Benefits of 120 mm diamond and 100 mm T90 codends in the Celtic and Irish Seas

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Benefits of 120 mm diamond and 100 mm T90 codends in the Celtic and Irish Seas

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Key Findings

1. Equivalent selectivity was demonstrated for small gadoids with less than 0.5% of cumulated haddock and whiting, and 2% of cod catches occurring below minimum conservation reference size.

2. The T90 100 mm caught almost twice as much haddock and three times fewer whiting compared with the 120 mm diamond mesh codend.

3. It is recommended that both the T90 100 mm and 120 mm diamond codends should be included in the list of gear options for vessels targeting whitefish species in the Celtic and Irish Seas.

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Introduction

Numerous studies have shown that there is no one-size-fits-all solution when it comes to gear-based reductions in unwanted catches. This is reflected in the 2019 North-Western waters discard plan for demersal fisheries which includes lists of gear options for vessels targeting whitefish species in the Celtic and Irish Seas (EC, 2018). Depending on species catch composition, a variety of codend and square mesh panel (SMP) configurations are available to choose from, with provision to add further gears if equivalent selectivity for cod, haddock and whiting can be effectively demonstrated. The commercially important seine net fishery off the south and to a lesser extent the east coast is impacted by the new gear requirements: Seiners traditionally use 100 mm codends with 120 mm SMPs, but also 120 mm codends without an SMP which helps prevent fish meshing in the SMP when hauling the seine. The latter is not included in the list of options in the Celtic Sea, so this study aimed to demonstrate equivalent selectivity of the 120 mm codend with one of the prescribed gears.

Methods

Fishing operations and gear

A trial was conducted on board the Róise Catríona (T100) from Castletownbere in November 2018 in ICES division 7j&g in the Celtic Sea protection zone (Figure 1). Catches were compared from 14 alternate hauls using a 120 mm diamond mesh codend (T0, 120), and a 100 mm T90 mesh codend (T90, 100) which is included in the discard plan. T90 mesh consists of diamond mesh turned 90° (Browne et al., 2016).

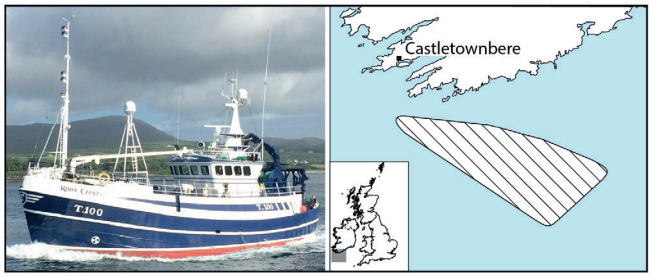

Figure 1. MFV Róise Catríona T100 and trial location (hatched area)

Two newly constructed codends of double 4 mm twine were used in the trial (Table 1). Two of the vessel's own seine nets were used which had a comparable fishing circle (number of meshes) and rigging (e.g. bridle and sweep lengths). Taking into account the practicalities of the gear and current regulations, different codend circumferences were employed (Table 1). No SMP was present in either seine given the relatively large codend mesh sizes and the absence of such a requirement for these gears under current regulations.

Seining differs from trawling in that there are no otter boards to keep the net open and haul duration is relatively short. The fly-seining operation encircles fish by deploying port seine ropes which are attached to a dan/buoys and payed out until the seine net is set. The starboard seine ropes are then payed out until the port rope is picked up and hauling can commence. Once hauling commences the seine ropes gradually come together as the vessel moves slowly forward into the tide (Figure 2).

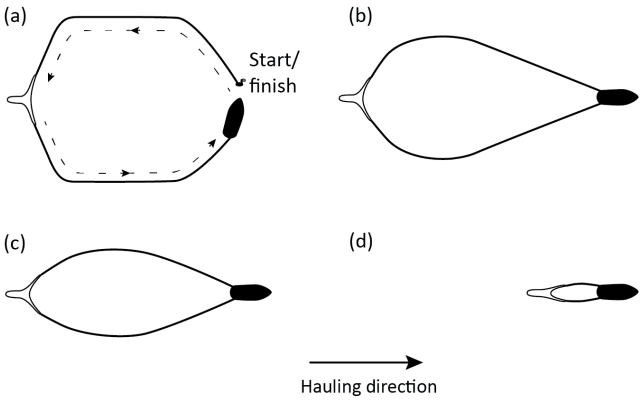

Figure 2. Seining operation: (a) setting the ring (b–d) hauling and closing the ropes.

