Bioeconomic assessment of an increase in mesh size in an Irish *Nephrops* fishery

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Introduction

With an estimated value of €49m at first point of sale in 2015, *Nephrops norvegicus* is Ireland's most commercially important demersal fishery. The Western Irish Sea is an important *Nephrops* fishing ground with ~ 2500 t of landings corresponding to 100% quota uptake by Irish vessels annually in that area, but with a discard rate of ~ 17% of *Nephrops*. Since the start of 2016, discarding of *Nephrops* has been restricted under the EU landing obligation, providing impetus for improved *Nephrops* selectivity. BIM carried out a bioeconomic assessment of an increase in minimum codend mesh size from 70 to 80 mm as a potential measure to improve *Nephrops* selectivity.

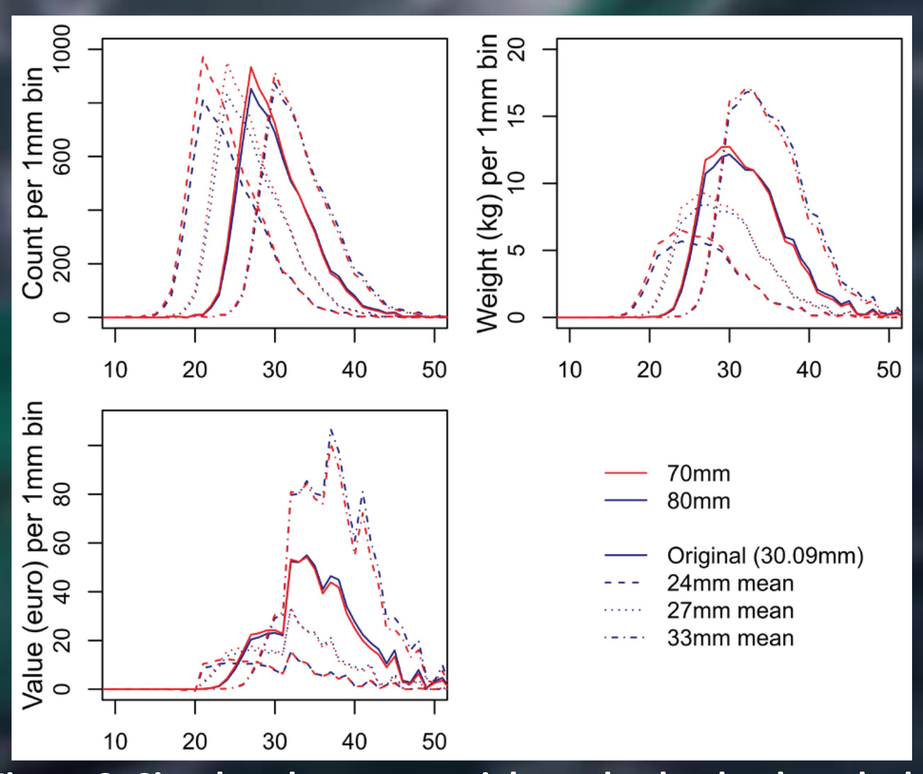

Figure 2. Simulated counts, weight and value by: length class, codend mesh size and simulated catch length composition scenario

Results

- Catches of undersize *Nephrops* reduced by 45% in the 80 mm codend
- Total *Nephrops* value (€) reduced by 5% in the 80 mm
- But 4% – 6% increase in profitability (Figure 3)

