

## The Effects of 110 mm and 120 mm Cod-Ends on the Catches of a Twin-Rig Trawler

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### Summary

A series of trials were carried out in May 2001 with a twin-rig demersal whitefish trawler to assess the effects on commercial fish catches of fitting 110 mm and 120 mm cod-ends (compared to the normal 100 mm cod-end). Both cod-ends showed the potential to reduce catches of undersized fish of a number of species, but they also substantially reduced catches of some marketable fish, especially haddock and whiting. The results suggest that the adoption of either of the cod-ends tested would have a significant short-term economic impact on demersal whitefish trawlers, especially those that target haddock and whiting, although in the longer term these vessels might benefit from increased catches of larger fish.



The fishing vessel Lomur (LK 801) used in these trials.

### Introduction

Under a recent agreement between Norway and the EU the minimum mesh size of demersal trawl nets is to be increased in an effort to reduce the bycatch of undersized (immature) fish, especially cod. The current high bycatch of immature fish, the vast majority of which are subsequently discarded dead, is arguably one of the most serious issues currently facing commercial fishermen and fisheries managers. This mortality of immature fish results in smaller future stock sizes and reduced earnings for fishermen.

Under the new agreement the minimum mesh size of towed nets for demersal species in the North Sea and

Norwegian waters will increase from 100 to 120 mm from 1<sup>st</sup> January 2002. A derogation will allow EU vessels targeting cod, haddock, saithe and whiting in EU waters to use 110 mm mesh until 31<sup>st</sup> December 2002, subject to conditions regarding the composition of catches. This derogation is to be reviewed before the end of 2002 so will not automatically end on 31<sup>st</sup> December 2002. Existing square-mesh panel rules will apply when using 110 mm mesh, but square-mesh panels will not be a legal requirement when 120 mm mesh is used.

In order to assess the likely effects of these regulations on commercial fish catches the North Atlantic Fisheries College undertook a series of trials during May 2001 to compare the catches taken with 110 mm and 120 mm cod-ends by a twin-rig trawler with those taken with the current standard 100 mm cod-end. (Similar trials were also carried out on an inshore trawler and a seine-net vessel - see *Development Notes* 11 and 12).

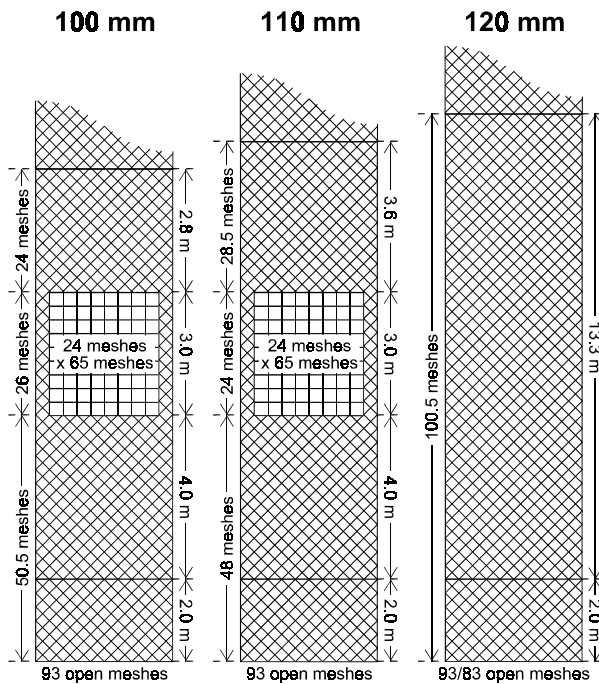
### Methods

The trials were carried out by the Shetland fishing vessel *Lomur* (LK 801), a 26 m, 485 kW demersal stern trawler utilising a three-warp twin-trawl system (in which two trawl nets are towed side by side). A twin-trawl allows direct comparisons to be made between two cod-ends on the two trawl nets (on the assumption that similar quantities of similarly sized fish enter both trawl nets).

Three cod-ends were manufactured for the trials (see diagram overleaf); a normal 100 mm cod-end fitted with a 90 mm square-mesh panel, a 110 mm cod-end, also fitted with a square-mesh panel, and a 120 mm cod-end, with no square-mesh panel. None of the cod-ends had a lifting bag fitted. The cod-ends as supplied were all constructed with the same number of open meshes (93) around, as the manufacturer noted that this was how all large-mesh cod-ends were supplied. In the light of results collected during the trials, however, the 120 mm cod-end was modified by taking 10 meshes into the selvages, leaving only 83 open meshes.

