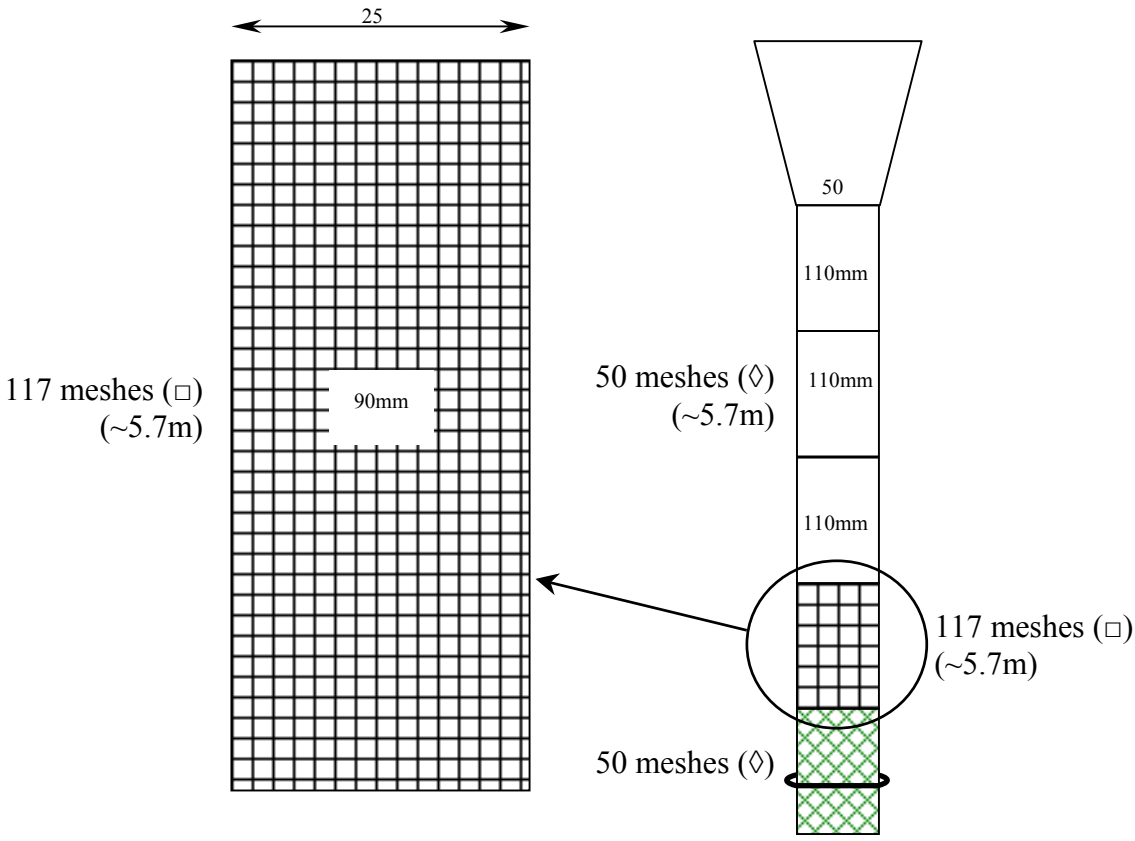

Figure 3: Single square mesh panel arrangement.

