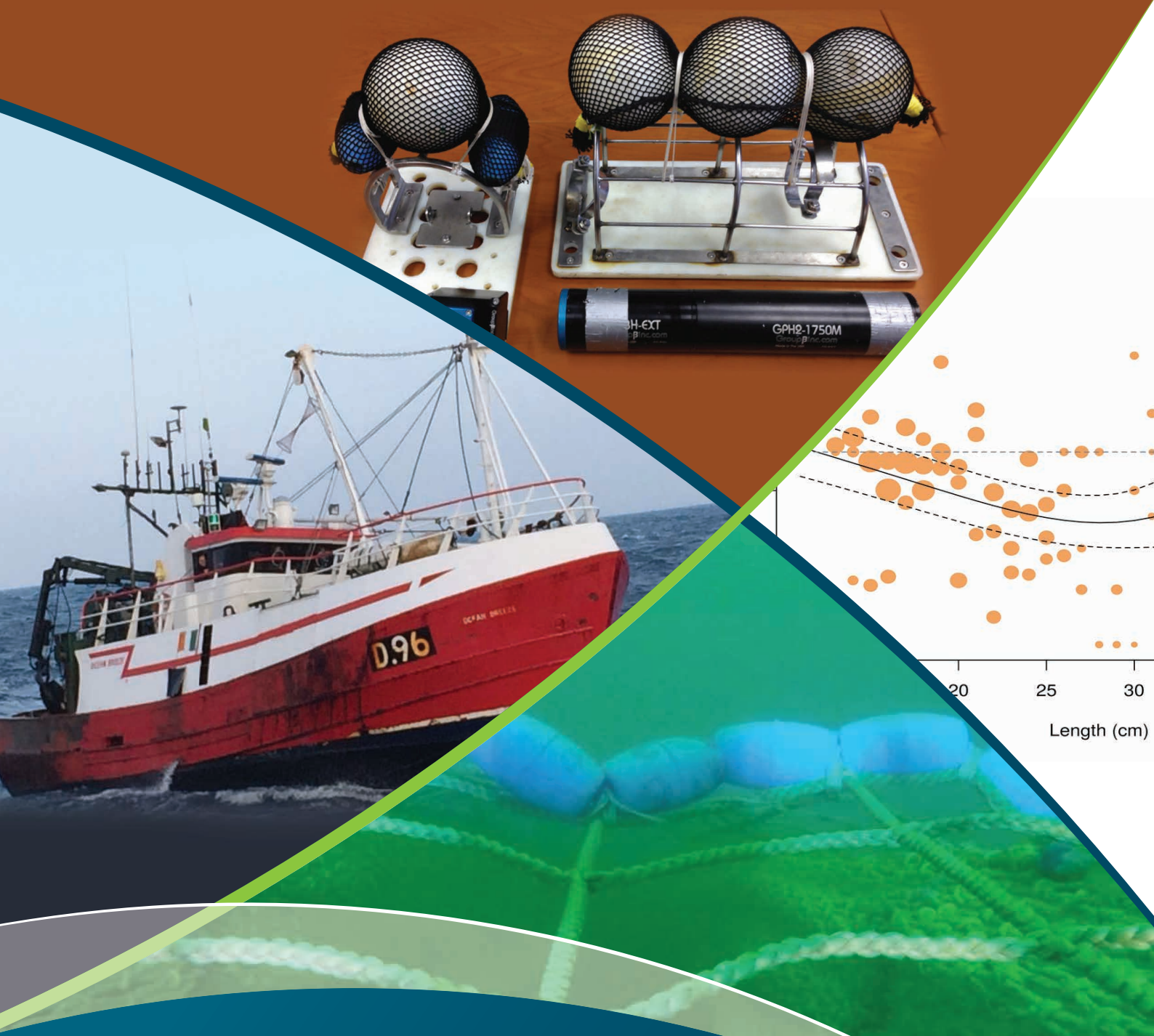

Assessment of an inclined panel and flotation devices in the SELTRA

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Assessment of an inclined panel and flotation devices in the SELTRA

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Key Findings

An inclined panel in the SELTRA reduced catches of undersize whiting by 33% but was ineffective for very small whiting < 20 cm and reduced *Nephrops* catches by 12%.

1

Underwater video footage was of major benefit in determining optimal float configuration on the SELTRA which remains an important gear measure in addressing challenges posed by the landing obligation.

