Assessment of 100 mm T90 codend in the Irish Sea

Fisheries Conservation Report

May 2020

BIM Ireland's Seafood Development Agency

Assessment of 100 mm T90 codend in the Irish Sea

Martin Oliver[1]*, Matthew McHugh[1], Daragh Browne[1], Shane Murphy[2], Cóilín Minto[2] and Ronán Cosgrove[1]

[1] Bord Iascaigh Mhara, New Docks, Galway, Ireland.
[2] Galway Mayo Institute of Technology, Dublin Road, Galway, Ireland.
* Email Martin.Oliver@bim.ie

Key Findings

1. Improved selectivity was demonstrated for haddock while equivalent selectivity was shown for cod and whiting in a 100 mm T90 codend compared with a 120 mm codend.

2. A reduction in the value of smaller market sized haddock was offset by increased catches of flatfish species in the 100 mm T90 codend.

3. The 100 mm T90 gear postponed choking and substantially increased total catch value under a monthly quota haddock scenario.

4. The 100 mm T90 codend should be added to the list of gear options in the Irish Sea to reduce unwanted catches and optimise quotas in the commercially important directed fishery for haddock.

Ireland's EU Structural and Investment Funds Programmes 2014 - 2020
Co-funded by the Irish Government and the European Union

An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

EUROPEAN UNION
This measure is part-financed by the European Maritime and Fisheries Fund

Introduction

Under the 2020 discard plan Irish vessels targeting demersal fish species in the Irish Sea are currently required to use a 120 mm diamond-mesh codend or an eliminator trawl with enlarged meshes in the trawl mouth with a 100 mm diamond-mesh codend. Other gear options may be introduced if equivalent selectivity for cod, haddock and whiting can be effectively demonstrated (EU, 2019). Haddock is a commercially important species in the Irish Sea with a 1,366 t quota available to Irish vessels in 2020. Nearly 70% of Irish haddock landings come from trips where haddock is the dominant species landed, mainly on otter trawlers and to a lesser extent seiners. Much of the remainder is likely taken as bycatch by otter trawlers targeting *Nephrops* (MI, 2019).

The mean haddock discard rate across all fleets operating in the Irish Sea was ~ 21% from 2016 to 2018 (MI, 2019). Due to larger codend mesh sizes, the haddock discard rate is likely lower in the directed haddock fishery compared with the *Nephrops* fishery. However, unwanted catches of juvenile haddock should be minimised in the directed fishery to avoid choking and make best use of available quotas under the landing obligation, and to support haddock stock conservation.

In relation to other key species a relatively small cod quota (bycatch only) of 170 t is available for Irish vessels in 2020. Most whiting catches are below minimum conservation reference size (MCRS) and no directed fishery for this species is permitted. Plaice can also form an important component of the catch with a relatively large quota (1,442 t) available to Irish vessels in 2020.

Previous BIM research (McHugh et al., 2019) demonstrated benefits of using a 100 mm T90 mesh codend when targeting fish species in the Celtic Sea. The 100 mm T90 gear caught significantly more ≥ MCRS haddock and less whiting across all size classes compared with a 120 mm diamond-mesh codend. Hence, the 100 mm T90 codend has major potential to assist Industry in reducing unwanted catches and optimising quotas in the Irish Sea. This study aimed to demonstrate equivalent selectivity of a 100 mm T90 codend with a 120 diamond-mesh codend with a view to having it added to the list of whitefish gear options in the Irish Sea.

Methods

A trial was conducted on board a 22m whitefish trawler in the Irish Sea, ICES Divisions 7.a (Figure 1) in March 2020. Catches were compared from alternate hauls using a 100 mm T90 mesh codend (T90 100), and a 120 mm diamond-mesh codend (T0 120) which is included in the discard plan.

Fishing operations and gear

Fishing gear consisted of a single-rigged high opening whitefish hopper trawl configured with three bridles. The ground gear was constructed with 36 cm (14 inch) discs. 100 mm T90 mesh and 120 mm diamond mesh were used in the codends and extension pieces. Both gears were constructed using 4 mm double twine as is commonly used in the fishery. Codend circumference was the maximum 100 meshes round in T0 120 and 77 meshes round in T90 100 (Table 1). The reduced codend circumference in T90 100 was based on previous trials which yielded positive results in this regard (Browne et al., 2016; McHugh et al., 2019). Alternate hauls were conducted in randomised order with time and distance minimised between the hauls for pairing in subsequent analysis. Headline height was estimated using the vessels e-sonar headline sensors.