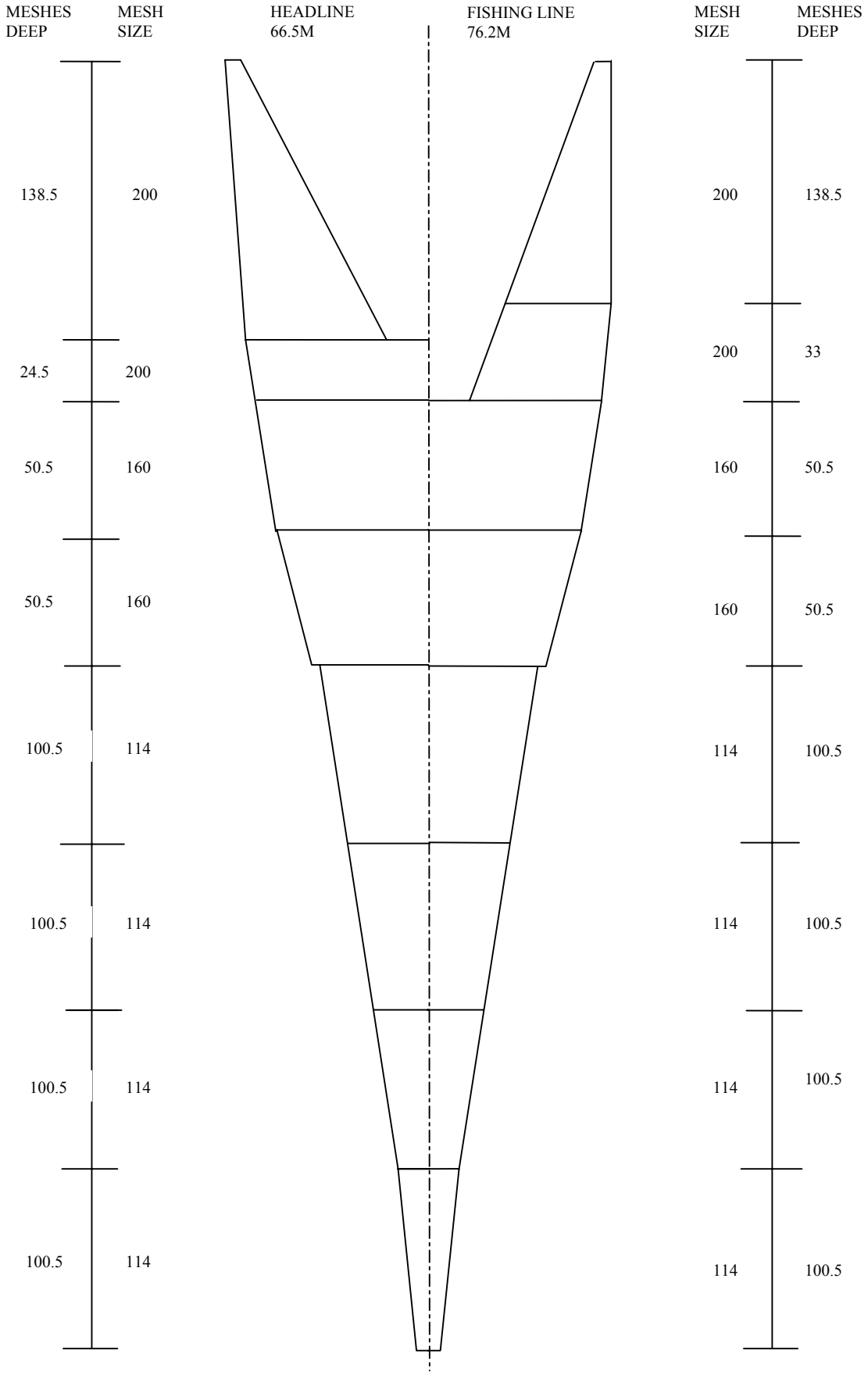

Figure 4: Schematic drawing of trawls used during the trials

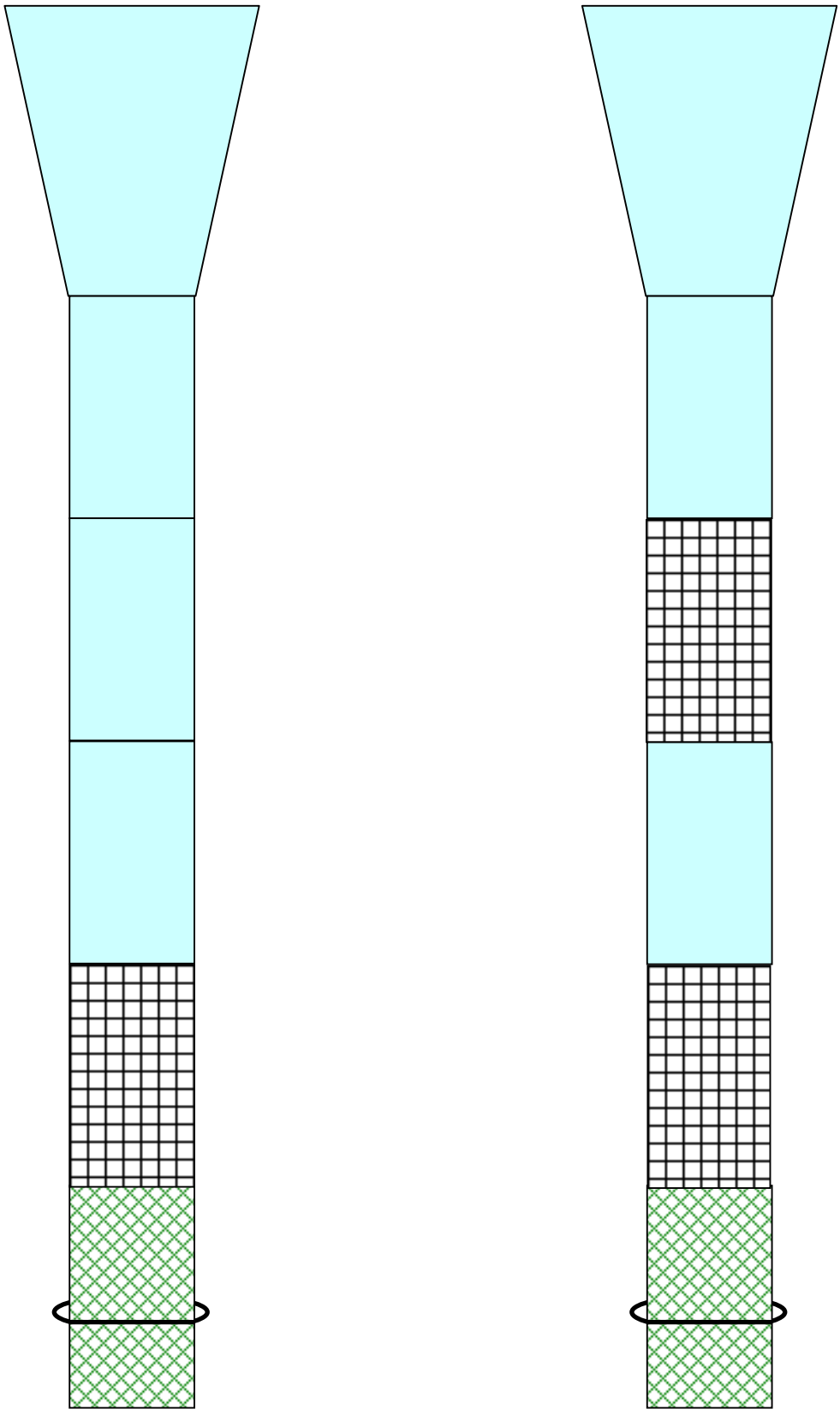

Figure 5: Showing relative positions of the square mesh panel arrangements compared during the trials.

4.4 Trials procedures

The trials were run over a period of 12 days during September 2001. They were conducted on the basis of normal commercial fishing practices with Seafish staff monitoring operations and recording catch data. The pair team would normally target ground fish species such as cod, flatfish and haddock. From the point of view of panel performance, haddock and whiting were expected to be the best indicator species. The skippers recommended the areas of operation, following instructions to target grounds holding concentrations of small haddocks. In this case, fishing took place in the northern North Sea (ICES IVa).

Operations were based in areas in which concentrations of small haddocks had been reported by a number of vessels fishing on these grounds a few days prior to this trip.

The single panel trawl was operated from MFV *Courageous*, for the first half of the trip, with alternate tows made with the double panel net from the partner vessel MFV *Treasure*. Most of the tows, (26 in total), were carried out in depths between 50 and 80 fathoms (92-124m). Tows were generally of 5 hours duration throughout the 24-hour period.

The catch sampling method used was agreed between the Seafish observers following discussions with the skippers and crews of both vessels. This reflected the limitations imposed by the working arrangements and the catch handling procedures on each vessel.

The total catch (bulk) was measured, in baskets, for each haul using the vessel's existing catch handling/sorting arrangement. Waste and discarded catch was channelled outboard by way of a disposal chute. The average capacity of this chute (number of baskets), was measured and the number of times that the chute was emptied outboard was recorded for each haul. This figure, multiplied by the average number of baskets of discarded catch used to fill the chute, was used to establish the raising factors for the catch samples and hence estimate the total number of discards.

Three separate, representative samples of the discarded fish were taken for measurement at the beginning, middle and end of the catch processing operations of each haul. This provided a good profile of the discarded fish.