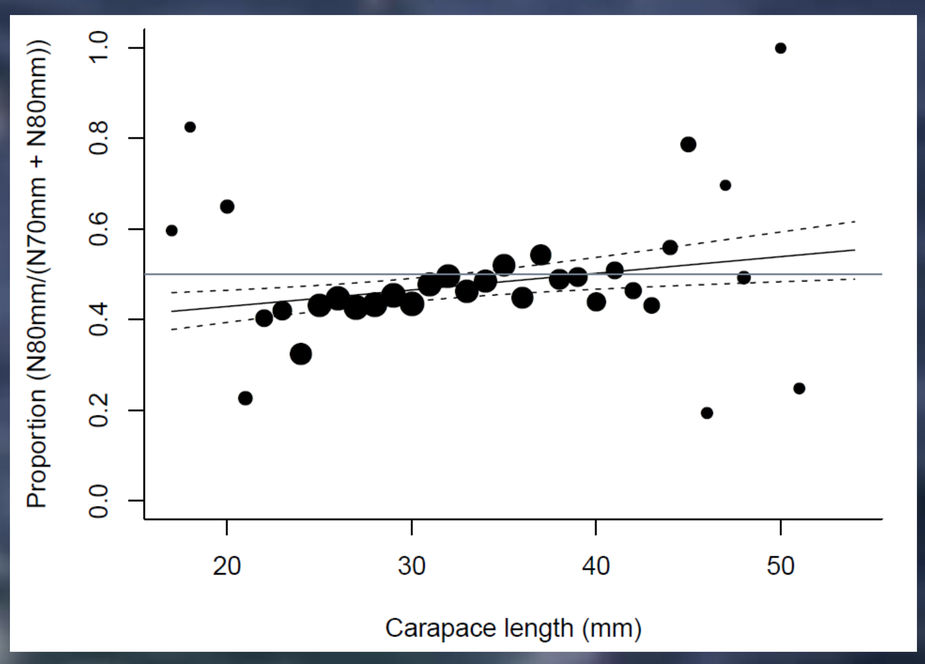

Figure 1. Predicted P_{80} values from a binomial GLMM

Methods

- Catch comparison gear trial on board a 22 m quad-rig trawler targeting *Nephrops* in the Irish Sea in July 2015
- Catches from from 70 and 80 mm codends compared
- Proportional catches at length modeled using a generalised liner mixed model (GLMM) (Figure 1)
- *Nephrops* length frequency distributions (LFD) are generally normally distributed so model outputs were used to simulate a series of *Nephrops* LFDs to take account of temporal or spatial variability in catch length compositions (Figure 2)
- Along with detailed operational costs from the trial vessel, and price data from BIM gear trials, these inputs were used to estimate *Nephrops* catch value and vessel profitability for a notional annual vessel catch allowance of 100 t

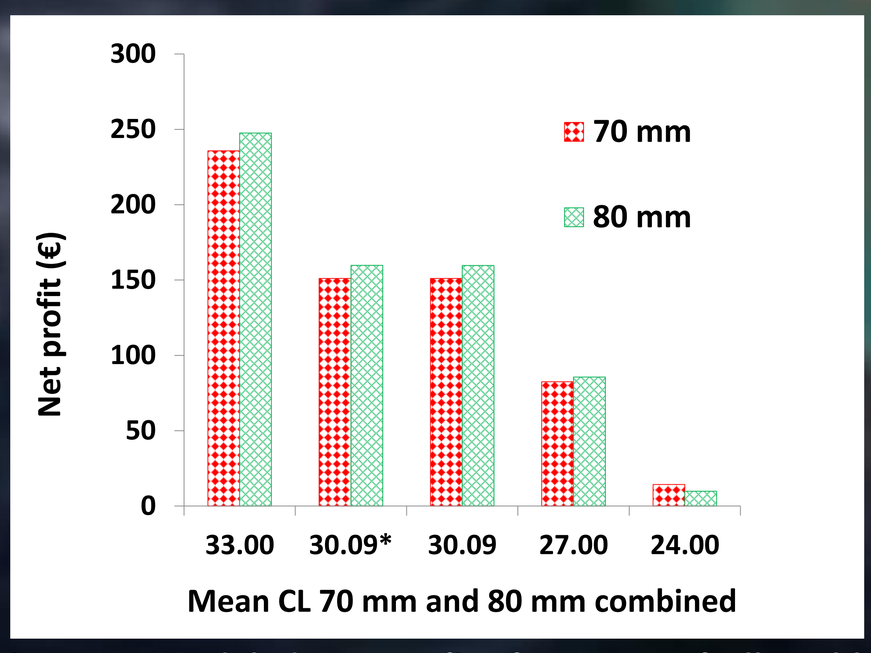

Figure 3. Modeled net profits for 100 t of allowable catches in relation to a range of observed* and simulated *Nephrops* length compositions

Conclusion

In the context of the Landing Obligation and 100% quota uptake, reduced catches of small *Nephrops* afforded an extra opportunity to catch increased quantities of larger more valuable *Nephrops*, resulting in increased profitability in the 80 mm compared with the 70 mm codend. Additional costs associated with extra fishing effort to avail of this opportunity were outweighed by the benefits of having increased access to available resources. Based on the results of this study, a national increase in minimum codend mesh size from 70 to 80 mm was introduced on the 1st January 2017 (S.I. No. 510 of 2016). This will greatly improve the sustainability of the Irish *Nephrops* fishery and assist in addressing landing obligation requirements. Study outcomes clearly demonstrate the utility of incorporating bioeconomics into assessments of gear changes in response to the landing obligation.