Three series of trials were carried out between 4<sup>th</sup> and 22<sup>nd</sup> May 2001. The first two series (Parts 1 and 2) compared the 110 and 120 mm cod-ends with the 100 mm (control) cod-end. In the light of preliminary analysis of the catches taken with the 120 mm cod-end this cod-end was modified to reduce the number of open meshes around, and the third series of trials (Part 3) carried out with this modified 120 mm cod-end. Each trial

# Long-Duration Trials of a Square-Mesh Panel



Schematic diagrams of the cod-ends used in these trials. The 120 mm had the number of open meshes reduced from 93 to 83 after Part 2 of the trials.

consisted of a series of hauls during each of which the 100 mm cod-end was attached to one of the twin-trawl nets and the experimental cod-end to the other. To cancel out any possible bias between the twin-trawls the control and experimental cod-ends were regularly swapped between the two nets.

Previous comparative trials with twin-trawls have encountered problems due to the fact that on many twin-trawl vessels the cod-end on one side is always hauled before the other. More fish tend to escape from the cod-end which is hauled last, which can confuse the effects of differences in the design of the two cod-ends. Such problems were avoided in these trials as the *Lomur* had a stern-ramp which allowed both cod-ends to be hauled onboard simultaneously.

The catches taken with the two cod-ends were kept separate. Each was sorted into baskets by species and all baskets were weighed on a motion-compensated balance. The haddock, whiting, cod, monkfish, ling and saithe, which accounted for the bulk of the catch, were measured. Haddock and saithe were sub-sampled in a few cases where large catches were taken but normally all fish were measured.

## Results

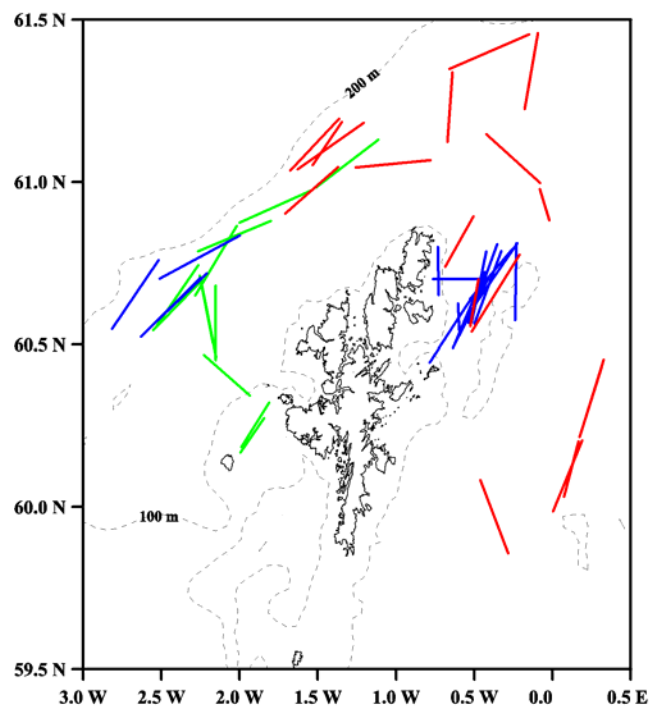
During the period from 4<sup>th</sup> to 22<sup>nd</sup> May 2001 the *Lomur* carried out a total of 51 hauls on fishing grounds to the North, East and West of Shetland as shown on the map below. Seven of these hauls were rejected because of gear damage or other problems, leaving 44 valid hauls;

16 each with the 110 mm and modified 120 mm cod-ends and 12 with the unmodified 120 mm cod-end. Each haul with the twin-trawl effectively represented a pair of hauls, one with the 100 mm control cod-end and one with an experimental cod-end. The average haul duration was exactly five hours.

The *Lomur's* total catch during the trials was 32,800 kg, of which about 24,600 kg (75%) was classed as marketable and retained. The remaining 25% of the catch was either unmarketable species or fish below minimum landings sizes and was discarded. The marketable component of the catch was dominated by haddock (26%), saithe (21%), cod (16%), monkfish (13%), ling (9%) and whiting (8%) which together accounted for 93% by weight.

The catches of these species are summarised in more detail in the table opposite. The graphs on the following page show the decrease in catch rate (kg per hour) for these species with each of the experimental cod-ends as a percentage of the catch rate with the control (100 mm) cod-end.

It became apparent during Part 2 of the trials that the 120 mm cod-end being tested was little more selective than the 100 mm control cod-end, and much less selective than the 110 mm cod-end tested in Part 1 of the trials. It was concluded that this lack of selectivity was a result of the 120 mm cod-end having the same number of meshes round as the control cod-end; this preventing the meshes from opening while the cod-end was being towed (because it was attached to a 100 mm mesh extension). As has been mentioned, the number of open meshes in the 120 mm cod-end was reduced for Part 3 of the trials, and this resulted in a marked improvement in selectivity.



