Bord Iascaigh Mhara
Irish Sea Fisheries Board

Summary report of Gear Trials to Support Ireland's Submission under Articles 11 & 13 of Reg. 1342/2008 *Nephrops* Fisheries VIIa & VIIb-k

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1 Introduction

In 2008, a new EU long-term plan for cod stocks, which introduced kw day allocations on an individual vessel basis for the first time. The impact of the new Cod Recovery Plan on Irish fisheries and fleets has already been significant in the resulting effort reductions experienced by many vessels, particularly in the Irish Sea prawn fleet. In early February Minister Killeen formed a Working Group to look at these regulations in detail and develop a strategy to maximise the effort allocations for Irish vessels within the framework of the regulation.

In this respect it was identified that under Article 13 of the regulation, Member States can recoup effort up to the original baseline levels (2004-2006) provided they satisfy a number of criteria set out. In broad terms, these criteria define certain thresholds of cod catches that vessels must keep below to benefit from additional effort or exemption. Specifically vessels must engage in cod avoidance programmes and/or use gears that reduce cod catches that maintain cod catches at < 5% (cod avoidance programmes) or 1% (highly selective gears). Article 11 makes provision for fleets to be exempt from effort controls provided that they can demonstrate that they constantly catch less than 1.5% cod by trip.

As a result of the deliberations of the Working Group, BIM was requested to carry out a series of trials to look at gear options that could reduce cod catches in prawn fisheries in the Irish Sea and to assess whether these gears could maintain cod catches at the thresholds required under the EU regulations. This report details trials carried out specifically to identify gear options under Article 13 2(a) and (b) for *Nephrops* fisheries in the Irish Sea (Area VIIa) but also with application for other *Nephrops* fisheries in the Celtic Sea Area VIIb-k but with the longer term view of developing gears that would give a case for exemption under Article11.

2 Gear Options under Articles 11 and 13

In deciding on the most appropriate gears to test to meet the 1% (highly selective gears) and 5% (cod avoidance measures) thresholds set under Article 13 in the short term and the 1.5% under Article 11 in the longer term, an initial review of gear selectivity work globally was carried out. This review indicated that the number of gears proven at releasing cod is fairly limited due mainly to the sedentary behaviour of cod in trawls. The best options identified were identified as follows:

- Swedish Grid: Essentially this is a rigid grid placed in the extension of the trawl designed to release the bulk of round fish including cod, while maintaining catch rates of *Nephrops.*
- Inclined separator panel: A panel of netting inserted into the trawl and uses the natural behaviour of fish species to sort the catch into different catch components Trials have shown it relative effectively at reducing catches of cod, haddock and whiting over most size ranges, while retaining catches of other marketable species such as *Nephrop* and flatfish
- Square mesh panels: Used extensively in legislation and are cheap and simple to install. They are effective for reducing discarding of whiting and haddock provided they are suitably positioned as close to the codend as practically possible and of a suitably large mesh size to release the species concerned.

For cod trials in the North Sea and other areas have shown the mesh size needs to be > 120mm before any effect is seen.

- Eliminator trawl: An American designed trawl with large meshes in the forward part of the net that has been shown to be effective at releasing cod, without affecting the haddock and whiting catch. A modified design of this trawl, the Orkney Cod Avoidance Trawl, has been tested in the North Sea with reasonable results although this design does not eliminate cod catch totally but reduces it to low levels

On the basis of this review the first three options were considered the most appropriate to test in the *Nephrops* fisheries – the Swedish grid, Inclined Separator Panel and a 160mm SMP. The Eliminator and Orkney Cod Avoidance trawls were not considered as the large mesh bottom sheet section were felt not to be a realistic option given the design of standard prawn trawls and the natural behaviour of *Nephrops* to fall back in the trawl along the bottom sheet.

Swedish Grid

The grid was fitted into an 8 m long, non-tapered section of the trawl. The grid dimensions were 150 cm in height by 85 cm in width. The grid was hinged horizontally and required floatation from six 20 cm (8″) floats. The angle of the grid was 45^{o} and the spacing between the bars of the grid was 35mm. It was placed approximately 5m from the codline. A guiding panel of 80mm mesh was fitted (54 meshes wide) which directed the catch towards the bottom of the grid and an escape hole was cut from near the corners (all bar cut) down into a triangle (leaving five meshes across at its apex). The exit hole was subsequently strengthened with nylon twine. Figure 1 shows a schematic of the Swedish grid showing its position within the trawl.