European Union
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Further Information
www.bim.ie/media/bim/content/publications/BIM,Cod-end,Mesh,Size,Report,2015_Oct.pdf

BIM Ireland's Seafood Development Agency

T90 mesh improves selectivity and addresses the landing obligation for Celtic Sea whiting

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Introduction

The 2017 Irish whiting quota in ICES VIIb-k (Celtic Sea) is worth approximately €10.4 million at first point of sale. Phased in under the landing obligation in 2016, a 7% *de minimis* exemption is in place. Minimum codend mesh size is 80mm in the targeted fishery but discard rates of >30% have been recorded. The high level of unwanted catch has potential to:

- ◊ Increase costs
- ◊ Reduce opportunity
- ◊ Adversely affect the economic viability of the fishery

Aim

To improve the size selectivity of the current (80 mm) minimum mesh size.

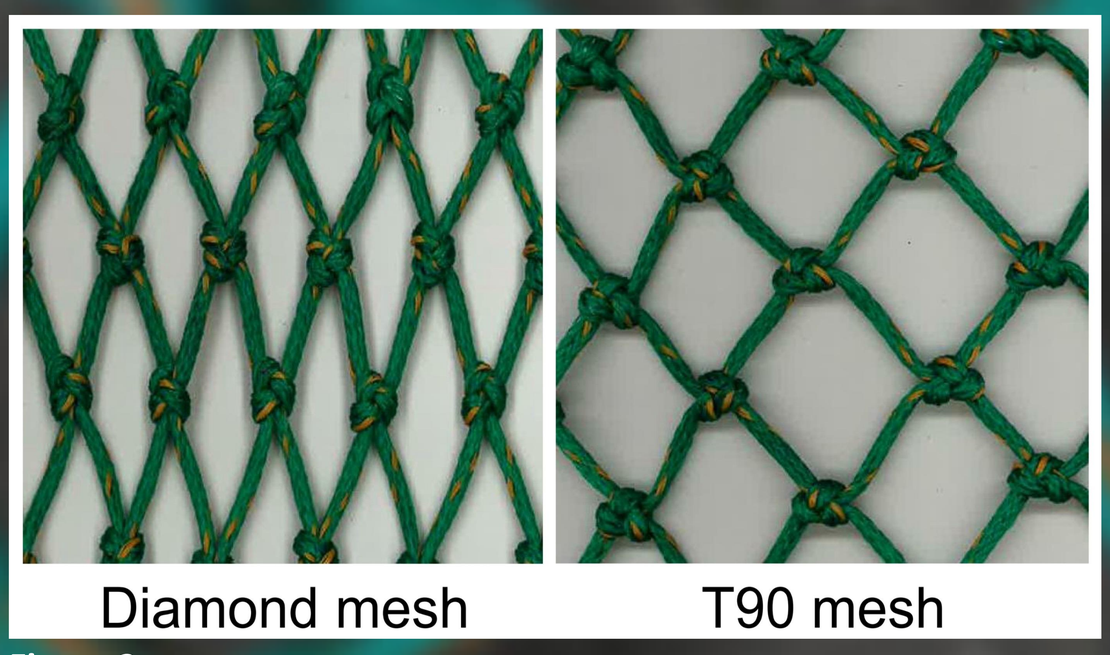

Figure 2.

Results

Using T90:

- ◊ Below market-size whiting catches (<32 cm) were reduced by 67%
- ◊ Market-size whiting catches (≥32 cm) were increased by 16% (Figure 3)
- ◊ Gutted whiting quality assessment scores increased over a range of quality parameters (Table 1).
- ◊ The value of gutted whiting increased by an estimated 19% (Table 1).

Table 1. Average increase in score per quality assessment parameter and value of fish caught using T90 compared with standard gear.