Sampling and Analysis

Total catches were weighed and sorted to species level. The total weight of each commercial species was recorded in addition to a random representative subsample (used to obtain average total lengths). The total weight of cumulated non-commercial species was also obtained. Total lengths (TL) of commercial fish species were measured to the nearest cm below. Length-weight relationships (Silva et al., 2013) were applied to the measured fish to obtain estimated weights by length class for comparative purposes. Codends were swapped once during the trial to help account for differences in fishing power in the two seines.

A binomial logistic model was used to statistically assess proportional differences in catches of key species in the two gears. To account for between and within-haul variability, we used an approach similar to (Sistiaga et al., 2016). Note that while Sistiaga et al. (2016) propose recovering selectivity parameters, here we ran catch comparison analyses but use their approach of bootstrapping (with replacement) the hauls to randomly pair among the observed hauls and within-haul sampling. The method effectively randomly pairs hauls, runs the analysis, stores the curves and in this case was repeated 10,000 times to estimate the mean curve and 95% confidence intervals. In resulting catch ratio plots, the null hypothesis of equal catch efficiency between gears was rejected for a given length class, when the confidence limits associated with each length class do not overlap the refence value of 0.5 (50% catch probability).

Table 1. Gear characteristics

Gear type	Seine
Manufacturer	Jackson Trawls
Sweep length (m)	55
Headline (m)	60
Footrope (m)	68
Seine rope length (m)	2860 × 2
Seine rope diameter (mm)	32
T90 100	
Nominal mesh (mm)	100
Measured mesh (mm)	110
Length (no. meshes)	49.5
Circumference (no. meshes)	80
T0 120	
Nominal mesh (mm)	120
Measured mesh (mm)	126
Length (no. meshes)	49.5
Circumference (no. meshes)	102

Results

A total of 14 valid hauls (7 with each seine) were completed over five days. Mean haul duration, hauling speed, depth fished, and distance towed were 02:23hr, 1.1 kt, 105 m, and 1.15 nm, respectively. Six species, haddock, hake, whiting, cod, megrim, and plaice represented 87% of the total catches by weight (Table 2). Less than 0.5 % of total haddock and whiting, and 2% of cod catches in both gears were below minimum conservation reference size (MCRS). In relation to ≥ MCRS fish, T90 100 caught almost twice as much haddock and three times fewer whiting compared with T0 120. The T90 100 caught ~ 60% more megrim and fewer small hake < 60 cm (Figure 3).

Modelling of proportional catch at length in the two gears confirmed significantly higher haddock and megrim catches, and significantly lower whiting and hake catches in the T90 100. Cod and plaice catches were not significantly different likely due to small sample size (Figure 3).

Table 2. Proportion of total catch weights in each codend

Species <≥ MCRS (cm)	T90 (%)	T0 (%)	Total (kg)
Haddock ≥ 30	66	34	3089
Haddock < 30	5	95	12
Hake ≥ 27	45	55	2617
Whiting ≥ 27	27	73	576
Cod ≥ 35	58	42	258
Monkfish	37	63	305
Megrim ≥ 20	62	38	246
Plaice ≥ 27	40	60	118
#Flatfish	74	26	34
*Other commercial species	53	47	34
Non-commercial discards	38	62	687

#lemon sole, turbot, witch *pollock, black pollock, John Dory, ling, blonde & cuckoo rays