Figure 1 Schematic drawing of the Swedish grid
(Images courtesy of Fisheries Research Services (FRS), Aberdeen. Crown Copyright 2004)

Inclined Separator Panel

The inclined separator trawl employs was inserted as a full 50 mesh section in the last tapered section fot he trawl ~12m above the codline with the leading edge of the panel horseshoe shape and set 1m into the bottom sheet. The panel measured ~ 3m long and was set at an angle of approximately 30º to the selvedge of the net. The leading edge of the panel was ~0.3m above the bottom sheet, and at it's widest point was one third of the width of the net from selvedge to selvedge. An escape hole was cut at the top of the panel and measured 30 meshes x 80mm across, approximately 2.4m stretched width. Figure 2 shows a schematic of the inclined separator panel and its position within the trawl.

Figure 2 Schematic drawing of the inclined separator panel
(Images courtesy of Fisheries Research Services (FRS), Aberdeen. Crown Copyright 2004)

160mm SMP

The 160mm square mesh panel was made up in a full net section with the square mesh panel in the top sheet and 80mm diamond mesh on the bottom sheet. This section was 3m long with the square mesh panel being 35 bars and made up in knotted 160mm (nominal mesh) x double 4mm PE twine mounted on the bar. This panel was inserted in two different positions. In the first trial the panel was placed 12m from the codline as part of the last tapered section of the trawl replacing the existing 80mm square mesh panel. In the second trial with the panel was moved closer to the codend approximately 5m from the codline. Only 6 hauls were completed with this second option and the results were inconclusive and are not presented in this report.

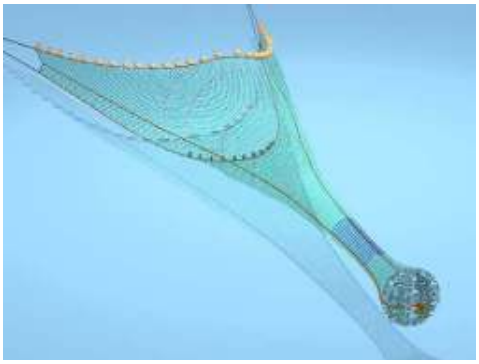

Figure 3 Schematic drawing of the 160mm Square mesh panel
(Images courtesy of Fisheries Research Services (FRS), Aberdeen. Crown Copyright 2004)

3 Objectives

These trials had the main objective of testing selective gears designed to reduce cod catches in *Nephrops* fisheries in Area VIIa and VIIb-k and to assess whether these gears could maintain cod catches at the thresholds required under Articles 11 and 13 of Regulation 1342/2008. A secondary objective was to estimate the impact of using such gears on catches of other key commercial species and discards as well as the practicability of using these gears on Irish vessels.

4 Overview of Trials

These trials were carried out on the Clogherhead based twin-rig trawler MFV "Supreme II", owned by Jim Connolly using a twin-rig catch comparison with one trawl rigged as standard with 80mm codeend and regulation 80mm square mesh panel and the other as an 'experimental trawl' with either a grid, separator panel or 160mm square mesh panel inserted. For the duration of the trials the skipper was asked to fish in an area where he knew there would be both *Nephrops* and fish. It was recognized that because of this, along with the absence of any quota restrictions during the trials and the presence of researchers, the catching patterns might not accurately reflect normal commercial practices. However, all tows were conducted on previously towed tracks and in proximity to other vessels fishing commercially; therefore, the trawls were considered to be characteristic of normal practice and also reasonably representative of conditions in Area VIIa.

The mfv "Supreme II" completed a total of 50 hauls from which 39 provided valid data as follows:

1. Swedish Grid – 15 hauls
2. 160mm SMP + 100mm codend – 16 hauls
3. Inclined Separator Panel – 19 hauls

These hauls were completed over four trips during the period March – April 2009 on the Smalls grounds in Area VIIg. Haul duration were 3-5 hours with a towing speed of 2.8-3.4 knots maintained throughout.

5 Summary of Results

Swedish Grid

1. The Swedish grid released all cod above mls. This is in line with results from previous trials carried out in the North Sea and in the Kattegat.
2. The grid reduced the catch of cod by 85% by numbers of fish (Table 1) and 99% by weight compared to the standard trawl.
3. From 15 hauls the grid trawl retained a total of 5kg of cod compared to 364kg of cod with the standard trawl.
4. The average percentage cod catch of the total catch by haul with the grid was 0.3% compared to 7.7% with the standard trawl.
5. This is below the 1% threshold indicated in Article 13(2a).
6. The number of haddock and whiting retained by the grid trawl across all size ranges were significantly reduced with the grid trawl. Catches of marketable fish > 30cm were reduced by 69% for whiting and 86% for haddock with the grid trawl. For fish < mls the grid reduced catches of whiting and haddock by 39% and 66% respectively (See Table 1 below).