Overall texture	Overall appearance	Filleting ease	Fillet bruising	Fillet Colour	Value
21%	35%	13%	31%	31%	19%

Figure 1. The trial vessel

Methods

A catch comparison trial was carried out in the Celtic Sea using identical twin-rigged trawls on board a 25m whitefish vessel during April 2016 (Figure 1).

The size selectivity of diamond mesh is largely determined by the openness of the mesh. Two relatively simple ways to improve mesh opening are:

- ◊ Turn the mesh 90° (T90) (Figure 2)
- ◊ Reduce the circumference

The test gear consisted of an extension piece, codend and lifting bag constructed from T90 80 mm mesh with a circumference of 80 meshes. The standard gear was similarly constructed but from 80 mm diamond mesh with a circumference of 120 meshes. A follow-up sea trial using identical test and standard gears was carried out in March 2017. Samples of gutted fish were collected from both gears for subsequent quality and value assessment by a panel of fishmongers.

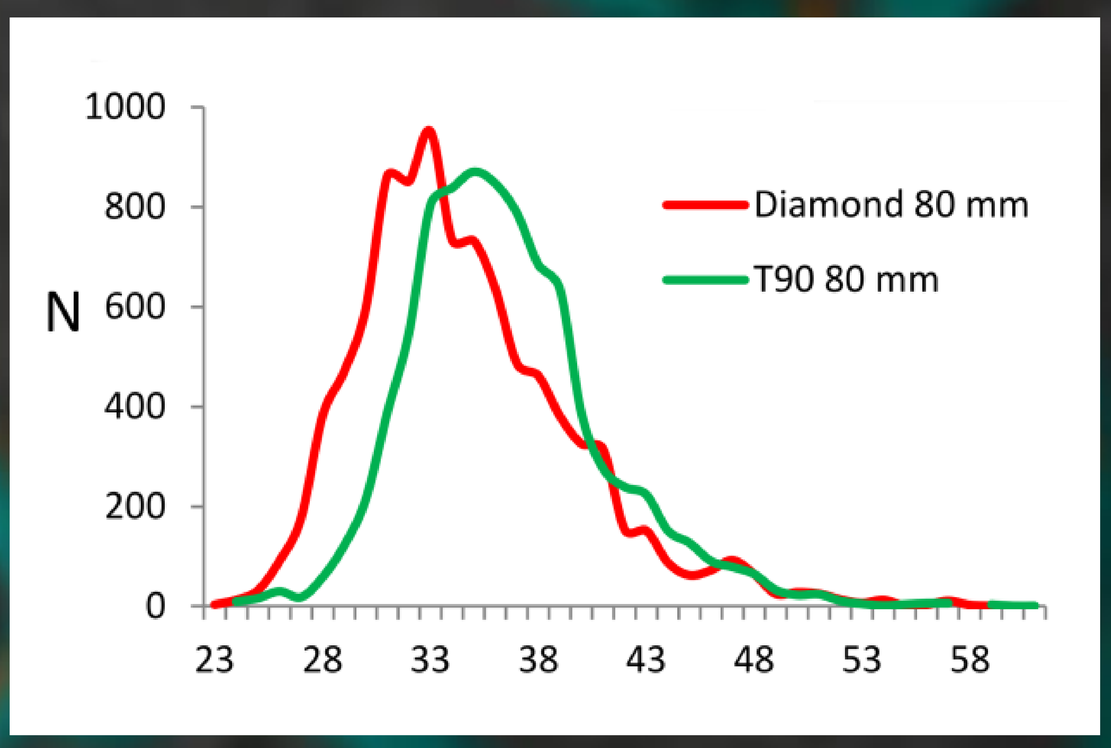

Figure 3. length-frequency distributions of whiting (cm)

Conclusions

- ◊ Substantial reductions in < market-size whiting can greatly assist vessels to meet landing obligation requirements
- ◊ Improved catches of market-size whiting along with an increase in value has major potential to reduce costs and increase the value of whiting landings which bodes well for the uptake of T90 in this fishery.