2

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Introduction

The SELTRA sorting box is highly effective in reducing unwanted fish catches in *Nephrops* trawls and has major potential to assist Irish vessels in meeting requirements under the landing obligation.

The four-panel SELTRA with 300 mm square mesh panel (SMP), henceforth the SELTRA, located 3 – 6 m from the codline reduced whiting and haddock catches by 57% and 91% and increased *Nephrops* catches by 9% compared with a standard 70 mm codend. The device also reduced whiting, haddock and cod catches by 24, 51 and 81% respectively, and improved *Nephrops* catches by 19% compared with a standard two panel cod end with a 300 mm SMP placed 9 – 12 m from the codline (Tyndall et al., 2017).

Whiting catches < minimum conservation reference size (MCRS) of 27 cm represent a major potential choke issue in the Irish Sea (Poseidon, 2013). The SELTRA achieved a 53% reduction in < MCRS whiting compared with a standard trawl but did not reduce catches of very small whiting < 20 cm. These very small whiting occasionally constitute a major component of the whiting catch.

Mixed results have been obtained with sorting grids in this regard. A Swedish grid achieved a 77% reduction by weight in whiting across all size classes including < 20 cm, but also a 4% reduction in total *Nephrops* catches, and an 11% reduction in valuable whole grade *Nephrops* > 31 mm carapace length (CL) over a 4 day period in 2015 (Cosgrove et al., 2016a). Longer term observations on the effectiveness of the Swedish grid were conducted in the Irish Sea from 2010 to 2014 as part of a cod recovery plan. These showed that on average, more than 50% of whiting < 20 cm were retained (pers. comm. Dominic Rihan). Grids are unlikely, therefore, to provide a comprehensive solution to the whiting choke problem in the Irish Sea, and may also have negative economic consequences in terms of reduced *Nephrops* catches. Furthermore, rigid sorting grids can be subject to handling difficulties when hauling on a vessel's net drum and power block (Graham and Fryer, 2006).

Separator or guiding panels have been used to separate fish species and *Nephrops* into two codends (Hillis, 1983; Main and Sangster, 1985; Graham and Fryer, 2006; Cosgrove et al., 2016b). Successful results in relation to very small whiting (100% separation of fish < 20 cm) were achieved by Hillis (1983) although *Nephrops* catches were reduced when tows of longer haul duration were conducted. Never the less these results were encouraging and suggested that a guiding panel might help reduce catches of very small whiting in the SELTRA.

BIM recently commenced using GoPro cameras to film and gain a better understanding of selectivity devices in operation. Questions arose from industry in relation to whether flotation was required on the SELTRA, and if so where best to place the floats. Hence, this issue was also investigated.

Methods

Two trials were conducted to assess these issues: Trial 1 comprised a catch comparison of various inclined panel designs against a standard SELTRA. Trial 2 used GoPro cameras to observe the gear's performance with different float configurations around the escape panel.

Table1. Gear specification used in Trial 1 and 2

Description	Trial 1	Trial 2
Vessel	Ocean Breeze	Karen Mary
Trawl type	Twin-rig *Nephrops*	Single-rig *Nephrops*
Trawl manufacturer	Pepe Trawls Ltd.	Marine suppliers (Howth)
Headline length (m)	36	38
Footrope length (m)	40	42
Fishing-circle (meshes × mm)	380 × 80	380 × 80
Sweep length (m)	2 × 70 (20 + 50)	78 (76 + 2)
Warp diameter (mm)	16	12
Door manufacturer	Dunbar	Bison
Door Weight (kg)	280	120
Engine power (kw)	224	150
SELTRA basic flotation	7 large	6 large
SELTRA SMP (mm)	300	
SELTRA panel mesh size (mm)	80	
SELTRA panel (no. meshes)	50 × 34	
SELTRA codend panel (no. meshes)	31 × 30 (x 4)	
SELTRA codend mesh size (mm)	80	