Table 1 Total Cod, Haddock and Whiting catches with the grid and standard trawls

Species	< mls		% diff	< mls		% diff	Total Catch		% diff
	Standard	Grid		Standard	Grid		Standard	Grid	
Cod	98	26	73%	68	0	100%	166	26	85%
Haddock	438	155	66%	537	79	86%	975	234	76%
Whiting	2313	1375	39%	426	133	69%	2739	1508	45%

7. Catches of marketable haddock, whiting, monkfish, megrim, lemon sole, John Dory and ling were all reduced significantly and in the case of monkfish this was almost by 100% (Table 2 below).

Table 2 Catches of key commercial species and % difference between the two gears
(Figures in Bold are statistically significant at p=0.05)

Species	Total Catch (kg)		% Diff
	Standard	Grid	
Nephrops	1974.63	1997.58	+1%
Haddock	394.43	49.90	**-87%**
Whiting	271.96	109.35	**-60%**
Monkfish	409.41	2.03	**-99%**
Megrim	99.37	45.78	**-54%**
Hake	180.46	170.39	-6%
Lemon Sole	43.8	20.74	**-53%**
John Dory	66.07	7.85	**-88%**
Ling	67.38	0.66	**-99%**

8. There were no major handling difficulties with the Swedish grid although these trials were carried out on a modern, well rigged vessels and handling of the grid may be more difficult on smaller vessels.

Inclined Separator Panel

1. The inclined separator panel retained less cod over all size classes and selection with this device does not seem to be length dependent. However, retention is more varied than with the grid and some fine-tuning is required to the panel to maximise release of cod without reducing the catch of all other species significantly. This is consistent with results from previous results with the inclined separator panel.
2. The inclined separator panel reduced the catch of cod by 72% by numbers of fish (Table 3) and 84% by weight compared to the standard trawl.
3. From 14 hauls the inclined separator panel retained a total of 108kg of cod compared to 668kg of cod with the standard trawl.
4. The average percentage cod catch of the total catch by haul with the inclined separator panel was 3.7% compared to 12% with the standard trawl.
5. This is below the 5% threshold indicated in Article 13(2b) but above the 1% threshold in Article 13(2a).
6. The number of haddock and whiting retained by the inclined separator trawl across all size ranges were significantly reduced. Marketable fish > mls were reduced by 81% for whiting and 77% for haddock with the inclined separator panel. For fish < mls the inclined separator panel reduced catches of whiting and haddock by 56% and 66% respectively (See Table 3).

Table 3 Total Cod, Haddock and Whiting catches with the inclined separator panel and standard trawls

SPECIES	< MLS		% DIFF	> MLS		% DIFF	TOTAL CATCH		% DIFF
	Standard	Grid		Standard	Grid		Standard	Grid	
Cod	92	28	70%	84	22	74%	176	50	72%
Haddock	267	90	66%	223	52	77%	490	142	71%
Whiting	362	160	56%	837	163	81%	1134	317	72%

7. Catches of marketable haddock, whiting, monkfish, megrim, lemon sole and ling were all reduced significantly (Table 4 below).

Table 4 Catches of key commercial species and % difference between the two gears
(Figures in Bold are statistically significant at p=0.05)

SPECIES	TOTAL CATCH (KG)		% DIFF
	Standard	ISP	
Nephrops	2204.86	2009.70	-5%
Haddock	215.52	39.20	**-82%**
Whiting	198.30	47.04	**-76%**
Monkfish	336.52	86.16	**-74%**
Megrim	182.48	92.40	**-49%**
Hake	97.74	133.88	+27%
Lemon Sole	225.90	155.36	**-31%**
John Dory	117.12	19.18	**-84%**
Ling	57.11	11.10	**-81%**

8. There were some rigging difficulties associated with the Inclined Separator Panel noted during this trial. The panel appeared to be too slack meaning the leading edge was very close to the bottom sheet of the trawl resulting in significant quantities of catch being lost. This was verified by putting a small mesh retainer bag over the escape opening. Subsequent adjustment of the panel rectified this problem reasonably simply.