European Union
This measure is part- financed by the European Marine and Fisheries Fund

Further Information on the T90 trial can be downloaded at:
www.bim.ie/media/bim/content/publications/5536,BIM,Assessment,-,T90,mesh,-,Whiting,-,Celtic,Sea,-,ONLINE.pdf

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Separating species to increase sustainability and economic returns in a mixed demersal fishery using a dual codend separator trawl

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Introduction

Mixed-species demersal trawling

- large polyvalent fishing fleet
- some reliant on *Nephrops* and a diversity of whitefish

Potential concerns

- EU landing obligation since January 2016 – restricted discarding of species subject to catch limits
- quota for some species (primarily whitefish species) can be quickly filled reducing fishers ability to continue fishing

Objective

- optimise selectivity of both *Nephrops* and whitefish species in a mixed demersal fishery

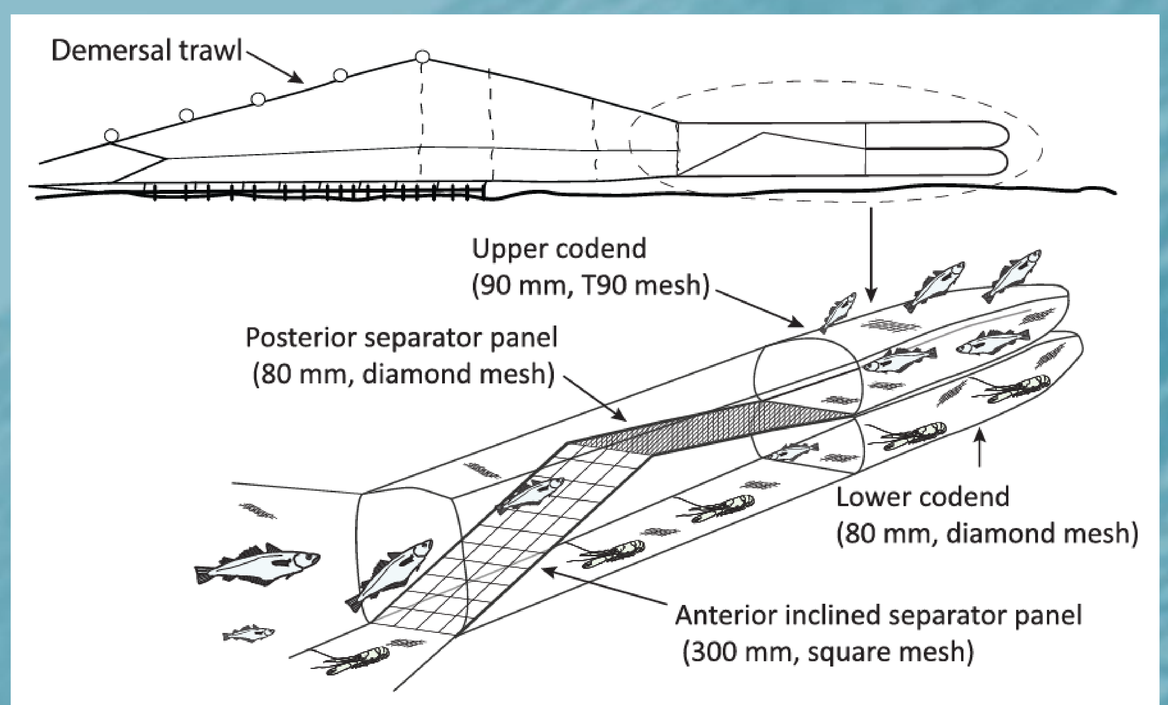

Figure 1. Schematic of a demersal trawl with a dual-codend

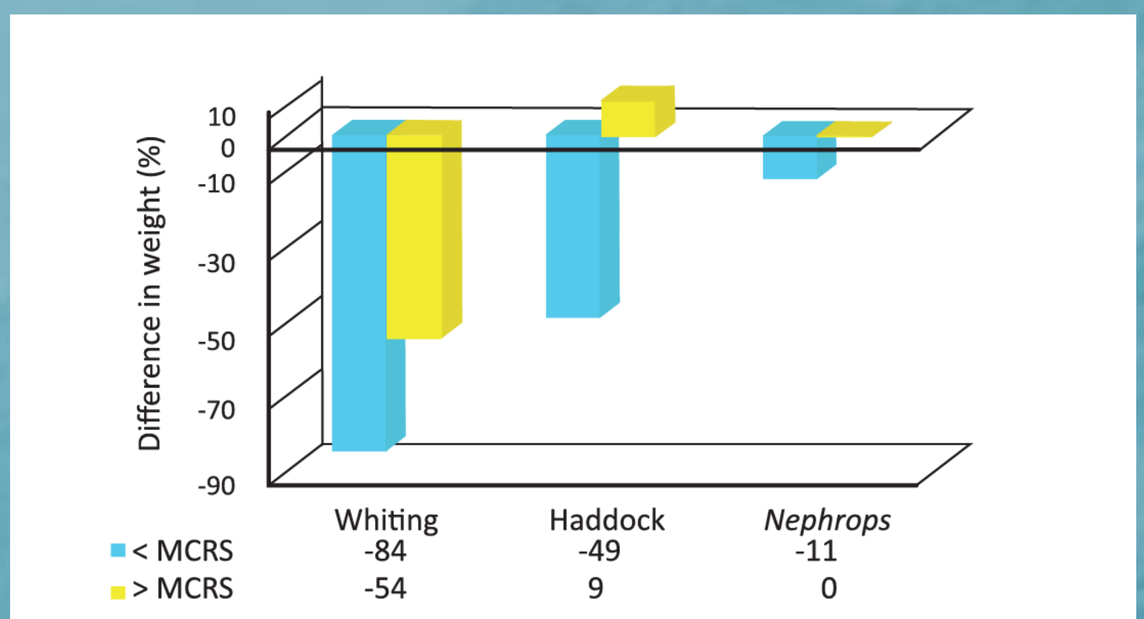

