Preliminary assessment of a four-panel 100 mm T90 codend and extension piece fitted with shortened lastridge ropes in the Irish demersal trawl fishery

Daragh Browne*, Martin Oliver, Matthew McHugh and Ronán Cosgrove

Bord Iascaigh Mhara, New Docks, Galway, Ireland.

*** Email: daragh.browne@bim.ie**

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Key findings:

- Substantial reductions in catches of small haddock and hake
- No loss in catches of larger haddock
- Catches of marketable hake were reduced but were mainly composed of small and medium grade fish
- The Skipper observed an improvement in catch quality and is keen to try the gear again
- These results demonstrate that this gear has major potential to assist industry with optimising haddock quota utilisation

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Introduction

The Irish quota for haddock in ICES 7.b to 7.k reduced by 33 % in 2024. Smaller grades of marketable haddock are less valuable than larger grades so optimising catches of larger haddock is one way to utilise available haddock quota more efficiently.

The 100 mm T90 (turned 90°) codend is a popular gear option (EU 2019/1241) amongst Irish demersal seine net fishers operating in the Celtic Sea. Benefits include more stable mesh openings when compared with diamond (T0) mesh which likely leads to reduced catches of small round bodied fish (Cheng et al., 2022). More stable mesh openings contribute increased water flow in the codend contributing to increased catches of large fish (Hansen, 2004; Digre et al., 2010) and improved catch quality likely (Digre et al., 2010). It is also less complex compared with other gear options that require the use of additional technical measures such as a square mesh panel (Brinkhof et al., 2022). Despite these benefits, uptake by Irish demersal trawlers has not been evident.

Canadian researchers developed the design of T90 mesh trawl codends to improve selectivity, catch quality and catch handling (Cheng et al., 2022). They constructed T90 codends from four mesh panels and added shortened Dyneema riblines (i.e. quicklines) to selvedges. Four-panel codends are considered to maintain a more stable shape than two panel codends which may be the result of the square cross section and doubling of the number of selvedges which likely contributes to increased catch quality. Riblines are composed of Dyneema rope with twine loops spliced at intervals longitudinally. Loops are interlaced through meshes adjacent to selvedges such that the length of the Dyneema rope is shorter than the codend's stretched mesh length. Riblines equate to lastridge ropes as they take the longitudinal strain from catch building up during deployment and improve codend selectivity by maintaining mesh openings (Isaksen and Valdemarsen, 1990; Sistiaga et al., 2023; Priour and Herrmann, 2005).

A BIM industry-led trial in the Irish demersal seine net fishery compared catches using: a test four-panel 100 mm T90 codend fitted with Dyneema riblines/ lastridge ropes and a control two-panel 100 mm T90 codend (Browne et al., 2021). Results were promising with the test gear reducing catches of small haddock and increasing medium and large grades. The change in catch composition resulted in a 94 % increase in the value of haddock landings. Catch quality also increased using the four-panel codend (trial Skipper pers. Comm.).

Given the promising results in the seine net fishery, BIM proposed to test the gear in the demersal trawl fishery. Here we describe the results of an industry-led trial of a four-panel 100 mm T90 codend fitted with shortened Dyneema lastridge ropes in an Irish demersal trawl fishery targeting haddock and hake.

Methods

The trial was carried out in ICES Division 7.j (Figure 1) on board the 23 m trawler MFV Virtuous (S80) from Dingle during March 2024. The 57 m footrope length demersal otter trawl deployed throughout the trial was designed to target hake and was constructed with 4 mesh panels (Table 1). As only one trawl was available, test and control codends were sewn on to the trawl on alternate hauls. The test gear comprised a 100 mm T90 codend fitted with shortened lastridge ropes along the selvedges with a 100 mm (nominal) mesh size four-panel diamond mesh (T0) extension piece . The control gear comprised a two-panel 100 mm (nominal) mesh size T0 codend and extension piece fitted with a 160 mm square-mesh panel (SMP) located between 9 and 12 m from the codline.