160mm Square Mesh Panel

1. The 160mm Square Mesh panel retained less cod below the minimum landing size of 35cm by 78%. However, above the mls catches with the 160mm SMP were not significantly different to the standard trawl as in the previous two trials (Table 5).
2. The 160mm SMP reduced the catch of cod by 35% by total numbers of fish but there was an increase in the weight cod retained with the 160mm SMP.
3. From 10 hauls the trawl with the 160mm SMP retained a total of 329kg of cod compared to 214kg of cod with the standard trawl.
4. The average percentage cod catch of the total catch by haul with the 160mm SMP was 5.6% compared to 3% with the standard trawl. This difference, however, was not statistically significant.
5. This is above both the 1% and 5% thresholds indicated in Article 13 (2a) and (2b).
6. Total haddock and whiting catches were consistently lower with the 160mm SMP fitted. For marketable fish above mls were the total numbers retained were reduced by 46% less for whiting and 39% for haddock with the 160mm SMP. Discards of whiting (in number) were also lower using the 160mm SMP by 87% and by 30% for haddock (Table 5).

Table 5 Total Cod, Haddock and Whiting catches with the 160mm SMP + 100mm codend and standard trawl (100mm codend)

SPECIES	< MLS		% DIFF	< MLS		% DIFF	TOTAL CATCH		% DIFF
	Standard	160mm SMP		Standard	160mm SMP		Standard	160mm SMP	
Cod	86	19	78%	47	78	+40%	133	87	35%
Haddock	1779	1083	39%	1799	1260	30%	3578	2343	35%
Whiting	545	73	87%	162	88	46%	707	161	77%

7. Catches of haddock and whiting only were reduced significantly (Table 6 below) with the 160mm SMP. Catches of all other species were not significantly different.

Table 6 Catches of key commercial species and % difference between the two gears
(Figures in Bold are statistically significant at p=0.05)

SPECIES	TOTAL CATCH (KG)		% DIFF
	Standard	160mm SMP	
Nephrops	315.67	257.02	-19%
Haddock	980.98	630.20	**-36%**
Whiting	77.28	24.02	**-77%**
Monkfish	492.48	403.59	-18%
Megrim	73.02	79.86	+9%
Hake	28.33	24.60	-13%
John Dory	107.82	100.14	-7%
Lemon Sole	na	na	Na

8. There were no differences with gear performance associated with the installation of the 160mm SMP.

6 Economic Analysis

To provide an estimation of the reduction in earnings from using each of the different gear types, a simple analysis on the value of the total catches for the key commercial species using average fish prices in March 2009 was carried out.

With the grid there was a reduction of 30% in total catch value when compared to the standard trawl. The value of fish catches was reduced by 86%. The majority of this reduction is from lower catches of monkfish, cod and John Dory although haddock and whiting catches during this trial were low so the reduction would be greater given the majority of marketable haddock and whiting are released by the grid. *Nephrops* made up 66% of the total value of the catch with the standard trawl compared to 93% with the grid.

With the inclined separator panel there was a reduction of 28% in total catch value. The value of fish catches was reduced by 68%. The majority of this reduction is from lower catches of monkfish, cod and John Dory, haddock and whiting. *Nephrops* made up 64% of the total value of catch with the standard trawl compared to 82% with the inclined separator panel.

With the 160mm SMP + 100mm codend, only catches of haddock and whiting were significantly reduced. Catches of the other key commercial species were not significantly different. Therefore there was only a 12% reduction in total catch value compared top the standard trawl. The value of fish catches was reduced by 11%. *Nephrops* make up 15% of the total value of catch with the standard trawl compared to 16% with the 160mm SMP. *Nephrops* catches were low for this trip but the figures with relationship to the fish catch are felt to be representative. Table 7 below summarises the catch values for each gear compared to the standard trawl.

Table 7 Summary Economic data for the grid, inclined separator panel and 160mm SMP

Gear Type	Total Value of commerical species		diff in Value	% Reduction in total value	% Reduction in fish catch value	Value of Nephrops as % of total catch	
	Standard	Experimental				Standard	Experimental
Grid	€12100.39	€8511.51	€3588.88	30%	86%	66%	93%
ISP	€14491.88	€10234.32	€4168.91	28%	68%	65%	84%
160mm SMP	€8405.23	€7399.09	€1006.14	12%	11%	15%	16%

These figures should be treated with caution as they are based on only the main commercial species. Other species were caught but were not included due to the volumes being small or the catches sporadic

It should be remembered that these trials were carried out on the Smalls and in the Irish Sea there are differences in catch composition between the two areas meaning the reductions in the landed value of the catch do not necessarily equate to the figures above. Therefore a further analysis was carried out taking catch data from vessels fishing in the Irish Sea as follows:

1. Landings data from vessels fishing in the Irish Sea was used to determine the catch composition of typical Irish Sea *Nephrops* vessels.
2. Assuming a catch of 7,500kg, for each species the reductions in catches observed by species with the grid, inclined separator panel and 160mm smp in the "Supreme II" trials were applied to this catch composition.
3. The same price data was then applied to the predicted catch compositions and weights for all of the gears included the standard trawl.
4. The same parameters were then calculated for the Irish Sea vessels.