Figure 2. Proportions of key species < and > MCRS (minimum conservation reference size) between the standard and dual-codend trawls

Results

Catch comparison (Figure 2)

- minimised catches of <MCRS key whitefish species
- maintained >MCRS *Nephrops* catches
- >80% of key whitefish species in upper codend
- >85% of *Nephrops* in the lower codend

Quality assessment (Figure 3)

- average 26% increase in quality
- average 19% increase in value

Methods

Catch comparison

- catch comparison of the dual codend separator with a standard trawl
- separate *Nephrops* and fish into two codends
- apply alternative selectivity devices in the two codends (Figure 1)

Quality assessment

- four independent fishmongers surveyed on quality and value differentials of haddock and whiting from a T90 compared with a standard codend

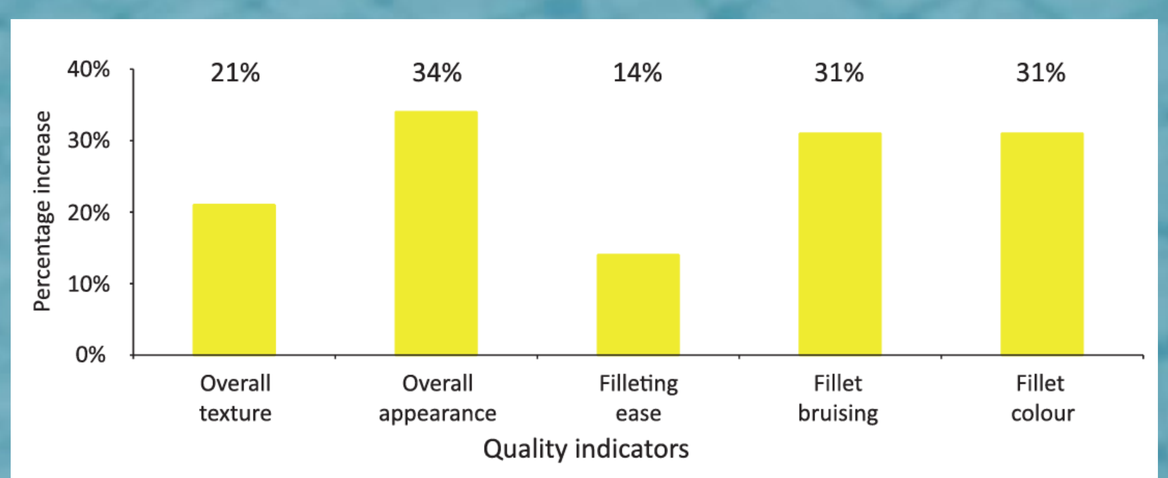

Figure 3. Bar plot of fish quality from five key indicators with percentage increase between T90 and diamond mesh codends

Conclusions

The dual codend

- selectivity of *Nephrops* and whitefish effectively improved with minimal loss of market sized catches
- codends can be modified to further improve selectivity
- a practical and flexible gear option under the landing obligation