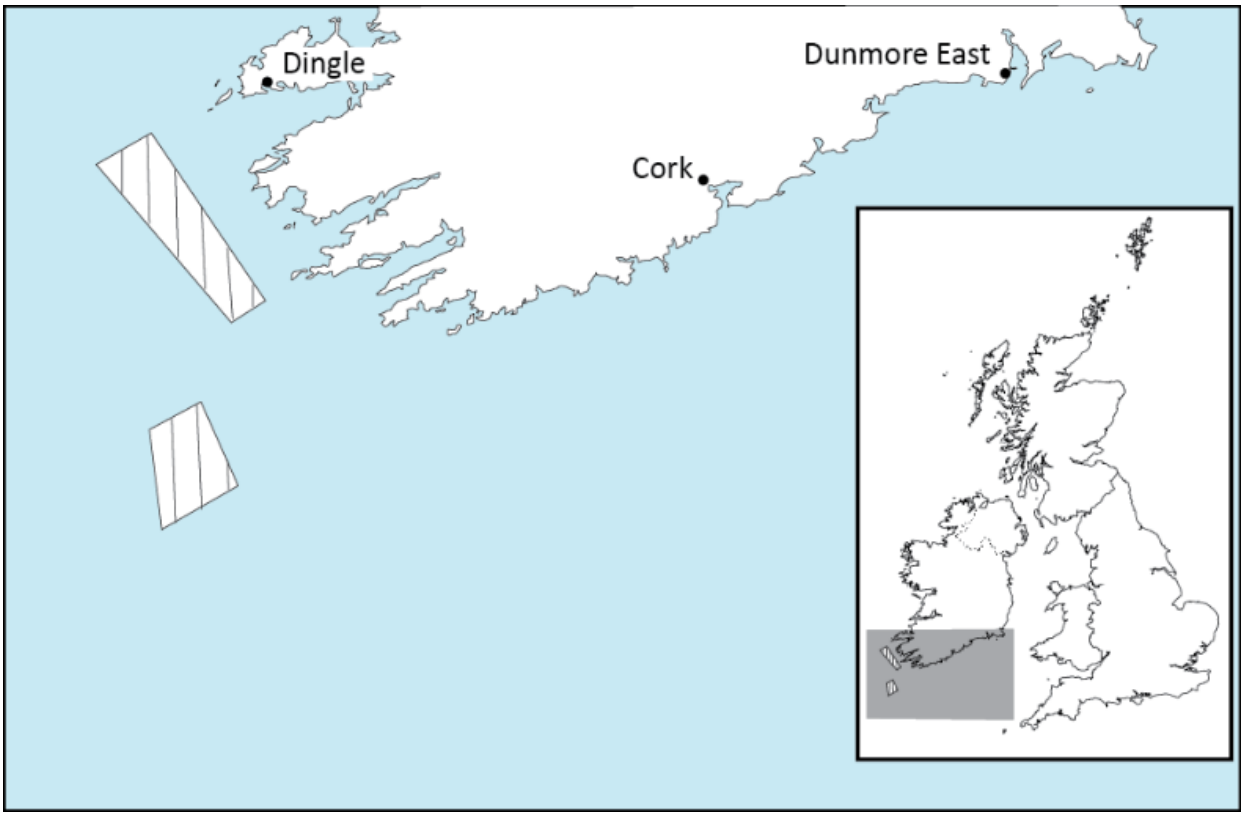

Figure 1. Trial location (hatched area) in the Celtic Sea (ICES Division 7.j)

Test and control codends were deployed on alternating days to reduce time spent changing gears. To reduce the likelihood of between-haul variation in species population abundance, each gear was deployed in a given area before the trial vessel moved ground. This approach maximised deployments and reduced the likelihood of a population effect masking a gear effect. Although the trial was scheduled for 4 days, on the 5th day the trial Skipper deployed the control and test gears, each for 2 consecutive hauls. As both gears were deployed on the

same ground the results have been included in the analysis. The trial was conducted on a self-sampling basis using protocols agreed with the vessel Skipper prior to the trial.

Table 1. Fishing gear characteristics

Warp length (average) (m)	551
Warp Diameter (mm)	18
Sweep length - singles (m)	218
Sweep length - doubles (m)	55
Door type	Thyboron type 11
Door weight (kg)	750
Door spread (average) (m)	144
Trawl manufacturer	Swan-Net Gundry
Trawl type	Single rig
Trawl twine thickness (mm)	2.5
Fishing circle (meshes x mm)	1015 x 90
Number of floats on headline	48
Footline length (m)	57
Ground gear	18 mm leaded rope
Control gear	
Nominal codend mesh size (mm)	100
Measured codend mesh size (mm)	106.0
Codend twine thickness (mm)/ twine (no.)	6 (single)
Square mesh panel mesh size (mm)	160
Test gear	
Nominal codend mesh size (mm)	100
Measured codend mesh size (mm)	111.4
Codend twine thickness (mm)/ twine (no.)	4 / double
Square mesh panel mesh size (mm)	n/a

Wanted and unwanted catches were sorted to species level, graded where appropriate, and weights were recorded. Due to relatively low catch weights, we combined catches of sole, lemon sole, megrim and turbot as commercial flatfish. Other landed species were combined as commercial species and included John Dory, pollack, rays and red mullet. Small quantities of non-quota species were present in the catch, not landed and combined as non-commercial species, including gurnard, octopus and crab.