Trial 1

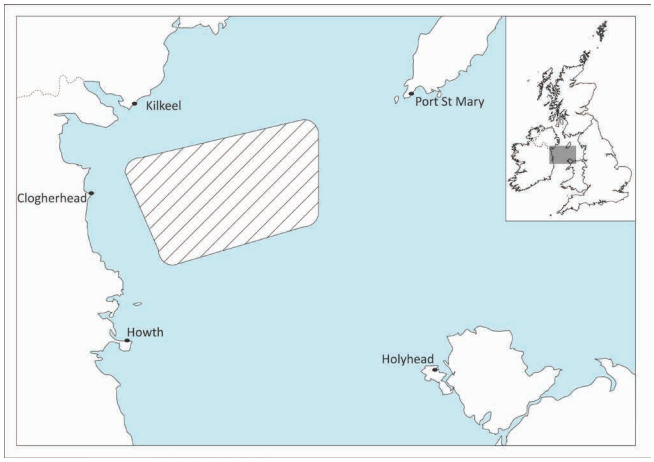

Figure 1. The vessel MFV Ocean Breeze and the area of operation in Trial 1

Trial 1 was conducted in the Irish Sea on board the MFV Ocean Breeze, an 18 m twin-rig vessel (Figure 1). In total, 6 valid tows were carried out over a three day period commencing 4th April 2017. Fishing was conducted under normal commercial fishing conditions with haul duration, towing speed and fishing depth averaging 4.2 hr, 2.77 kn and 83 m respectively. The twin rig was configured using a two-warp system that split into four, where the outer two warps were attached to the trawl doors (Dunbar), and the inner two warps were attached to a centre plate. Details of basic gear specifications used in both trials are outlined in Table 1.

A modified SELTRA was fitted with an inclined panel consisting of 6 × 17 meshes of 300 mm square (T45) mesh, constructed of 8 mm knotless PE, identical to that of the 300 mm SMP. The inclined panel was fixed along the bottom panel on the anterior end of the extension piece before the SELTRA at an angle of ~ 30° rising up the meshes to the escape window half way along the SELTRA (Figure 2a). The panel was modified in an attempt to avoid reduced *Nephrops* catches by removing 7 meshes from the back of the inclined panel (Figure 2b), and subsequently a further 3 meshes from the font end (Figure 2c).

Total catches were weighed and sorted to species level, with some species subsequently combined due to low numbers (e.g. commercial flatfish). The total weight of each commercial species was recorded in addition to a random representative length subsample for fish species. Cumulative total weight of non-commercial species such as mixed flatfish, small pelagic species and invertebrates were also obtained and categorised as discards. A general additive mixture model (GAMM) was used to statistically assess proportional differences in catch at length for whiting and haddock in the modified SELTRA.

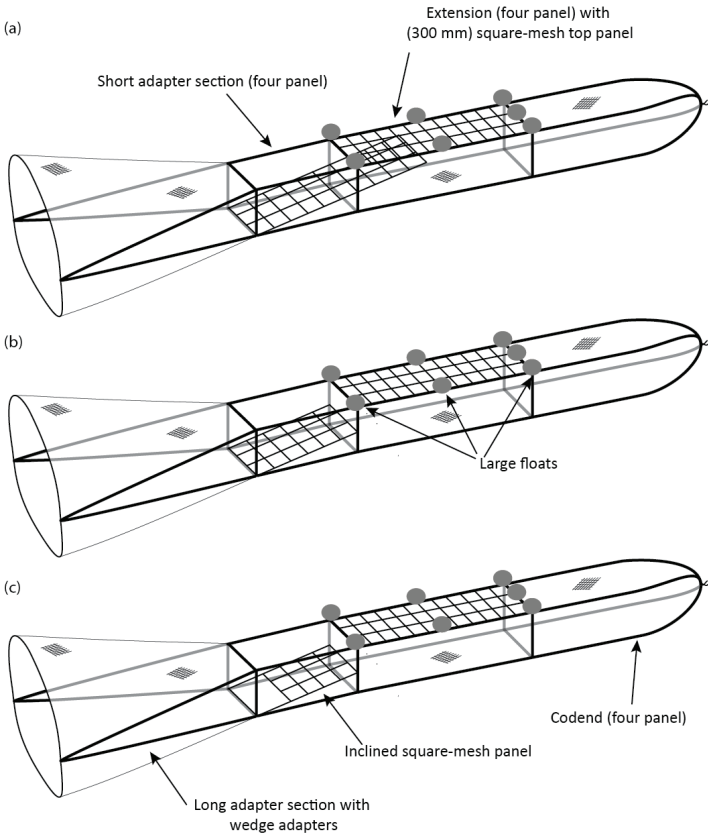

Figure 2. Illustration of the modified SELTRA panel configurations: (a) Hauls 1 – 3 (b) Hauls 4 & 5 (c) Haul 6

