Bord Iascaigh Mhara
Irish Sea Fisheries Board

Catch comparison of Quad and Twin-rig trawls in the Celtic Sea *Nephrops* fishery

Key Findings

- **Significant reductions of cod by 61%, haddock by 38% and an increase in *Nephrops* by 54% in the Quad-rig**
- **Increased proportions of juvenile fish and *Nephrops* in the Quad-rig require further investigation**

MFV Celtic Chieftain

June 2014

Introduction

The benefits of multi-rig compared to single-rig trawls include reduced drag due to smaller net size, improved catch rates of *Nephrops* and reduced bycatch of fish species such as cod helping to avoid such species where required (Revill et al., 2009). In recent years a considerable number of larger vessels in the *Nephrops* fleet have replaced Twin-rigs with Quad-rigs. This project aimed to compare catch compositions between Quad and Twin-rig trawls to further investigate the performance of the Quad-rig in the Celtic Sea.

Methods

The trial was carried out onboard the MFV Celtic Chieftain (DA2) a 22m trawler (see cover photo) from Clogherhead, County Louth. The two gears were towed simultaneously by rigging with a triple warp and centre clump-weight arrangement. This approach was considered optimal in terms of reducing variability across hauls. In addition, the two gear types were rotated to account for any potential differences in fishing power on each side of the vessel. Scanmar door and clump-weight distance sensors were deployed to monitor the spread of the doors relative to the clump-weight and net spread.

The trial took place on the Smalls ground in ICES Division VIIg (Figure 2). A total of 30 hauls were carried out over a 5 day period from April 1st 2014. Haul duration, towing speed and depth of ground fished averaged 2 hours, 3 knots and 110m respectively.

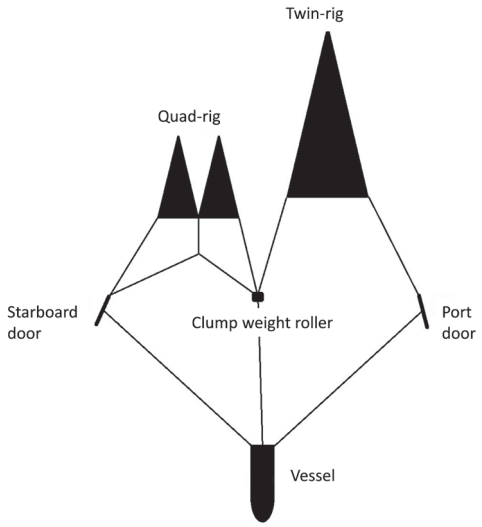

Figure 1. Trial gear rigging

Total catches were separated to species level and weighed to the nearest kg. Discarded undersized *Nephrops* were excluded from this process but were included in length sub sampling. All commercial fish species were measured to the nearest cm below and a sub-sample of *Nephrops* from 4 hauls was measured to the nearest mm below. Total weights and lengths of commercial species occurring in each of the trawl rigs were compared. A Generalised Linear Mixed Model (GLMM) which provided comparisons of fish catch at length by the two gears through a continuous curve with a realistic confidence band (Holst and Revill, 2009) was also applied using R version 3.02 (R_Core_Team, 2013).

Table 1. Quad and Twin-rig specifications

	Quad-rig	Twin-rig
Manufacturer	GK Nets	Pepe
Headline length (m)	30.5	69
Footline length (m)	35.5	73
Fishing circle (mm)	380 x 80	650 x 80
Sweep length (m)	70	90
Bridle diameter (mm)	22	22
Door to clump spread (m)	48	60
Cod-end mesh size (mm)	75	75
Square mesh panel (mm)	110	110

Results

Details of the total weights of commercial species caught during the trial are outlined in Table 2. Major reductions in catches of gadoid/whitefish species were generally observed in the Quad-rig. The reduction in cod catch was 61% although relatively low quantities of this species were encountered during the trial. Haddock and hake catches were also reduced by around 40% in the Quad-rig. The one exception was whiting where catch rates were similar between the two rigs. Mixed results were obtained in relation to flatfish or more bottom dwelling fish with small reductions in monkfish and witch catches and small increases in plaice and black sole catches in the Quad compared to the Twin-rig. The Quad-rig caught 54% more *Nephrops* across all size grades but higher proportions of smaller *Nephrops* were also retained by this gear.

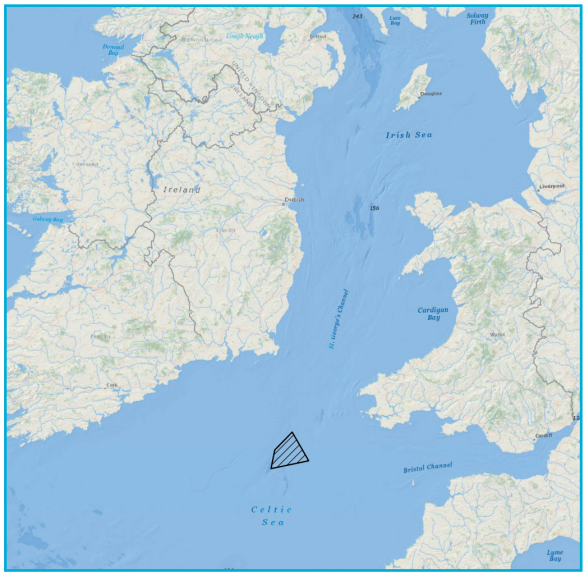

Figure 2. Gear trial location (striped area)

Catch composition curves for the top four commercial species caught during the trial are presented in Figure 3. Results of the GLMM showed significant differences in the catch composition of cod, haddock and *Nephrops* between Quad and Twin-rig trawls ($P<0.05$ in all cases). No significant difference was observed for whiting ($P=0.48$). The Quad-rig caught significantly lower proportions of larger cod, higher proportions of smaller cod and lower proportions of haddock across the range of fish sizes A significantly higher proportion of smaller *Nephrops* modelled in the catch composition curve is consistent with the higher proportions of smaller *Nephrops* observed in the total catch weights (Figure 3).