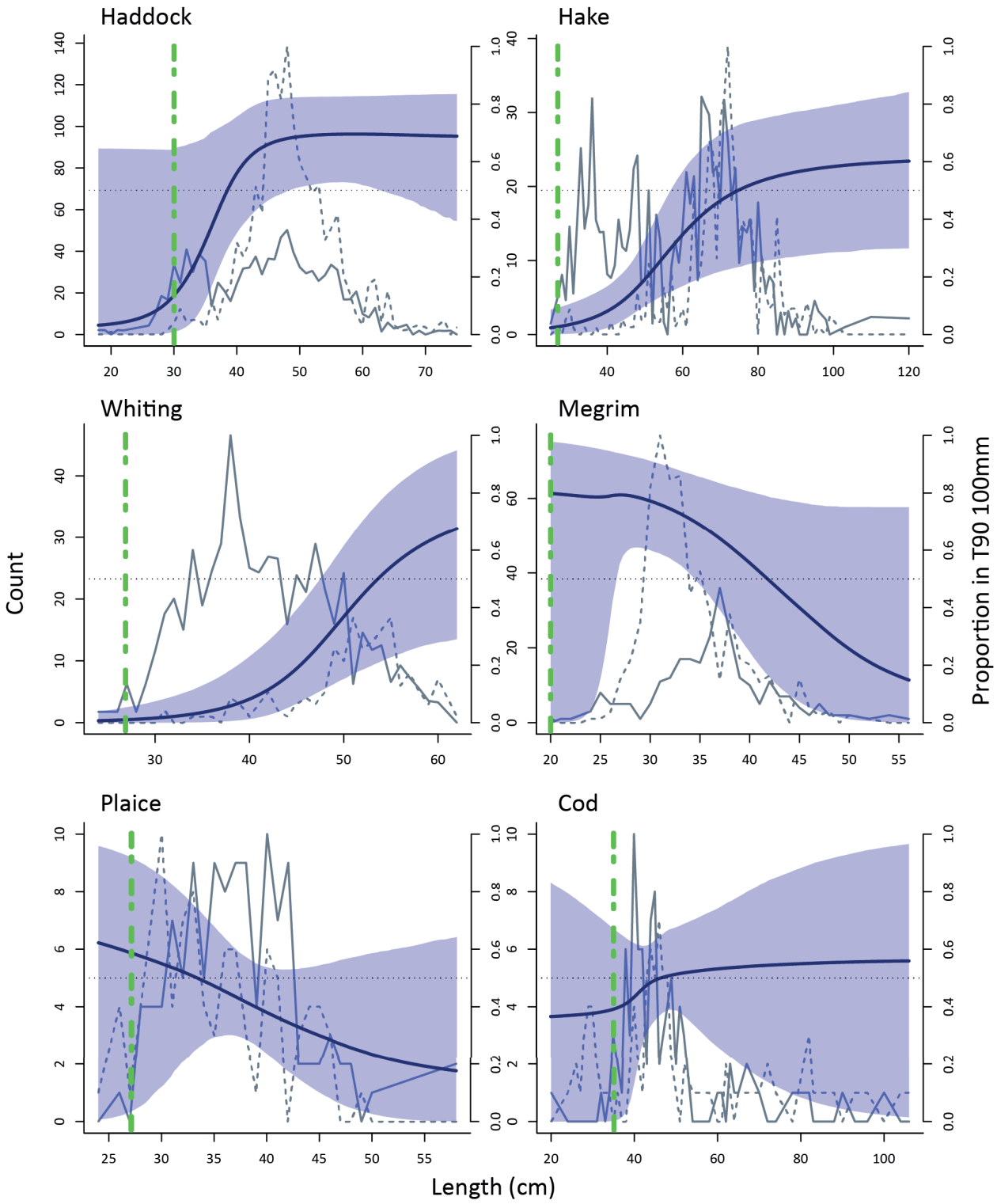

Figure 3. Proportional catch at length for key species in T90 100. Fitted average (solid) and 95% confidence intervals (shaded areas) come from the binomial model with boot strapping. MCRS is denoted by vertical dashed lines. Length frequencies are represented by grey dashed lines (T90 100) and grey solid lines (T0 120).

Discussion

Study results strongly support the case for the 120 mm diamond mesh codend to be added to the list of gear options in the Celtic Sea. Very few fish < MCRS were caught in either gear. However, the T90 100 mm codend caught substantially more ≥ MCRS haddock and substantially less ≥ MCRS whiting. Due to relatively low quotas, haddock is a high-risk choke species while whiting is the least quota limited fish species in the Celtic Sea. Hence, vessels in that area should have an option not to catch excessive quantities of haddock while maintaining reasonable whiting catches using a 120 mm diamond mesh codend. The T90 100 mm codend remains a useful option when vessels are primarily targeting haddock or megrim. In addition, anecdotal reports from the crew suggest superior fish quality in the T90 gear.

These findings also apply to the Irish Sea where Irish whitefish vessels target haddock, while avoiding whiting which are predominantly < MCRS. Currently limited to a 120 mm diamond mesh codend or an eliminator trawl with enlarged meshes in the trawl mouth, the T90 100 mm codend would make an extremely useful addition to the list of permitted gears in the Irish Sea. Study results will be forwarded for assessment to the EC Scientific, Technical and Economic Committee for Fisheries (STECF) with a view to expanding the lists of permitted gears at the earliest opportunity.

Acknowledgements

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