All the main species of round fish entering the fishroom were sampled, either by measuring all the different size grades of cod, haddock and whiting, or a representative sample if large quantities were being retained. In most cases, because of the quantities involved, all of the haddock and whiting were measured. This procedure was used consistently on both vessels for all valid hauls.

The final tally of saved fish was combined with the discard figures to produce total numbers for cod, haddock and whiting and the subsequent length/frequency data shown in the results section.

Haul by haul observations were made on the general handling and performance of the double panel arrangement.

The first hauls produced unexpectedly low numbers of small fish despite good indications from the vessel's fish location equipment. This was also not consistent with the catch reports from other vessels in the area.

It was suspected that the combination of the increased panel area and lighter twine codends was releasing most of the small fish entering the gear. In order to test this idea, the codend/extension arrangement supplied by Seafish was exchanged for one haul for the vessel's own codend/extension, incorporating a single standard regulation 3m square mesh panel. The vessels own codends were constructed from heavier, stiffer twine (double 5mm, high density PE). The first haul following this change produced a bulk catch in the region of 100 baskets. The hauls immediately prior to and immediately following this were producing catches in the region of 20 baskets.

In order to retain more fish and therefore to establish a more realistic profile of the fish being encountered, a decision was taken to continue the trials using the vessel's own heavier codends attached to the original experimental square mesh panel extension arrangements.

5 Results

The aim of the exercise was to establish if the use of the double panel arrangement could reduce the number of discards of haddock and whiting without losing too many marketable size fish over the full range of species encountered.

Considering the catch profiles for the trip, the information collected was limited to length/frequency data for cod, haddock and whiting. Measurements for cod were included, but the data are of limited benefit in assessing performance due to their very limited escape responses when confronted with square mesh panels of this configuration.

Whiting are normally a very good indicator species in assessing the performance of square mesh panels. However, catch rates during these trials were extremely low, to the extent that the whiting data are of no significant value to this exercise. The catch data for cod and whiting are presented in Figures 6 and 7 and Tables 1 and 2 respectively in Appendix 1.