Species separation will likely

- reduce catch sorting times
- increase catch quality and value (especially with larger and/or T90 mesh)

Overall the dual codend has major potential to address a range of challenges posed by the landing obligation while boosting fishery sustainability and economic viability of vessels targeting *Nephrops* and whitefish species

EUROPEAN UNION
This measure is part financed by the European Maritime and Fisheries Fund (EMFF)

Further Information
http://www.bim.ie/media/bim/content/publications/5987-BIM-Stella-Nova-Trial-Brochure.pdf

BIM Ireland's Seafood Development Agency

High survivability, an important driver for improved sustainability and economic returns in the Irish *Nephrops* fishery

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Introduction

- *Nephrops norvegicus* is Ireland's most commercially important demersal species
- *Nephrops* discard rates range from 5 to 28.5%
- Under the Landing Obligation (LO), undersize *Nephrops* must be landed and deducted from quota with major economic implications

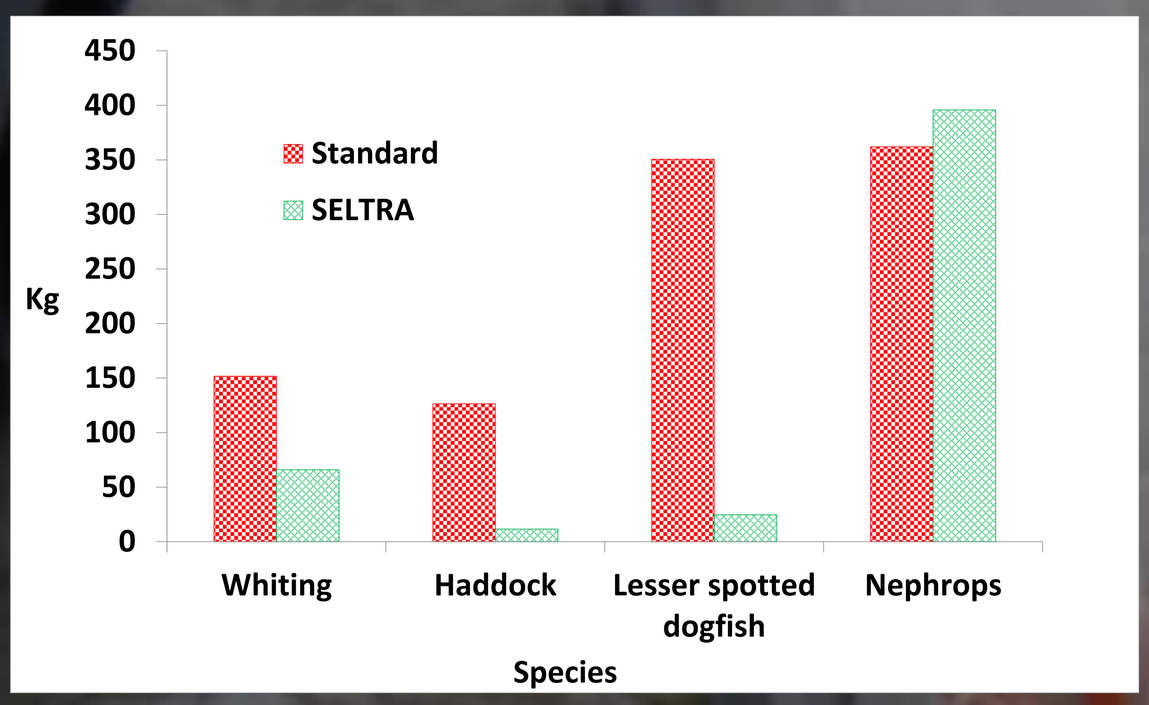

Figure 2. Species catch weights in catch comparison of SELTRA and standard trawl

Aim

To assess the survivability of *Nephrops* using a SELTRA selectivity device in ICES sub area VII to support an application for exemption from the LO under the high survivability provision.

