

First results from a pilot study 'North Sea fishing trials using the Eliminator trawl'



The Eliminator trawl being hauled aboard the MFV Our Lass II in the North Sea trials Dec 2007
(NB: large rope meshes of 2.4 metres at front and in belly of trawl)

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1. Summary

This study reports on the first known testing of a new design of trawl gear (known as the Eliminator trawl) in European waters. This pilot study has been undertaken during the first week of December 2007 to compare the fish catches from a new trawl design, the 'Eliminator trawl', to the fish caught in a typical industry whitefish trawl (described here as the control trawl). The pilot study was undertaken in the North Sea (off the Yorkshire coast) using two charter commercial fishing vessels. One vessel towed the Eliminator trawl, while the other towed the industry control trawl. Both vessels towed along parallel tracks in close proximity for the same duration. A total of twelve commercial-length hauls were obtained.

The results from these paired-hauls indicate that the Eliminator trawl can be used to selectively target haddock and whiting in a mixed demersal fishery. Very few other species were caught in the Eliminator trawl and the catches were consistently dominated by whiting and haddock. This was not the case with the control trawl.

Catches of whiting in the Eliminator trawl appeared to be skewed to the right, with a greater proportion of larger fish being caught than smaller fish (when compared to the control trawl). Overall, catches of haddock in the Eliminator trawl were around 75% of the catches from the control trawl, with no obvious length relationship.

Catches of cod (all lengths) in the Eliminator trawl were around 90% less than the quantity caught in the control trawl. The Eliminator trawl also caught 83% less unwanted fish (normally discarded) of a variety of other species including gadoids, rays, flatfish and gurnards.

This pilot study has demonstrated that the Eliminator may have considerable potential as a management tool to aid cod recovery or facilitate cod avoidance in mixed European demersal fisheries.

There are likely benefits to be derived from further work aimed at improving the performance of the Eliminator trawl and for a range of complementary studies, all of which are described in this document.



MFV's Our Lass II (WY 261) and Jubilee Quest GY 900, the commercial fishing vessels chartered for the sea trials

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The Eliminator trawl being hauled aboard the MFV Our Lass II in the North Sea trials Dec 2007 (NB: large rope meshes of 2.4 metres at front of trawl)

3. Background to this pilot study

The Eliminator trawl is a US design used in the New England fisheries off the Atlantic coast of the USA. The design of trawl is such that it allows cod and other species of conservation concern to escape capture, while allowing fishermen to catch haddock. By using the Eliminator trawl, fishermen gain access to areas of restricted access where cod is more prevalent and where less selective trawling is not permitted.

After a visit to the USA (Rhode Island) by Andy Reville (Cefas), Arnold Locker (NFFO) and Ken Arkley (Seafish) in November 2007, an Eliminator trawl was purchased and shipped back for trials in UK waters of the North Sea. The aim of this study was to investigate whether the Eliminator trawl could have potential utility as a cod protection /avoidance tool in EU waters (North Sea).



The Eliminator trawl in earlier Canadian flume tank trials (Courtesy of Superior Trawls, USA)

4. Methods

A series of sea trials to compare the catches from an Eliminator trawl with those from a typical whitefish trawl currently used by the fishing industry (described here as the control trawl) were conducted between 2nd – 8th December 2007. The fishing trials were undertaken under full commercial conditions. Both trawls were rigged with rock-hopper ground gear of a type suited to local seabed conditions.