Trial 2

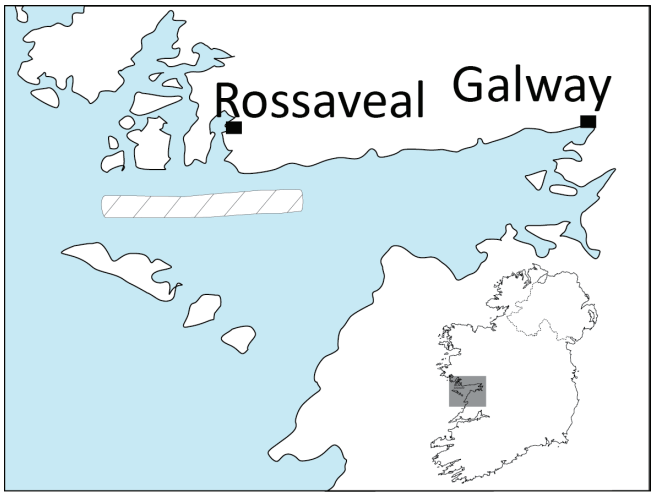

Figure 3. The vessel MFV Karen Mary Breeze and the area of operation in Trial 2

Trial 2 was conducted in Galway Bay on board the MFV Karen Mary (Figure 3) over three days during summer 2017 using a single-rig configuration. On each day up to four tows were completed under normal towing speeds (~ 2.5 kts) in approximately 35 m water depth. Haul durations were kept short at (~ 1 hr) in order to maximise the number of trawl observations. A GoPro camera and light were attached on the top panel of the trawl immediately forward of the SELTRA SMP, to optimise video capture.

Three different flotation configurations were assessed using a conventional SELTRA: without floats (Figure 4a); with 6 x 140 mm Ø floats positioned along the 300 mm SMP, three each side, at the start, middle and end of the panel (Figure 4b); with 6 x 140 mm Ø floats plus three strings of 8 gillnet floats (50 x 80 mm Ø) attached at mesh row three, nine and sixteen (Figure 4c). The approximate buoyancy of each 140 mm Ø and gillnet float was 0.85 kg and 0.08 kg respectively.

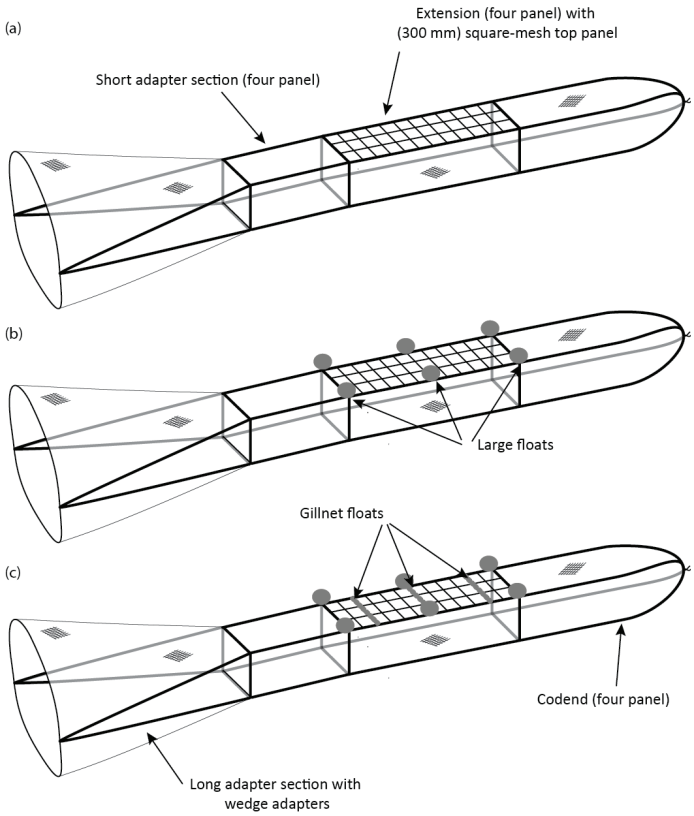

Figure 4. Illustration of three different flotation configurations (a) without floats; (b) with six large 140 mm Ø floats; and (c) with the six large floats and three rows of 50 x 80 mm Ø gillnet floats