Methods

- Study area: south west or south coast of Ireland during July/ August 2017
- Commercial fishing vessels will be chartered to obtain samples using the SELTRA under normal trawling conditions. Traps/pots will provide a proxy of optimal survivability
- Fishing will take place over the course of one week in order to obtain samples from a range of locations and conditions. Representative samples will be stored in a flow through system of trays and tubes (Figure 3), landed daily and transported to an onshore holding facility where further monitoring will occur for ~ 360 h
- Survivability will be assessed using vitality scores and reflex assessments as per sampling protocols developed by the ICES Working Group; Workshop on Methods for Estimating Discard Survival (WKMEDS)

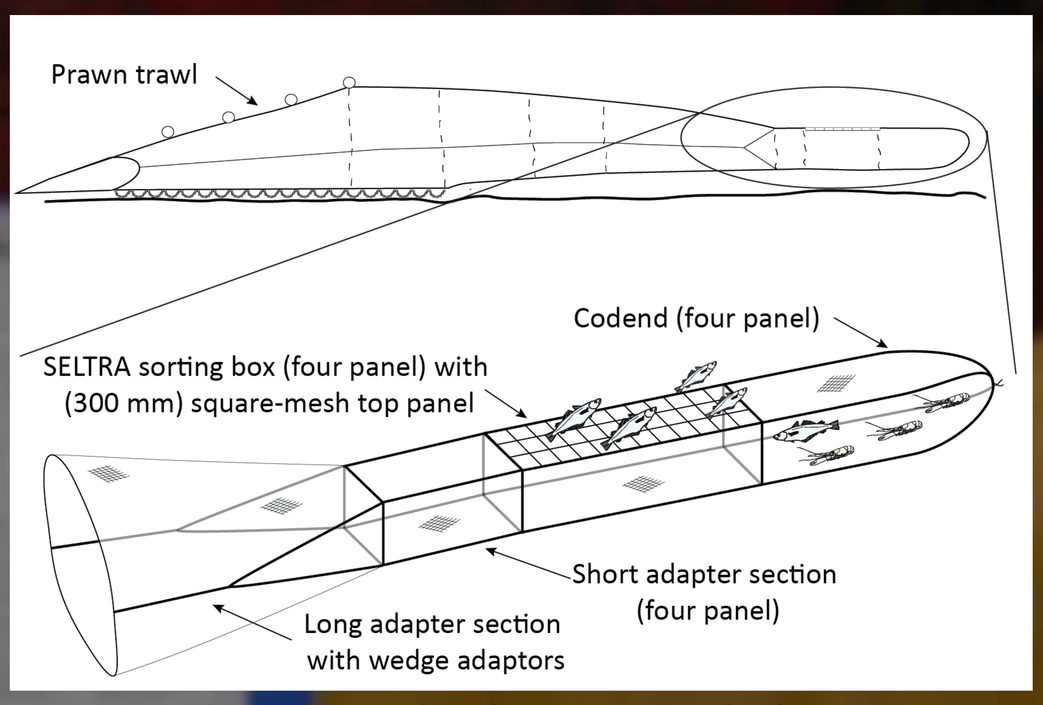

Figure 1. Schematic trawl with SELTRA attached

Potential solutions

- Gear modifications can partially assist but are not currently capable of excluding undersize *Nephrops* without losing marketable catches
- Under Article 15.4(b) of Regulation (EU) No. 1380/2013 the LO shall not apply to species for which scientific evidence demonstrates high survival rates
- UK and Sweden demonstrated high *Nephrops* survivability by reducing fish catch and improving *Nephrops* condition using the netgrid, Swedish grid and SELTRA selectivity devices. This resulted in high survivability exemptions for *Nephrops* caught using these devices in ICES sub areas III and IV
- BIM has also achieved substantial reductions of fish catches using the SELTRA (Figure 1) compared with a standard trawl in Irish waters, e.g. 91% reduction in haddock and 93% reduction in lesser spotted dogfish catches - strong industry interest in the SELTRA given higher catches of *Nephrops* (Figure 2)

Figure 3. *Nephrops* placed in individual cells for live storage

Conclusion

The study has major potential to assist vessels targeting *Nephrops* in ICES sub area VII to address LO requirements, improve biological sustainability and economic returns. A high survivability exemption would also assist vessels meet LO requirements for fish species, given it incentivises use of the SELTRA which is highly effective in reducing fish catches. The economic benefits of a high survival exemption will be assessed to help drive uptake of this approach by the Irish fishing industry.

European Union
This measure is part- financed by the European Marine and Fisheries Fund

Further Information on the SELTRA trial
http://www.bim.ie/media/bim/content/publications/fisheries/6140-BIM-Fisheries-Conservation-report-4-1.pdf

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