Tracks of tows made by the *Lomur* during these trials ( — Part 1 — Part 2 — Part 3 ).

# Long-Duration Trials of a Square-Mesh Panel

With the exception of haddock (and saithe in Part 3 of the trials), the numbers of undersized fish caught during these trials were generally relatively small. The catch rate (kg per hour) of undersized haddock was substantially reduced with both the 110 mm and (modified) 120 mm cod-ends; by 62% and 76%, respectively. The catch rate of undersized saithe was reduced by 43% with the (modified) 120 mm cod-end.

For undersized cod the reductions in catch rate with the two cod-ends were 10% and 43%, although as noted the numbers caught were relatively small. There were also reductions in the catch rates of undersized saithe with the 110 mm cod-end, and of ling and monkfish with the (modified) 120 mm cod-end although again the numbers caught were generally small.

*Summary of the weights (kg) of cod, haddock, ling, monkfish, saithe and whiting caught with the control (100 mm; shaded) and experimental (110 and 120 mm) cod-ends, by size grade and marketable (retained) and undersized (discarded) components.*

		Cod						Haddock					
		Part 1		Part 2		Part 3		Part 1		Part 2		Part 3	
		100	110	100	120	100	120	100	110	100	120	100	120
<b>Grade</b>	<b>I</b>	32	17	8	43	13	8	18	20	83	51	39	40
	<b>II</b>	103	74	60	196	301	44	31	38	87	60	75	38
	<b>III</b>	170	124	105	133	296	141	81	71	177	130	136	86
	<b>IV</b>	193	172	138	130	209	196	126	76	325	328	261	91
	<b>V</b>	275	258	192	167	349	290						
	<b>Marketable</b>	773	645	503	668	1,276	679	256	205	672	569	512	254
	<b>Undersized</b>	17	15	9	7	20	2	692	263	1,181	1,056	1,869	446
	<b>Total</b>	790	660	512	676	1,296	690	947	468	1,852	1,625	2,381	701

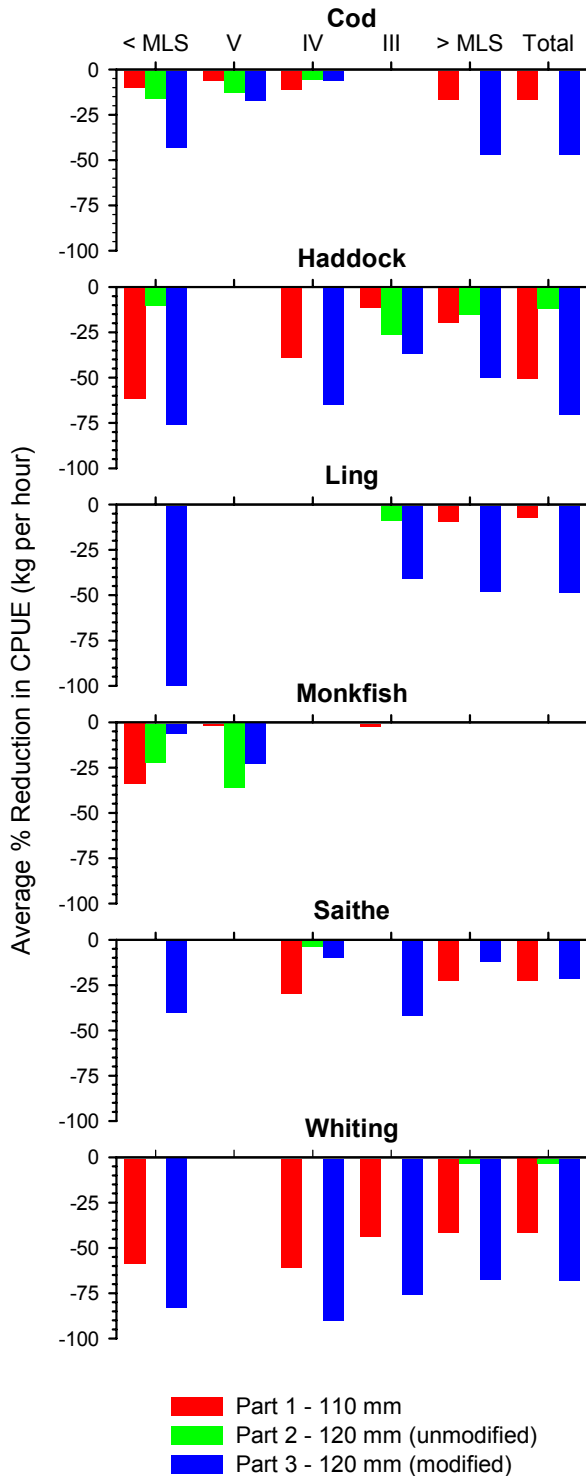
		Ling						Monkfish					
		Part 1		Part 2		Part 3		Part 1		Part 2		Part 3	
		100	110	100	120	100	120	100	110	100	120	100	120
<b>Grade</b>	<b>I</b>	18	8	8	199	355	149	0	10	0	0	16	21
	<b>II</b>	40	28	96	481	264	159	56	43	34	34	38	24
	<b>III</b>	63	73	282	257	195	25	194	189	94	117	56	119
	<b>IV</b>							240	281	303	303	261	293
	<b>V</b>							51	50	39	25	173	133
	<b>Marketable</b>	13	20	386	937	815	423	541	574	470	479	543	590
	<b>Undersized</b>	20	3	2	2	8	0	24	16	15	11	42	40
	<b>Total</b>	140	130	396	949	822	423	564	590	484	490	585	629