The best results, (greatest quantities of fish) were achieved during daylight hours, between early morning and noon. On the whole, concentrations of haddocks were difficult to locate and subsequently, catches were more inconsistent than had been expected. A considerable amount of time was expended steaming to and from different grounds in search of small haddocks.

Over the period of 10 fishing days 26 hauls were completed between the two vessels. Of these 20 produced catch data that could be utilised, the remaining hauls were invalidated due to gear damage resulting in incomplete hauls.

General observations of the panel performance were positive. No rigging or gear handling problems were identified. Very few meshed fish ('stickers') were observed in the panels. The exception being on some occasions when saithe and horse mackerel were encountered in the catches, resulting in some fish becoming enmeshed but not to the extent to cause problems.

Prior to the codends being exchanged, it was noticeable that the majority of the codend 'stickers' were trapped with their tail ends outwards. This suggested 'washout' rather than escape.

5.1 Haddock

The catch analysis for this exercise is concentrated on haddock as the predominant species caught that could be relied on as an indicator of the performance of the square mesh arrangements under test.

Figure 8 shows the Length/Numbers plot for the total haddock catch for the double and single panel arrangements. Further details of the total haddock catch are given in Table 3 in Appendix 1.

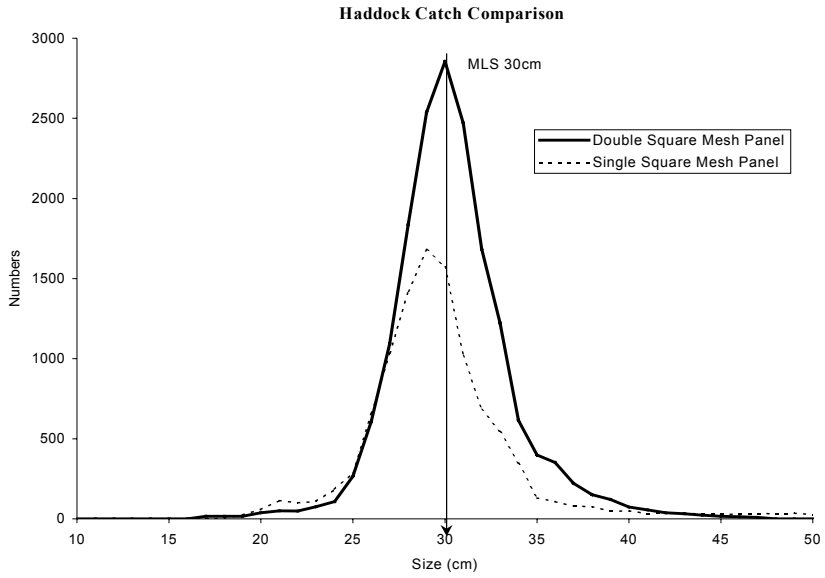

Figure 8: Length/Numbers plot for total haddock catch

From the catch data (Figure 8 and Table 3, Appendix 1), it can be seen that the size of fish retained ranged from 17cm to 47cm with the peak size being 29-30cm, i.e. right on the minimum landing size (MLS) for this species.

When comparing the catches from the two panel arrangements, the proportion of the total haddock catch retained that was below MLS, i.e. discards, was 38% for the double panel arrangement, compared to 54 % for the single panel, (a difference of 16%).

However, Figure 8 clearly shows a significant increase in numbers of haddock retained by the net fitted with the double panel. This was a result that was not expected and warranted further investigation.

Despite the double panel arrangement being swapped between vessels and used on an alternate haul basis, there appeared to be an unintentional bias in the trial procedures. The numbers of haddock caught by the net operated by MFV *Treasure* (19528) were far in excess of those caught by the MFV *Courageous* (7760) by a factor of about 2.5. A number of possible explanations are offered for this.

As a result of a combination of the working arrangements of the pair trawl team and a certain amount of coincidence, the net fished by MFV *Treasure* had more fishing time during the times of day that produced the best catches, i.e. dawn and dusk. Factors such as the number of invalid hauls attributable to each vessel (four for MFV *Courageous* and 2 for MFV *Treasure)* and the first hauls on new grounds after steaming producing poor catches, followed by further searching could all have a bearing on this result.

To take account of the differences in numbers retained between the two trawls used, further analysis of the data was required.

To aid in the interpretation of the results the data for catches taken by the net operated by MFV *Treasure* are labelled trawl A (TA) and those for MFV *Courageous* labelled trawl B (TB). The single square mesh panel configuration is labelled codend 1 (CE1) and the double square mesh panel codend 2 (CE2).

The data were analysed using:

- Length/Frequency (L/F)
- Length/Weight (L/W) using weight/length ratio formulae
- Length/Proportion (L/P)

The following summarises the data for the various panel and net combinations.