Tables 8, 9 and 10 below show the results for this analysis:

Table 8 Estimated economic impact on catch value of using the Swedish grid in the Irish Sea (VIIa) based on catch composition of 5 vessels

Gear Type	Total Value of commerical species		diff in Value	% Reduction in total value	% Reduction in fish catch value	Value of Nephrops as % of total catch	
	Standard	Experimental				Standard	Experimental
Vessel A	€13391	€11716	€1675	13%	80%	84%	96%
Vessel B	€13373	€11841	€1532	11%	74%	84%	95%
Vessel C	€13597	€12257	€1341	10%	87%	89%	98%
Vessel D	€14034	€13142	€891	6%	80%	92%	98%
Vessel E	€13124	€11430	€1694	13%	66%	80%	92%

Table 9 Estimated economic impact on catch value of using the Inclined Separator Panel in the Irish Sea (VIIa) based on the catch composition of 5 vessels

Gear Type	Total Value of commerical species		diff in Value	% Reduction in total value	% Reduction in fish catch value	Value of Nephrops as % of total catch	
	Standard	Experimental				Standard	Experimental
Vessel A	€13391	€12055	€1336	10%	64%	84%	94%
Vessel B	€13373	€12124	€1250	9%	60%	84%	93%
Vessel C	€13597	€12257	€1341	10%	73%	89%	97%
Vessel D	€14034	€13333	€701	5%	63%	92%	97%
Vessel E	€13124	€11800	€1324	10%	52%	80%	90%

Table 10 Estimated economic impact on catch value of using the 160mm SMP in the Irish Sea (VIIa) based on the catch composition of 5 vessels

Gear Type	Total Value of commerical species		diff in Value	% Reduction in total value	% Reduction in fish catch value	Value of Nephrops as % of total catch	
	Standard	Experimental				Standard	Experimental
Vessel A	€13391	€13347	€44	0.3%	2%	84%	85%
Vessel B	€13373	€13307	€66	0.5%	3%	84%	85%
Vessel C	€13597	€13476	€121	0.9%	6%	89%	89%
Vessel D	€14034	€14015	€19	0.1%	2%	92%	92%
Vessel E	€13124	€13076	€48	0.4%	2%	80%	81%

These estimates are based on a total catch of 7500kg and using average fish prices from March 2009. The 5 vessels were selected randomly on the basis of being representative of vessels fishing in the Irish Sea.

This analysis indicates that the impact on vessels in the Irish Sea of using the grid or the inclined separator panel is less than in the Smalls fishery. Depending on the catch composition of the different vessels, using the grid will reduce overall catch value by ~10% with a reduction in fish catch of 76%. This compares with reductions of 30% in total catch value and 86% in fish catch value in the trials on the "Supreme II". With the inclined separator panel the estimated reductions are in the order of 8% and a reduction of fish catch of ~62% compared with 28% and 68% respectively in the trials on the Smalls. The estimated reductions with the 160mm SMP are less than ~1% in the Irish Sea reflecting the fact that only haddock and whiting catches are reduced with this gear modification and catches of these two species are relatively low currently in the Irish Sea.

7 Conclusions

It is important to note that these results are based on a short set of experiments carried over a 2-3 week period and therefore should not be considered as definitive. However, these trials are in line with results from previous work in the North sea and other areas and indicate that the grid and inclined separator panel are potential tools that could be used by vessels to allow them to buy back effort and ultimately be excluded from the days at sea regime. The 160mm SMP has merit for reducing discarding of juvenile cod, haddock and whiting but its use will not give the required reductions in cod catches.

The losses in earnings associated with using the grid and the inclined separator panel are considerable and fishermen must decide for themselves whether this is an acceptable trade-off to forego these earnings for increased effort. Losses in earnings in the Irish Sea are predicted to be less than on the Smalls grounds reflecting different catch compositions but are nonetheless still significant over the course of a year. It should be noted, though that it is highly likely under the EU regulation that effort levels in the Irish Sea will be reduced by a further 25% in 2010 unless there is a dramatic upturn in the cod stock so without any additional measures the number of days available for individual vessels will be further restricted. In this respect the use of the grid and the inclined separator panel should be considered.