Table 2. Total catch weight comparison between Twin and Quad-rig trawls

Species	Twin-rig (kg)	Quad-rig (kg)	Difference (%)
Cod	137	53	-61
Haddock	428	266	-38
Whiting	259	252	-3
Hake	108	63	-42
Ling	109	37	-66
Monkfish	124	109	-12
Witch	59	41	-31
Plaice	36	38	6
Lemon sole	16	16	0
Black sole	10	13	30
Retained *Nephrops*			
10 – 30/kg	233	330	41
30 – 40/kg	92	120	30
40 – 50/kg	54	87	61
Tails (live weight)	90	185	106
Total retained *Nephrops*	469	722	54

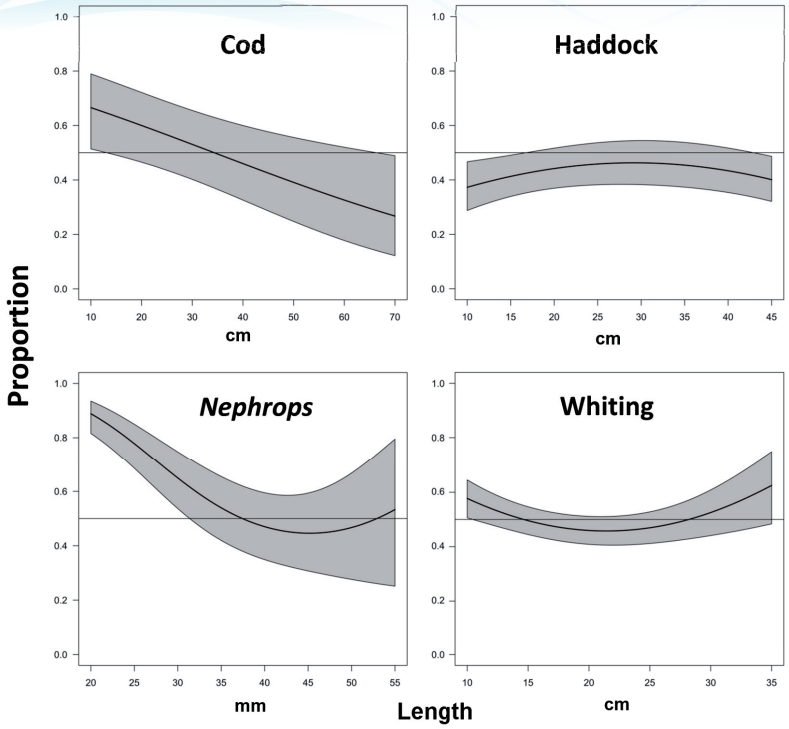

Figure 3. Catch comparison curves for cod, haddock, whiting and *Nephrops*. Observations that fall on the 0.5 line indicate that the proportion caught in each of the gears is equal. Observations above the line show that more fish are caught in the Quad-rig and observations below the line show that more fish are being caught in the Twin-rig. Grey shaded areas either side of the curve illustrate the 95% confidence limits.

Discussion

Results of this trial are broadly in line with a similar trial carried out by CEFAS in the North Sea where cod catches were reduced by around 60% and *Nephrops* catches were almost doubled (Revill *et al.,* 2009). Lower fish catches may be related to factors such as lower headline height, reduced sweep length, a narrower fishing circle and altered herding effects in the Quad compared to the Twin-rig. Increased *Nephrops* catches in the quad-rig may be related to improved ground contact, an altered sweep arrangement ahead of the nets or other differences in the performance of trawls. Diverging from the results of our study, whiting catches were reduced by around 60% in the UK study. Almost the entire catch of whiting in the Irish study were, however, juveniles below the minimum landing size of 27 cm. Fish react to a trawl with a series of behaviours that often are species and size specific (Krag *et al.,* 2014). The Quad-rig may be more efficient at catching juveniles of certain fish species as was the case was the case for cod in our study cod in our study. Higher proportions of smaller fish and *Nephrops* in the Quad-rig raise some concerns in relation to the impending Landings Obligation and stock conservation.

BIM are due to carry out further gear trials in the *Nephrops* fishery in 2014. We will test the SELTRA sorting box with a view to achieving further reductions in fish catches in the Quad-rig. We will also test a range of larger cod-end mesh sizes with a view to reducing bycatch of undersized fish and *Nephrops*. Reductions in landings of small *Nephrops* (in italics) can also be investigated using sorting grids and square mesh panels in the bottom of the SELTRA panel (Frandsen et al., 2011).

Acknowledgements

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References

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