The GoPro camera (Hero 5 Black) was enclosed in an anodised aluminium housing (2,600 m depth rating) that was attached to a bespoke camera mount, constructed from a 12 mm nylon baseplate with stainless steel shield (21 × 29.5 × 17 cm; W × L × H) (Figure 5a). To aid illumination at depth a Nautilux custom light (with up to 3,500 lumens and a 7 hr battery life) and housing (depth rated to 1,750 m) was also mounted on a 12 mm nylon baseplate with a stainless steel shield (21 × 49.5 × 19 cm) (Figure 5b). Both the camera and light were mounted outside the trawl pointing towards the SELTRA's top sheet (i.e. the 300 mm SMP). The camera was attached in the centre of the 80 mm upper panel where it joined the 300 mm SMP, while the light was positioned approximately 0.25 m behind and offset (to point it around the camera) (Figure 5c). The camera and light's nylon baseplates were secured to the net using polyethylene or nylon twine and carabiners. To limit disruption to the trawl's operation, floats were added to the camera mount to keep the camera and light neutrally buoyant (Figure 5a, b).

Video footage was recorded using a wide-angle field-of-view, with 48 frames per second and 1080p (progressive scan) resolution onto a 128 GB mircoSD card. The video started recording just before shooting the trawl and recorded for approximately 90 mins. All video footage was initially assessed at sea on a Toughbook laptop and backed up on an external hard drive.

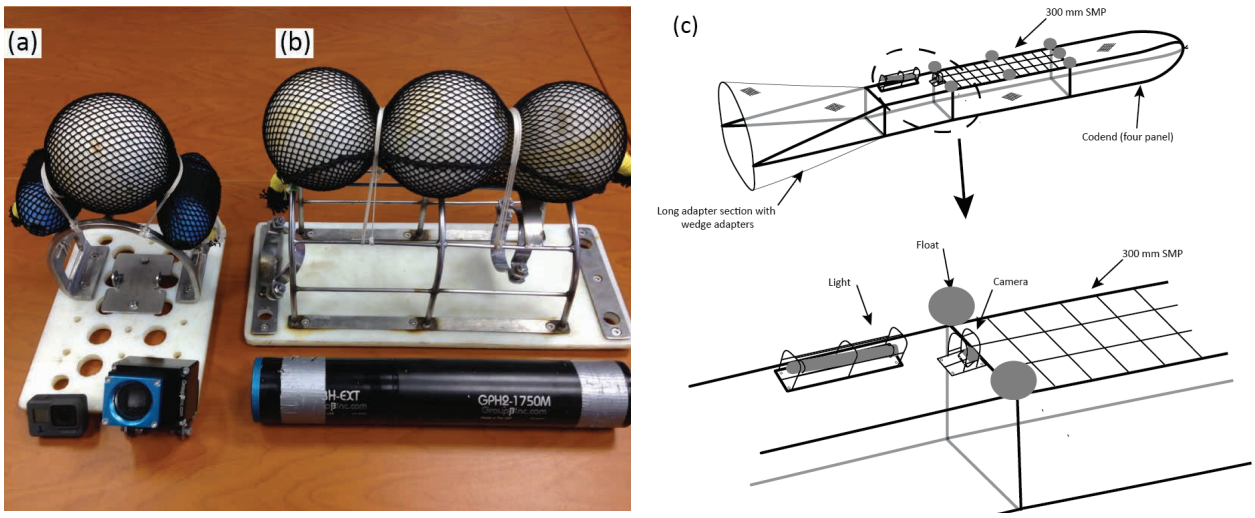

Figure 5. The camera and light configurations used during Trial 2

Results

Trial 1

The main commercial species caught during the trial were *Nephrops*, lesser spotted dogfish, whiting, haddock and mixed flatfish. Gear configuration (a), the full inclined panel, performed best in terms of reduced catches of whiting and haddock (-33% in both cases). Gear configuration (a) also performed the best in relation to *Nephrops* catches with a 12% reduction compared with 13 and 23% reductions in other configurations (Table 2).

Focussing on configuration (a), catches were predominantly below the MCRS of 27 mm for whiting and 30 mm for haddock (Figure 6). A 10% reduction in catches of whiting < 20 cm by number was observed. The GAMM analysis showed that whiting < 20 cm and haddock across all size classes were not significantly different in the modified SELTRA (Figure 7).