Mean catch weights per haul of key species were calculated for test and control gears. We plotted standard error bars to provide a simple test for significant differences between means using available data.

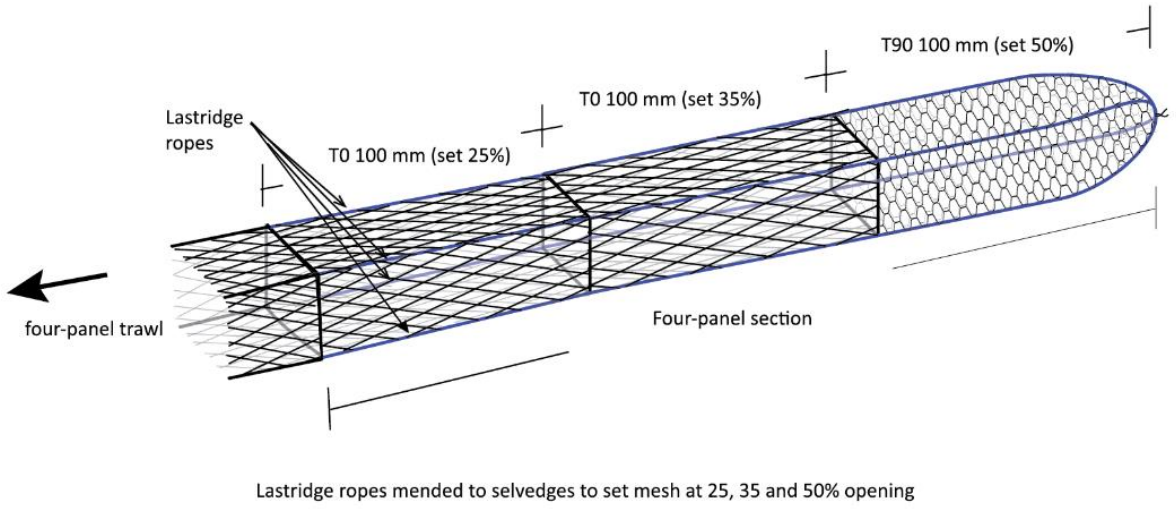

Figure 2. Diagram of test gear

Results

The trial was carried out over 5 days during March 2024. Control and test gears were deployed on alternate days except for day 5 where two consecutive hauls were completed with each gear. The trial vessel fished the same ground on days 1 and 2; days 3 and 4; and day 5. A total of nine hauls were completed with the control and eight with the test gear. Mean depth, haul duration and towing speed were 176 m, 295 mins and 3 knots. Catches were considered slack during the trial (Skipper Pers. Comm.).

Table 2. Mean weight of key species per haul

Species grade	Control (kg)	Test (kg)	Difference (%)
Haddock Large	99	105	7
Haddock Medium	86	102	19
Haddock Round	29	6	-80
Haddock undersized	23	< 1	-100
Hake	98	32	-67
Hake undersized	14	< 1	-98
Monkfish	45	48	8
Spurdog	114	6	-95
Commercial flatfish	14	12	19
Other commercial species	87	46	-47
Non-commercial species	23	4	-83

Mean catch weights of large and medium grade haddock were greater in the test gear (Table 2) but not significantly so (Figure 3). Round grade haddock were significantly lower in the test gear (Figure 3).

Mainly composed of small and medium grade fish, catches of marketable hake were significantly lower (Table 2, Figure 3). Very few larger grade hake were encountered during the trial (Skipper, pers. comm.). Undersized haddock, hake and whiting of all sizes were practically eliminated in the test gear (Figure 3).

Commercial flatfish catches were greater in the test gear but not significantly so and catches of these species were relatively low (Table 2). It should be noted that T90 has been shown to retain more flatfish species than T0 of equal mesh size (Bayse et al., 2016).

Other commercial species were significantly lower in the test gear, but species catches were relatively low and variable, and differences were more likely an abundance effect than a gear effect (Table 2; Figure 3).