Analysis Summary

Configuration:	Sample numbers	Raised numbers	Percentage discarded	Percentage retained
Total CE1 (L/F)	2720	10687	54	46
Total CE2 (L/F)	2950	16721	38	62
Total CE1 (L/W)	N/A	N/A	31	69
Total CE2 (L/W)	N/A	N/A	29	71
TA CE1	1430	8156	55	45
TA CE2	1763	11472	38	62
TB CE1	1290	2411	50	50
TB CE2	1167	5249	40	60
Total TA	3213	19528	45	55
Total TB	1650	7660	43	57

From the information above, it can be seen that the double square mesh panel configuration (CE2), retained less discards by both weight and numbers. The figures were 38% and 29% respectively compared to 54% and 31% for the single panel configuration (CE1).

When comparing the various combinations of panels and trawls, the double panel (CE2) showed a reduced discard rate to that of the single panel whichever trawl it was attached to. On trawl A (TA), the double panel (CE2) produced discard rates of 38% compared to 55% for the single panel (CE1), a difference of 17%. When the double panel was fished on trawl B (TB) the rates differed by 10%, (40% and 50% respectively). Overall, the discard rates between trawls were very similar at 45% for trawl A and 43% for trawl B.

As previously highlighted, the number of haddocks retained by the double panel configuration (CE2) was significantly higher than that for the single panel (CE1). The Length/Numbers plot (Figure 8), for the total haddock catch, clearly shows the difference in catches between the two panel configurations, including the difference in numbers of fish above MLS retained by the double panel arrangement. However, it can also be seen that there is no discernible movement of the curve for the double panel to the right that would indicate a more selective configuration.

By considering the proportions of the catch at each length category rather than actual numbers, further analysis did indicate some signs of improved selectivity.

These data are presented in Figures 9-12 describing the various trawl/panel configurations as Length/Proportion plots for the data summarised in the analysis summary.

Looking at Figure 9, which compares the two panel configurations (CE1 and CE2) on trawl A (TA), there is a noticeable shift to the right of the curve representing the double panel configuration.

A similar shift is indicated in Figure 10 for the two panel arrangements on trawl B (TB). In this case it is a slightly bigger shift at the lower size range. Taken together, these data do appear to be indicating a slight improvement in selectivity for the double panel over the single panel.

As a further examination of the influence of the trawls themselves on these results, the data from each trawl, with each of the two panel configurations (CE1 and (CE2), are compared in Figures 11 and 12. In Figure 11 the performance of the single panel is compared on trawls A and B and in Figure 12, the double panel is similarly compared. The plots show no significant shifts in the curves indicating little, if any difference in selectivity between nets.