Table 2. Differences in species catch quantities in different gear configurations used in Trial 1

Configuration	Haul	Species	Control (kg)	Test (kg)	Difference (%)
(a)	1–3	Bulk catch	642	623	-3
(a)	1–3	Cod	15	22	43
(a)	1–3	Discard	15	30	94
(a)	1–3	Flatfish	57	77	35
(a)	1–3	Haddock	17	11	-33
(a)	1–3	Lesser spotted dogfish	66	59	-11
(a)	1–3	*Nephrops*	429	377	-12
(a)	1–3	Whiting	43	29	-33
(b)	4–5	Bulk catch	357	349	-2
(b)	4–5	Cod	16	18	15
(b)	4–5	Discard	18	15	-14
(b)	4–5	Flatfish	31	37	20
(b)	4–5	Haddock	17	18	8
(b)	4–5	Lesser spotted dogfish	41	36	-11
(b)	4–5	*Nephrops*	196	171	-13
(b)	4–5	Whiting	34	45	34
(c)	6	Bulk catch	165	133	-20
(c)	6	Discard	9	14	53
(c)	6	Flatfish	29	9	-69
(c)	6	Haddock	8	10	28
(c)	6	Lesser spotted dogfish	16	13	-17
(c)	6	*Nephrops*	86	66	-23
(c)	6	Whiting	12	8	-28

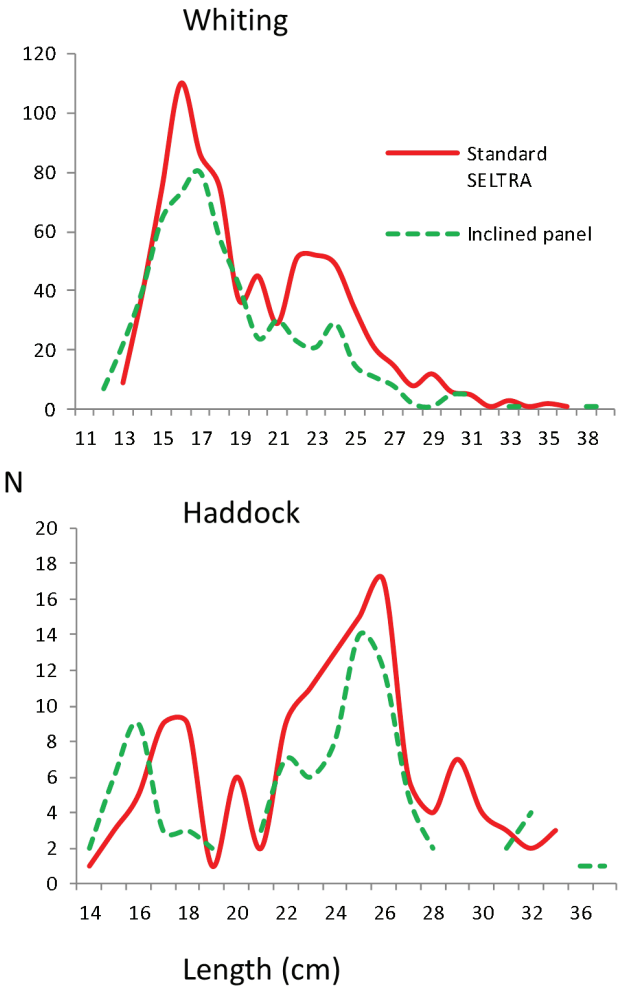

Figure 6. Length frequency distributions for the standard SELTRA and configuration (a) of the modified SELTRA