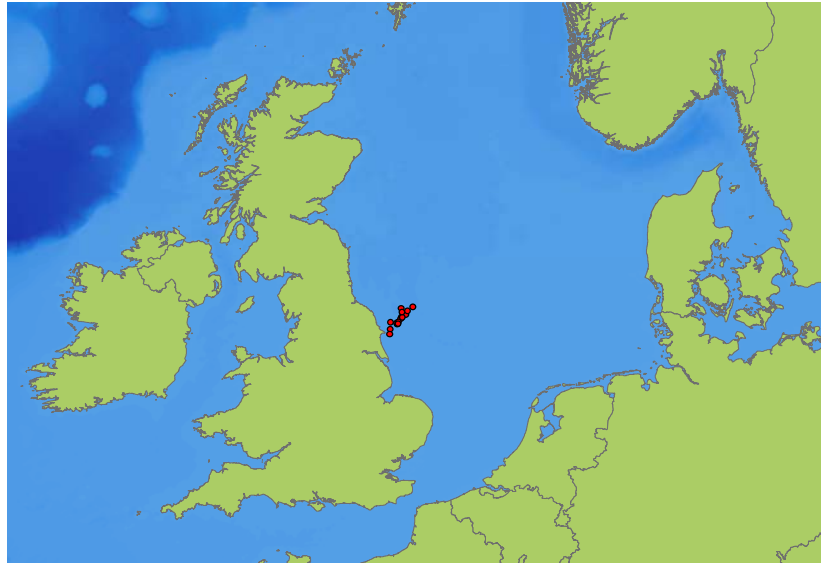
Parallel hauls method

The parallel hauls method was used to compare the catches between the two different trawls. Two fishing vessels were chartered for the work (MFV Our Lass II and the Jubilee Quest). The MFV Our Lass II towed the experimental trawl (the Eliminator trawl) while the Jubilee Quest towed an industry standard trawl (control trawl). Both vessels towed the gears along parallel tracks, keeping as close together as was practicable and safe (usually within 0.5 nautical miles). Further details of the trawls used and the vessel chartered for the work are contained in the appendix. Both trawls were fitted with new and identical cod ends, with a mesh size of 80mm.



The MFV Jubilee Quest towing a parallel haul in close proximity to the MFV Our Lass II from where the picture was taken. Dec 2007

The hauls were all of commercial duration (4-5 hours each) and were undertaken on established whitefish fishing grounds, off the Yorkshire coast in the North Sea. Fifteen hauls were completed, however three hauls were considered 'void' due to gear damage and/or fouling on the seabed. This left a total of twelve valid hauls for the subsequent analysis.



Location of the sea trials (haul shooting positions marked)

Onboard catch sampling

Two Cefas scientists were present on each vessel throughout the trials. All fish caught were measured by the scientists to the nearest cm (below). When catch rates were high, representative sub-samples of the catch were measured. These samples were subsequently raised to haul level to give an estimate of the total catch. Records were kept as to whether the fish were discarded or retained by the crew. All hauls were sampled and measured.

Analysis

The catch data from each haul are compared using the non-parametric statistical method 'Wilcoxon Rank Test'. This test is performed at the species level and in some cases on fish above and below the minimum landing size (MLS). Summary pooled length-frequency distributions are presented in the results section below. A basic comparison of the total quantities of discarded fish is also presented.

5. Results

COD

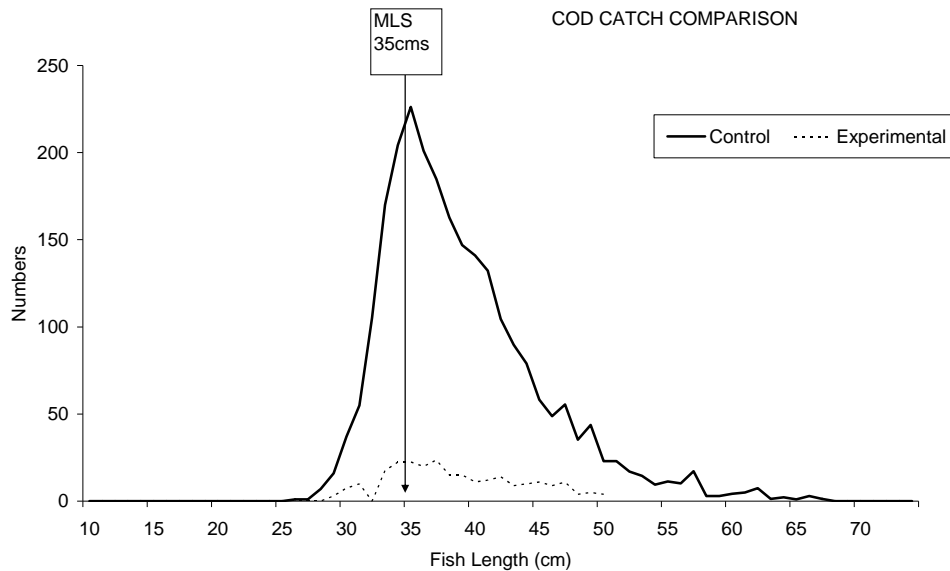
Numbers of cod caught (all lengths)

Haul No.	No of cod caught (all lengths)	
	Control trawl	Eliminator trawl
1	379	76
4	255	23
5	329	14
6	380	30
7	204	20
8	169	16
9	83	5
10	70	33
11	118	1
12	152	8
13	202	38
14	123	21
Total	2,085	209