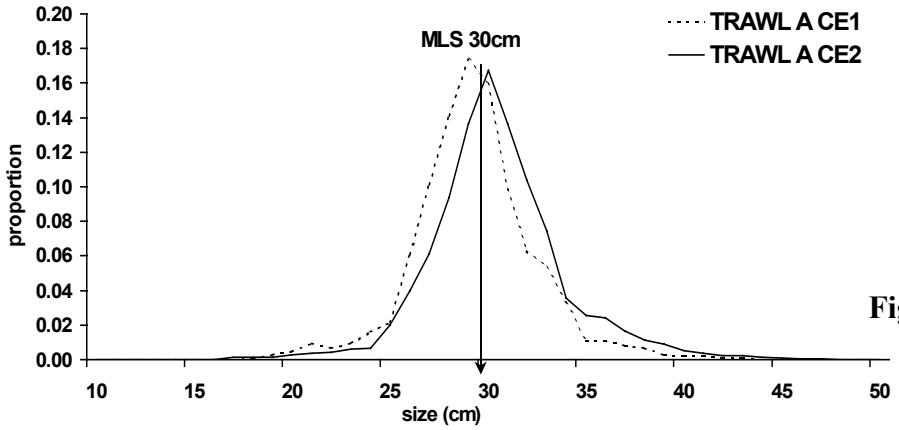

Figure 9

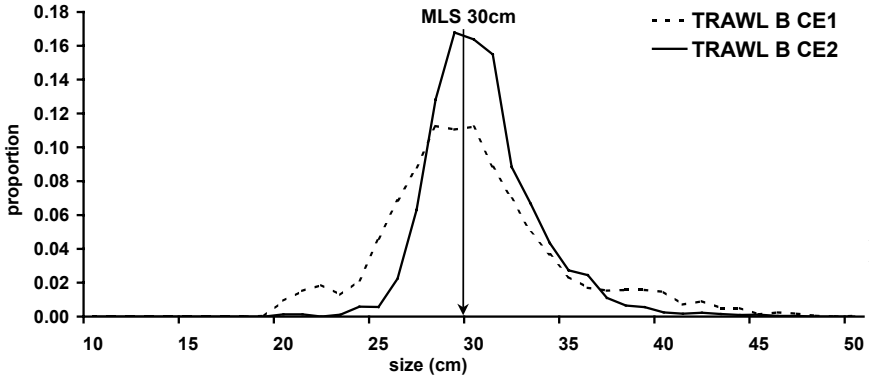

Figure 10

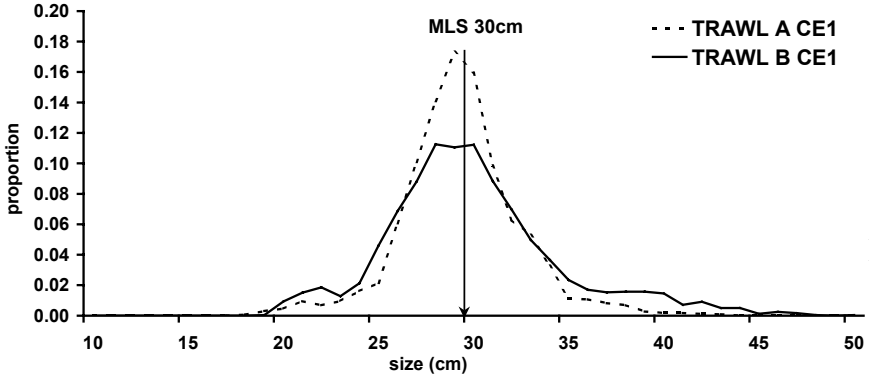

Figure 11

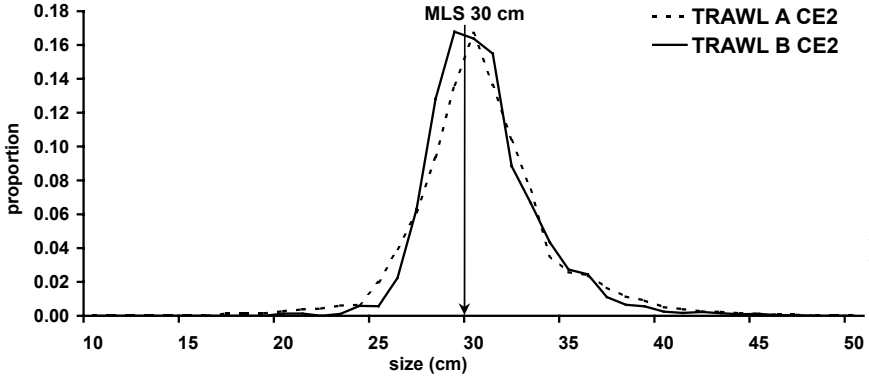

Figure 12

Figures 9-12: Length/Proportion plots for the net/panel combinations under test

6 Discussion and Findings

The main aims of the trials were achieved. The double panel arrangement did appear to have the ability to reduce discards and be more selective. However, considering the difference in panel area between the two configurations under test, a more significant improvement would have been expected.

It was expected that the combination of the increased panel area (x 2) and the positioning of the second panel in the double panel arrangement would have significantly reduced the numbers of small haddocks retained by the gear in situations where large concentrations of haddocks were encountered. Unfortunately, there was no opportunity to test this case during these trials. It is suggested that the increased panel area (approximately twice the minimum regulation requirement) in the single panel configuration was sufficient to deal with the numbers of haddocks encountered during these trials. In this case, perhaps the true benefits of the double panel were not realised.

The pair trawling operation proved to be a difficult one as a means for conducting an alternate haul catch comparison exercise. Problems were encountered in achieving consistent hauls as a result of the scarcity of small haddocks. The vessels spent considerable amounts of time moving from ground to ground in search of a suitable catch mix. The first hauls on new grounds were often unproductive necessitating further moves until suitable catches were achieved. The catch data from these hauls, although valid, contributed little to the evaluation of the different gear configurations.

The results have indicated that there is potential for improving the level of discard reduction of haddock and whiting using a double square mesh panel arrangement in pair trawls. This can be achieved without any detrimental affects on normal operating procedures, or the catch rates of marketable fish of the main target species. There is the additional benefit that an improvement can be achieved by using configurations that are allowable within the current fisheries regulations.

No practical handling problems were encountered during these trials. The practicalities of incorporating multiple square mesh panel sections should not pose any problems to experienced fishermen. The construction of the panels in the equivalent of 50 diamond mesh lengths also provides a certain amount of flexibility with regard to panel position. There is further scope for investigating optimum panel positions to suit specific species and/or fisheries conditions. This could easily be achieved by fishermen themselves, should the willingness be there.

7 Acknowledgements

Seafish gratefully acknowledge the following:

The Scottish Executive for its financial support to this work conducted under the Industry Partnership Programme.

The skippers and crews of the pair trawling team of MFVs *Courageous* and *Treasure* for their services and cooperation during these trials.

Skipper John Smith for his participation in these trials acting as industry observer and being actively involved in the catch sampling and data collection on behalf of Seafish.