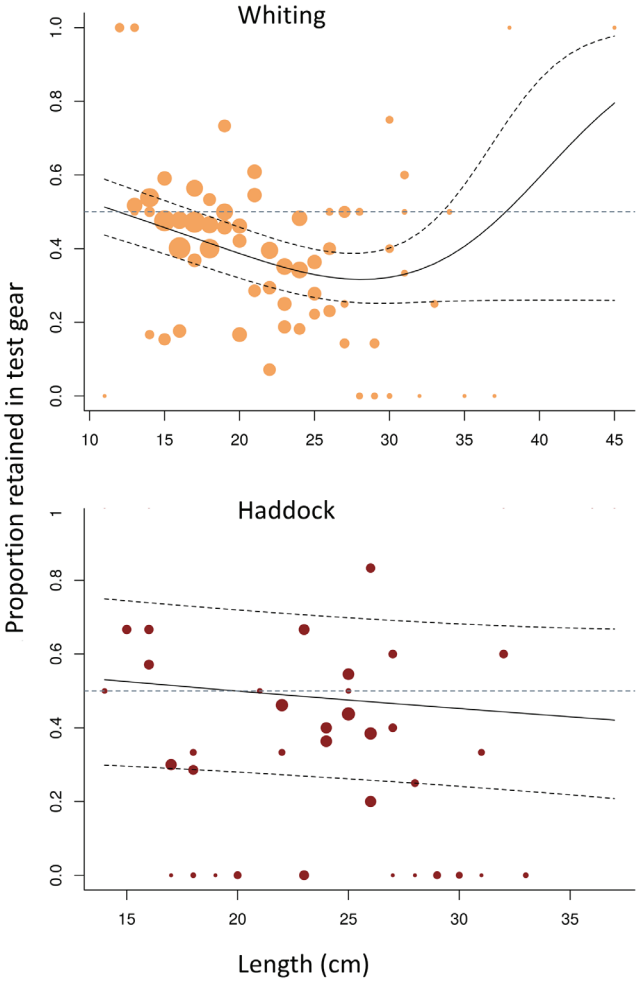

Figure 7. Predicted GAMM of proportional catch at length and approximate 95% confidence intervals for configuration (a) of the modified SELTRA. Point size is proportional to the total raised count.

Trial 2

The SELTRA without floats tended to collapse under normal trawling conditions (Figure 8a). The addition of the six large floats improved the SELTRA's overall shape but it tended to laterally compress, collapsing the top sheet (Figure 8b). The addition of three strings of smaller gillnet floats across the SELTRA further improved the overall shape by giving it a more box/square profile (Figure 8c).

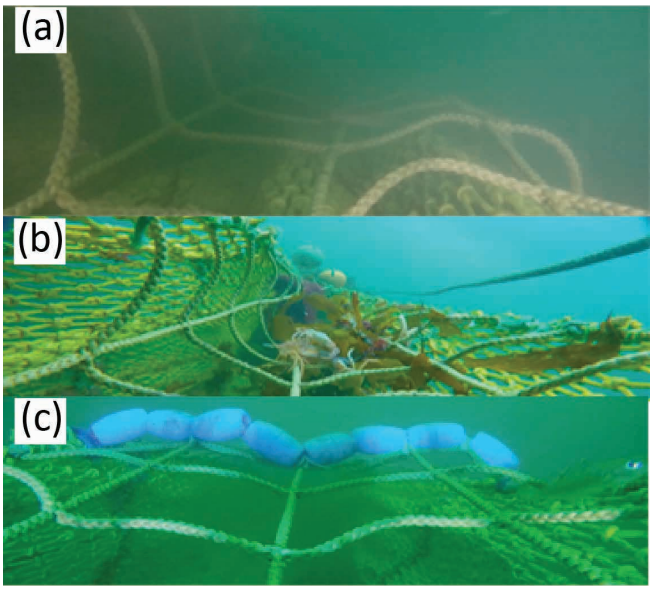

Figure 8. Stills taken from video footage of: a) SELTRA without floats; b) SELTRA with six large floats; and c) SELTRA with six large floats and three rows of eight gillnet floats

Discussion

The best inclined panel configuration in the modified SELTRA succeeded in reducing catches of undersize whiting by 33% but also reduced *Nephrops* catches by 12% and was not effective for very small whiting < 20 cm. Other measures such as altered rigging forward of the trawl to reduce herding of fish into the path of the *Nephrops* trawl may also have potential to reduce catches of very small whiting and are due to be investigated by BIM.

Reduced catches of whiting, haddock and *Nephrops* with the inclined panel were likely due to a combination of factors. As highlighted by the camera observations in Trial 2, the flotation used in Trial 1 was unlikely to have produced a stable vertical opening in the SELTRA. The addition of an inclined panel is likely to have further reduced the vertical opening making it easier for fish and *Nephrops* to escape. In addition, regardless of the vertical opening, inclined panels are known to direct fish and *Nephrops* to the upper part of the trawl e.g. ~ 14% separation of *Nephrops* in the dual codend experiment (Cosgrove et al., 2016b). Attempts to deal with the issue of reduced *Nephrops* catches by modifying the inclined panel in the current study were unsuccessful. On this basis, the optimal float configuration (Figures 4c, 8c) would be unlikely to solve the issue in relation to reduced *Nephrops* catches.

The underwater camera set up was of major benefit in determining optimal float configuration on the SELTRA which remains a key gear option for reducing fish catches under the landing obligation. This technology is extremely useful in improving knowledge of any gear modification and will continue to be used in future BIM studies on reducing unwanted catches.

Acknowledgements

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