Statistic $p = 0.002$ (by Wilcoxon rank test)

(i.e. 99.8 % probability that there is a significant difference in the catches between the two trawls)

Length frequency distribution of cod caught (all hauls summed)



NB:

Experimental trawl = Eliminator trawl
Control trawl = Industry standard trawl

WHITING

Numbers of whiting caught *below* the minimum landing size (<MLS of 27cm)

Haul No.	No of whiting caught (< MLS of 27 cm)	
	Control trawl	Eliminator trawl
1	1,103	140
4	504	235
5	791	242
6	850	63
7	1,407	579
8	2,715	287
9	97	24
10	344	38
11	142	62
12	330	18
13	165	26
14	267	300
Total	7,612	1,873

Statistic $p = 0.003$ (by Wilcoxon rank test)

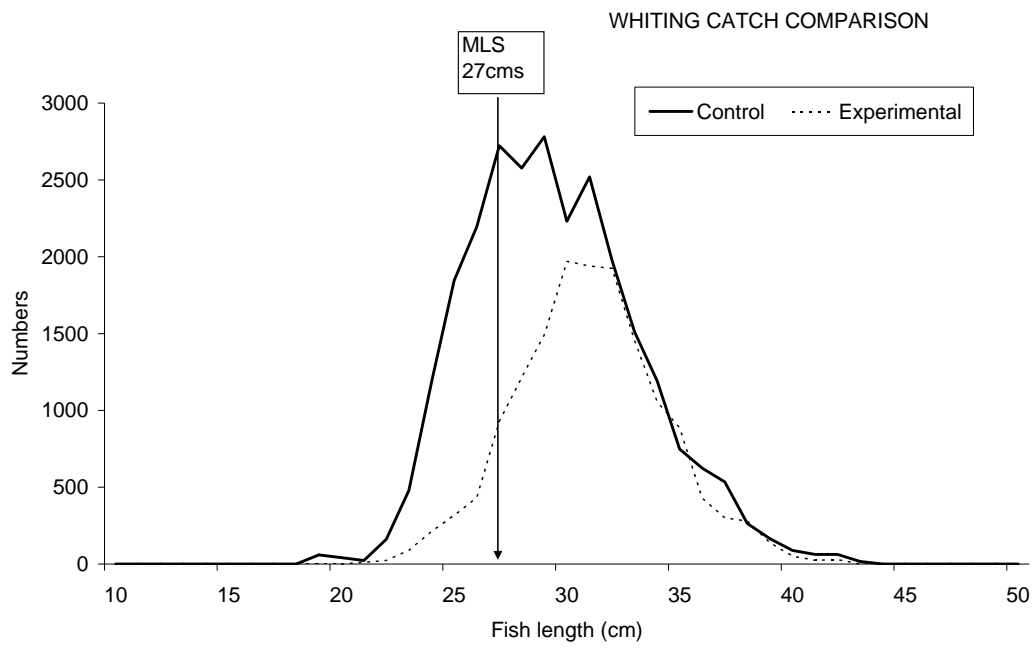
(i.e. 99.7 % probability that there is a significant difference in the catches between the two trawls)

Numbers of whiting caught *above* the minimum landing size (>MLS of 27cm)

Haul No.	No of whiting caught (MLS > of 27 cm)	
	Control trawl	Eliminator trawl
1	1,119	1,309
4	882	964
5	1,376	967
6	1,180	1,140
7	2,563	1,997
8	3,147	2,471
9	351	446
10	1,236	475
11	1,686	666
12	1,365	678
13	939	650
14	1,506	1,426
Total	16,231	11,879

Statistic $p = 0.034$ (by Wilcoxon rank test)

(i.e. 97 % probability that there is a significant difference in the catches between the two trawls)



NB:
Experimental trawl = Eliminator trawl
Control trawl = Industry standard trawl

HADDOCK

Numbers of haddock caught *below* the minimum landing size (<MLS of 30cm)

Haul No.	No of haddock caught (< MLS of 30 cm)	
	Control trawl	Eliminator trawl
1	390	243
4	38	38
5	191	59
6	52	180
7	65	116
8	315	271
9	38	58
10	414	165
11	888	548
12	750	142
13	126	74
14	154	111
Total	3,031	1,760

Statistic $p = 0.050$ (by Wilcoxon rank test)

(i.e. 95 % probability that there is a significant difference in the catches between the two trawls)