Appendices

Appendix 1: Catch Data

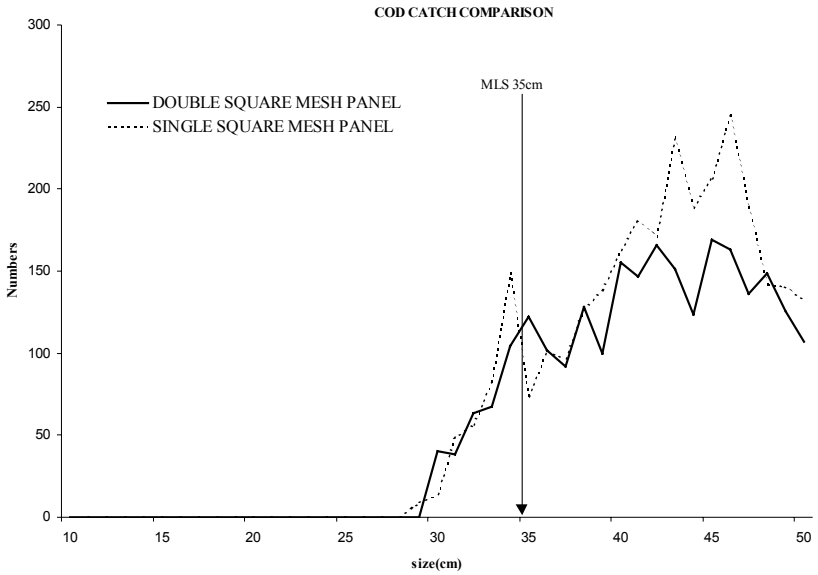

Figure 6: Length/Numbers plot for total cod catch

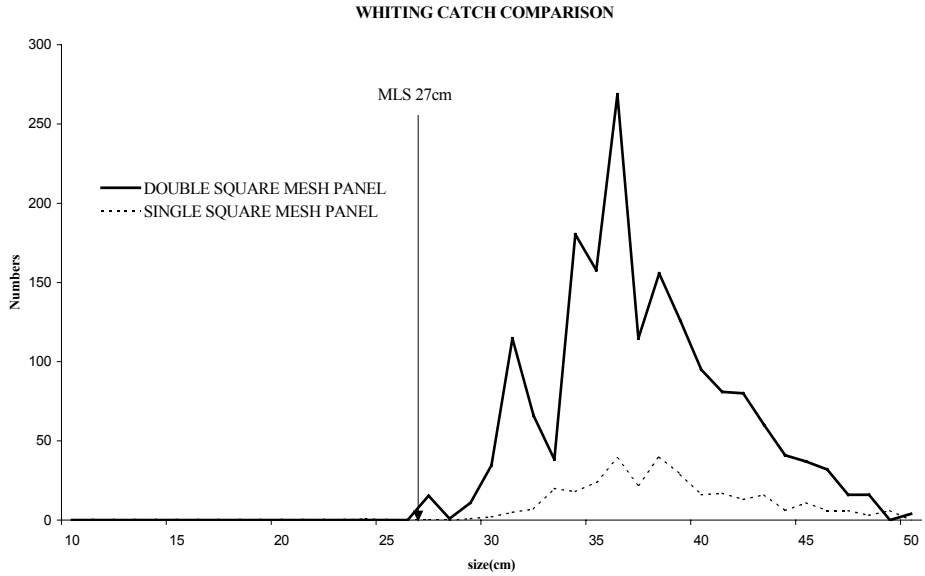

Figure 7: Length/Numbers plot for total whiting catch

Table 1: Catch data for cod

DOUBLE SQUARE MESH PANEL			SINGLE SQUARE MESH PANEL		
SAMPLE TOTAL	1657		SAMPLE TOTAL	1770	
RAISED TOTAL	3313		RAISED TOTAL	3882	
MLS (cm)	35		MLS (cm)	35	
% DISCARDS	9		% DISCARDS	9	
% RETAINED	90		% RETAINED	90	
COD			**COD**		
CLASS (cm)	RAISED NUMBERS	FREQ. (%)	CLASS (cm)	RAISED NUMBERS	FREQ. (%)
10	0	0.000	10	0	0.000
11	0	0.000	11	0	0.000
12	0	0.000	12	0	0.000
13	0	0.000	13	0	0.000
14	0	0.000	14	0	0.000
15	0	0.000	15	0	0.000
16	0	0.000	16	0	0.000
17	0	0.000	17	0	0.000
18	0	0.000	18	0	0.000
19	0	0.000	19	0	0.000
20	0	0.000	20	0	0.000
21	0	0.000	21	0	0.000
22	0	0.000	22	0	0.000
23	0	0.000	23	0	0.000
24	0	0.000	24	0	0.000
25	0	0.000	25	0	0.000
26	0	0.000	26	0	0.000
27	0	0.000	27	0	0.000
28	0	0.000	28	0	0.000
29	0	0.000	29	9	0.002
30	40	0.012	30	14	0.004
31	38	0.011	31	48	0.012
32	63	0.019	32	56	0.015
33	67	0.020	33	83	0.021
34	104	0.031	34	149	0.038
35	122	0.037	35	73	0.019
36	102	0.031	36	102	0.026
37	92	0.028	37	96	0.025
38	128	0.039	38	126	0.032
39	100	0.030	39	138	0.036
40	155	0.047	40	162	0.042
41	147	0.044	41	181	0.047
42	166	0.050	42	171	0.044
43	151	0.046	43	231	0.060
44	124	0.037	44	188	0.048
45	169	0.051	45	206	0.053
46	163	0.049	46	245	0.063
47	136	0.041	47	189	0.049
48	149	0.045	48	142	0.037
49	126	0.038	49	141	0.036
50	107	0.032	50	132	0.034