		Saithe						Whiting					
		Part 1		Part 2		Part 3		Part 1		Part 2		Part 3	
		100	110	100	120	100	120	100	110	100	120	100	120
<b>Grade</b>	<b>I</b>	65	10	0	0	0	0	75	49	118	108	92	67
	<b>II</b>	74	82	0	19	0	4	145	114	130	111	146	53
	<b>III</b>	322	350	44	85	78	45	193	108	70	83	147	35
	<b>IV</b>	1,145	804	432	415	851	767	154	60	32	36	134	13
	<b>V</b>												
	<b>Marketable</b>	1,605	1,246	477	519	928	817	566	331	350	338	519	168
	<b>Undersized</b>	2	2	14	30	485	289	9	4	4	4	21	3
	<b>Total</b>	1,607	1,248	490	549	1,413	1,106	576	335	354	342	539	172

# Long-Duration Trials of a Square-Mesh Panel

There were also reductions in the catches of marketable fish with both the 110 mm and (modified) 120 mm cod-



The average percentage reduction in CPUE (kg per hour) with the experimental cod-ends, compared to the control (100 mm) cod-end, for cod, haddock, ling, monkfish, saithe and whiting.

end, especially of haddock and whiting. The catch rate

(kg per hour) of Grade IV haddock was reduced by 39% and 65%, respectively, with these cod-ends, and that of Grade III haddock by 12% and 37%. Overall the catch rate of marketable haddock was reduced by 20% with the 110 mm cod-end and by 50% with the (modified) 120 mm cod-end.

The catch of whiting was affected even more than that of haddock, with the catch rate of Grade IV reduced by 61% and 90%, and of Grade III by 44% and 76%, respectively. Overall the catch rate of marketable whiting was reduced by 42% and 68%, respectively.

Catches of other species were also reduced, although generally not to the same extent. The catch rate of cod was reduced by 6% and 17%, respectively, for Grade V, and by 17% and 47% for all marketable sizes. The catch rate of all marketable ling was reduced by 7% and 48%, and of saithe by 22% and 12%. There was no reduction the catch of monkfish with either cod-end.

## Discussion

Overall these trials went well; in general the twin-trawl and cod-ends performed properly and appeared to give valid comparisons between the cod-ends being tested. The only significant problem encountered was with the initial design of the 120 mm cod-end, as discussed above, but this was successfully rectified by modifying the cod-end design.

The results demonstrate the potential of 110 and 120 mm cod-ends to substantially reduce catches of undersized fish of a number of whitefish species. However, it is clear that they will also significantly reduce catches of marketable fish, especially of haddock and whiting, on which large numbers of Scottish vessels depend. This indicates that the adoption of such cod-ends would have significant short-term economic impacts on many fishing vessels. In the longer-term these vessels might expect to benefit from increased catches of larger fish but no attempt was made to quantify this in this study.

The problem encountered in these trials with the design of the 120 mm cod-end demonstrate the importance of considering net design and construction (as well as mesh size) in attempts to improve selectivity. Simply attaching a larger meshed cod-end onto an existing extension did nothing to improve selectivity. It was only when the number of open meshes was reduced that the larger meshes became effective. Although the design of the 110 mm cod-end was not altered during these trials, it is possible that its selectivity could also have been improved by reducing its number of open meshes.

## Acknowledgements

The cooperation and assistance of the skipper and crew of the *Lomur*, without which these trials could not have been conducted, is gratefully acknowledged.

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