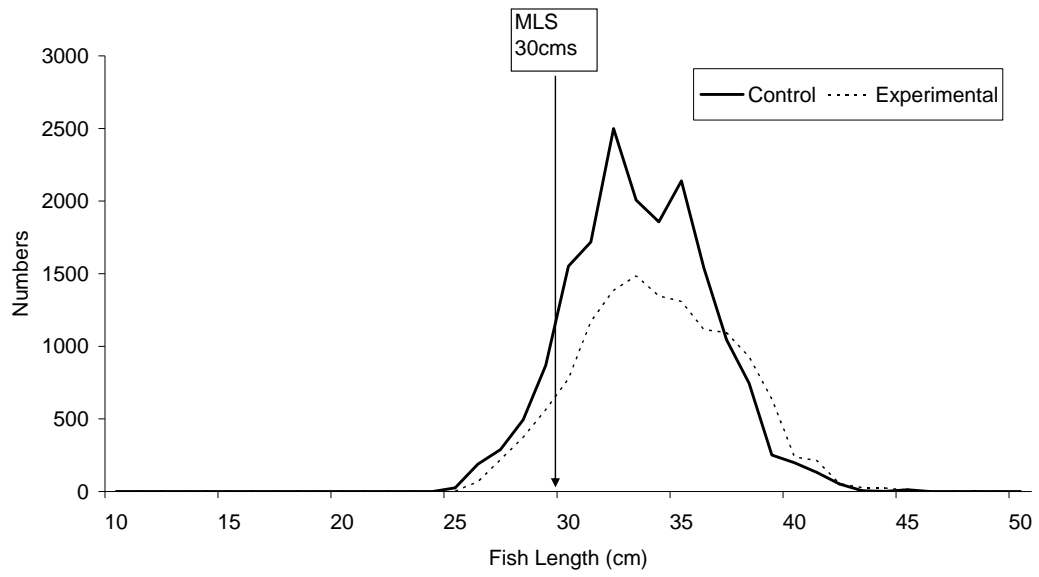
Numbers of haddock caught *above* the minimum landing size (>MLS of 30cm)

Haul No.	No of haddock caught (> MLS of 30 cm)	
	Control trawl	Eliminator trawl
1	3,497	3,043
4	192	104
5	1,056	375
6	694	1,663
7	121	555
8	884	688
9	48	163
10	1,497	326
11	1,759	2,137
12	3,255	926
13	683	718
14	520	340
Total	10,708	7,996

Statistic $p = 0.347$ (by Wilcoxon rank test)

(i.e. 65 % probability that there is a significant difference in the catches between the two trawls)

HADDOCK CATCH COMPARISON



NB:
Experimental trawl = Eliminator trawl
Control trawl = Industry standard trawl

TOTAL DISCARDS (all species combined)

Comparison of discards (all species combined)

Haul No	Quantity of discards*	
	Control trawl	Eliminator trawl
1	11.3	3.0
4	6.0	1.5
5	6.5	1.0
6	3.5	1.5
7	17.0	1.8
8	23.0	2.5
9	8.0	1.0
10	12.0	2.3
11	14.0	3.0
12	15.0	1.5
13	9.0	1.8
14	11.0	1.8
Total	136.3	22.6
Total (Kg)	5,450	904

* Units (40 Kg baskets)

Example catches from the Eliminator trawl showing predominantly whiting and haddock



Example catches from the control trawl showing a mix of species including cod, rays, flatfish, benthos as well as haddock and whiting.



6. Discussion

Cod

This study has demonstrated that the Eliminator trawl has the potential to selectively target haddock and whiting in the currently mixed demersal fisheries in EU waters. Cod catches were consistently and significantly reduced with this trawl (i.e. by 90% when directly compared with the numbers caught in the control trawl). No obvious length dependency was observed with these reductions.

Haddock

Overall, the total catch of haddock above the MLS in the Eliminator trawl was 75% of the catch from the industry standard trawl. This was less than was achieved in the US study with this trawl, whereby US workers recorded haddock catches of around 100%. Haddock catch rates appeared to be more variable than with other species and on several occasions the Eliminator trawl caught more haddock than the control trawl.

Whiting

Overall, the total catch of whiting above the MLS in the Eliminator trawl was 73% of the catch from the industry standard trawl. The Eliminator trawl caught significantly less whiting than the control trawl. There appeared to be a length dependency associated with this observation, whereby less small whiting were caught than large whiting with the Eliminator trawl. Catches of whiting above 32cm appeared to be broadly comparable between the two trawls.