Spurdog catches were substantially lower in the test gear. Mean catches of non-commercial species were significantly lower in the test gear but species catch weights were variable and differences may be attributable to both species' abundance and gear selectivity.

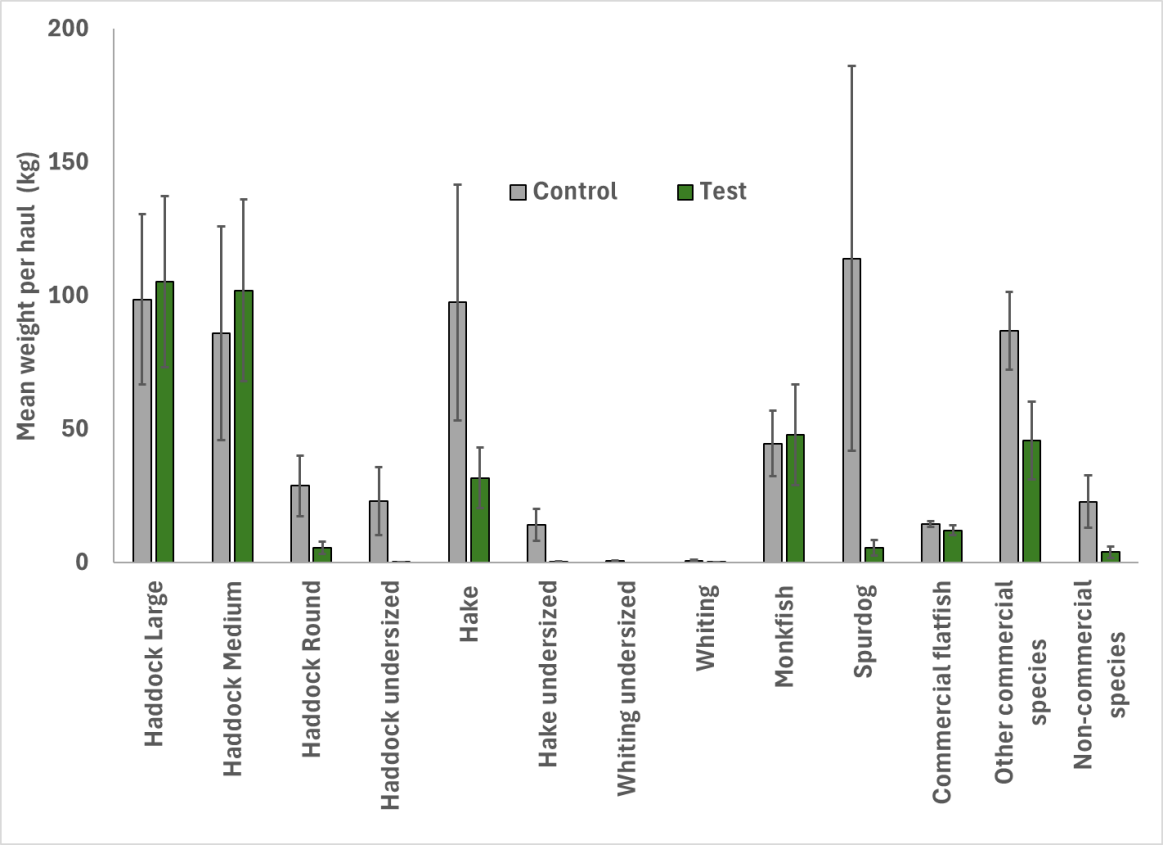

Figure 3. Mean weight per haul of key species with standard error bars

Discussion

The 4-panel 100 mm T90 codend retained fewer, less valuable, small haddock while maintaining catches of larger, more valuable haddock. This result demonstrates that the gear has major potential to assist the fishing industry in optimising haddock quota utilisation.

The test gear caught fewer hake but sizes encountered during the trial were small and more likely to escape through 100 mm T90 meshes. Results from previous trials of a 100 mm T90 codend on a seine netter suggest larger hake are less likely to escape from this gear (McHugh et al., 2019)

The mean catch of spurdog in the control gear was the highest of all species during the trial. The majority of the total spurdog catch (1023 kg) was taken with the control gear over three hauls on the first day of the trial. Catches in the test gear over 3 hauls on the same ground the following day amounted to just 41 kg. Only 2.5 kg of spurdog were caught in the control gear in subsequent hauls suggesting that the observed variation in spurdog catches is likely to be a localised abundance rather than a gear effect.

The Skipper reported an obvious increase in catch quality in the test gear and would be keen to try the gear again.

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