Table 2: Catch data for whiting

DOUBLE SQUARE MESH PANEL			SINGLE SQUARE MESH PANEL		
SAMPLE TOTAL	614		SAMPLE TOTAL	241	
RAISED TOTAL	1746		RAISED TOTAL	308	
MLS (cm)	27		MLS (cm)	27	
% DISCARDS	0		% DISCARDS	0	
% RETAINED	100		% RETAINED	100	
WHITING			**WHITING**		
CLASS (cm)	RAISED NUMBERS	FREQ. (%)	CLASS (cm)	RAISED NUMBERS	FREQ. (%)
10	0	0.000	10	0	0.000
11	0	0.000	11	0	0.000
12	0	0.000	12	0	0.000
13	0	0.000	13	0	0.000
14	0	0.000	14	0	0.000
15	0	0.000	15	0	0.000
16	0	0.000	16	0	0.000
17	0	0.000	17	0	0.000
18	0	0.000	18	0	0.000
19	0	0.000	19	0	0.000
20	0	0.000	20	0	0.000
21	0	0.000	21	0	0.000
22	0	0.000	22	0	0.000
23	0	0.000	23	0	0.000
24	0	0.000	24	1	0.003
25	0	0.000	25	0	0.000
26	0	0.000	26	0	0.000
27	15	0.009	27	0	0.000
28	1	0.001	28	0	0.000
29	11	0.006	29	1	0.003
30	35	0.020	30	2	0.006
31	115	0.066	31	5	0.016
32	66	0.038	32	7	0.023
33	38	0.022	33	20	0.065
34	180	0.103	34	18	0.058
35	158	0.090	35	24	0.078
36	269	0.154	36	39	0.127
37	115	0.066	37	22	0.071
38	156	0.089	38	40	0.130
39	126	0.072	39	29	0.094
40	95	0.054	40	16	0.052
41	81	0.046	41	17	0.055
42	80	0.046	42	13	0.042
43	60	0.034	43	16	0.052
44	41	0.023	44	6	0.019
45	37	0.021	45	11	0.036
46	32	0.018	46	6	0.019
47	16	0.009	47	6	0.019
48	16	0.009	48	3	0.010
49	0	0.000	49	6	0.019
50	4	0.002	50	0	0.000

Table 3: Catch data for haddock

DOUBLE SQUARE MESH PANEL			SINGLE SQUARE MESH PANEL		
SAMPLE TOTAL	2950		SAMPLE TOTAL	2720	
RAISED TOTAL	16721		RAISED TOTAL	10687	
MLS (cm)	30		MLS (cm)	30	
% DISCARDS	38		% DISCARDS	54	
% RETAINED	62		% RETAINED	46	
HADDOCK			**HADDOCK**		
CLASS (cm)	RAISED NUMBERS	FREQ. (%)	CLASS (cm)	RAISED NUMBERS	FREQ. (%)
10	0	0.000	10	0	0.000
11	0	0.000	11	0	0.000
12	0	0.000	12	0	0.000
13	0	0.000	13	0	0.000
14	0	0.000	14	0	0.000
15	0	0.000	15	0	0.000
16	0	0.000	16	0	0.000
17	15	0.001	17	0	0.000
18	15	0.001	18	5	0.000
19	16	0.001	19	25	0.002
20	38	0.002	20	60	0.006
21	50	0.003	21	115	0.011
22	49	0.003	22	102	0.010
23	75	0.004	23	111	0.010
24	105	0.006	24	184	0.017
25	257	0.015	25	288	0.027
26	571	0.034	26	665	0.062
27	1032	0.062	27	1042	0.097
28	1749	0.105	28	1430	0.134
29	2446	0.146	29	1699	0.159
30	2777	0.166	30	1590	0.149
31	2379	0.142	31	1037	0.097
32	1656	0.099	32	695	0.065
33	1205	0.072	33	565	0.053
34	635	0.038	34	364	0.034
35	439	0.026	35	147	0.014
36	404	0.024	36	129	0.012
37	248	0.015	37	104	0.010
38	165	0.010	38	94	0.009
39	132	0.008	39	60	0.006
40	72	0.004	40	50	0.005
41	54	0.003	41	32	0.003
42	41	0.002	42	31	0.003
43	34	0.002	43	20	0.002
44	23	0.001	44	13	0.001
45	19	0.001	45	3	0.000
46	9	0.001	46	6	0.001
47	9	0.001	47	4	0.000
48	0	0.000	48	1	0.000
49	0	0.000	49	0	0.000
50	0	0.000	50	1	0.000