General discards

Discard levels (all species combined) were greatly reduced with Eliminator trawl when compared to those arising from the control trawl (83% reduction). Species discarded included cod, whiting, haddock, dab, gurnards, several ray species, shads, lemon sole, plaice, scorpion fish, benthic invertebrates and pogge.

Fish quality

The fish caught in the Eliminator trawl were considered by the skipper and crew to be of high quality. This was thought to be due to reduced abrasion arising from the absence of benthos and shells etc in the catch. It was not possible to quantify this however during these trials due to time constraints.

Other demersal fish species of commercial value

The Eliminator trawl caught only small quantities of species other than haddock and whiting, whereas the industry control trawl caught a mix of species including other commercially valuable species such as lemon sole, brill, monkfish and halibut. It is assumed, the large meshes in the Eliminator trawl facilitate the escape of these species. Details on the catches of these other species is not presented here due to time constraints but will be reported on later in a scientific publication.

Handling

Like all new trawls, the Eliminator trawl requires some time and experience for the crew to become proficient at shooting and hauling the gear, however it is unlikely that this would present a barrier to UK or EU fishermen in general.

Economics

The Eliminator trawl appears to be effective at targeting haddock and whiting. Whether such a trawl would prove economically attractive to fishers would depend on a variety of individual factors, such as quota, fishing grounds, species mix, access rights, alternative opportunities, vessel layout etc. This study should not be viewed as a definitive economic study on this trawl.

Squid

Based on information from the US, the Eliminator trawl may have potential to be used to selectively target squid. This requires further investigation.

Fuel efficiency

There may be some fuel saving associated with towing this trawl, due to the reduced drag from the large meshes in its front parts. This was not quantified in this study due to time constraints and requires further investigation.

Season

This study was conducted during winter in the North Sea. If fish distribution in the water column were to change at other times of the year or in other areas, it is reasonable to expect different results than those obtained in this work. This should be investigated.

Optimising rigging of the trawl

There are most likely rigging improvements that can be made to the trawl to improve catch rates of haddock in particular (based on the US experience). There is also scope to investigate the adaptation of this trawl to other fisheries and fishing grounds.

Generic comment on the trials

Considering that the Eliminator trawl was shipped to the UK, arriving only one week before the sea trials, this work has been remarkably successful. To unpack a trawl out of a box, fix it onto new ground-gear and start commercial fishing in an area where the trawl has not previously been used can be extremely problematic. It is to the credit to all concerned with this work, for their hard work and considerable effort of, that we have good results to report on here.

7. Future work

The following future work may be of potential value to Defra, SEAFISH, Cefas and the UK fishing industry:

- Strengthen and optimise the rigging / construction of the Eliminator trawl to suit conditions for fishing in UK and EU waters
- Optimise the ground-gear rigging arrangements of the Eliminator trawl for fishing in UK and EU waters
- Construct a model and undertake flume tank trials to assist with further rigging
- Investigate potential adoption of Eliminator trawl for use in other fisheries, such as Irish Sea, smaller vessel pair team, North Shields fleet etc
- Investigate seasonal effects on catch rates (i.e. seasonal fish distributions may change within the water column and could affect performance)
- Conduct underwater observations on the Eliminator trawl to understand fish behaviour in relation to the trawl
- Utilise the positive features of the Eliminator trawl and incorporate them into existing designs of fishing gear to improve selectivity
- Evaluate the Eliminator trawl in a squid directed fishery

8. Acknowledgments

Barry Deas	NFFO
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Skipper and crew	Jubilee Quest
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MFA	London, North Shields, Scarborough and Grimsby
NESFC	Beverley

9. Appendix

Vessel and gear details

	Our Lass II (WY 261)	Jubilee Quest (GY 900)
Vessel overall length	21.5 m	21.2 m
Year of build	2007	1997
Home port	Whitby	Grimsby
Main engine power	480 kW	347 kW
	Eliminator trawl (Superior trawls, Rhode Island USA) with rock-hopper ground-gear	108 foot (Jackson trawl, Scotland) with rock-hopper ground-gear
Otter boards	3m NETS doors	88 inch Perfect Patent B doors
Door spread	28 fathom	30 fathom
Sweep length	38 fathom	38 fathom
Headline height	5-6 fathom (estimated)	2.8-3 fathom
Towing speed	2.5 – 3 knots	2.5 – 3 knots
Cod end	80 mm	80 mm