Figure 1. Trial location (hatched area)

Table 1. Gear characteristics

Codend type	120 mm diamond (T0 120)	100 mm T90 (T90 100)
Trawl type	Single-rig whitefish	
Headline length (m)	30	
Footrope length (m)	18	
Fishing-circle (meshes × mm)	540 x 120	
Sweep length (m)	30 + 30	
Warp diameter (mm)	20	
Door manufacturer & model	Morgère Exocet	
Door weight (kg)	800	
Average headline height (m)	16.1	
Average door spread (m)	58.8	
Nominal mesh size (mm)	120	100
Measured mesh size (mm)	123.9	109.2
Codend circumference (mesh no.)	100	77

Sampling and Analysis

Total catches were weighed and sorted to species level. The total weight of main commercial species was recorded in addition to a random representative subsample. Total length (TL) of commercial fish species were measured to the nearest cm below with raising factors applied if subsampling occurred. Length-weight relationships (Silva et al., 2013) for key species were applied to estimate weight in relation to minimum conservation reference sizes (MCRS) for comparative purposes. A generalised additive model (GAM) was used to statistically assess proportional differences in catch at length of key species, with length frequencies superimposed on the resulting graphs.

Economic analysis

Sales note data were used to apply total catch values to the two gear types. A simplified economic analysis was conducted to estimate total catch values when the monthly haddock quota was fully utilised. For the purpose of this analysis we assumed that the 7 hauls conducted with each gear type represented half a fishing trip with that gear type, and similar catch rates by the two gears over subsequent trips. The trial vessel name was excluded from this report due to use of economic data.

Results

A total of 14 valid hauls (7 with each codend) were carried out over four consecutive days. Mean haul duration, towing speed, and depth was 05:07 hr, 2.66 kt and 97.5 m. The weather was calm with wind speeds of 1 to 19 km/h or Beaufort 0 to 3. The main commercial fish species caught were haddock, plaice and cod.

Very few whiting were caught in either gear. The total quantity retained corresponded to 0.53% of the total bulk catch across the two gears and little difference occurred in catches between gears. Minimal difference in cod catches also occurred (Tables 2 and 3, Figure 2).

Haddock catch at length was small in both gears with a median length of 25 cm in T90 100 and 27 cm in the T0 120 (Figure 2) or 25 cm combined. Moderate reductions (~ 40%) occurred in haddock $<$ and $\geq$ MCRS in T90 100 (Table 3). These reductions were significant for haddock $<$ MCRS of 30 cm, and for smaller market size haddock ~ $<$ 40 cm but not significant for larger haddock (Figure 2). Substantial increases in plaice $<$ and $\geq$ MCRS occurred in T90 100 (Tables 2 and 3).

Table 2. Total catch weights

Species	T0 120 (kg)	T90 100 (kg)	Difference (%)
Haddock	4165	2462	-41
Mixed non-commercial species[#]	642	867	35
Nursehound	680	410	-40
Lesser spotted dogfish	481	273	-43
Plaice	308	569	85
Ray and Skate	218	398	83
Smooth hounds	196	12	-94
Cod	191	204	7
Other species[$]	112	128	14
Monkfish	74	40	-46
Whiting	30	37	22
Lemon Sole	15	35	>100
Spurdog	11	32	>100
Mixed flatfish*	3	16	>100
Bulk	7125	5480	-23

[#]Gurnards and other species (small quantities); [$]john dory, black pollock, white pollock, ling, hake, *Nephrops*; *brill, turbot, witch, black sole

Table 3. Estimated catches in relation to minimum conservation reference sizes

Species	Size category (cm)	T0 120 (kg)	T90 100 (kg)	Difference (%)
Haddock	<30	2565	1520	-41
	≥30	1897	1100	-42
Cod	≥35	169	179	6
Whiting	<27	12	13	8
	≥27	19	21	11
Plaice	<27	43	246	>100
	≥27	266	442	66

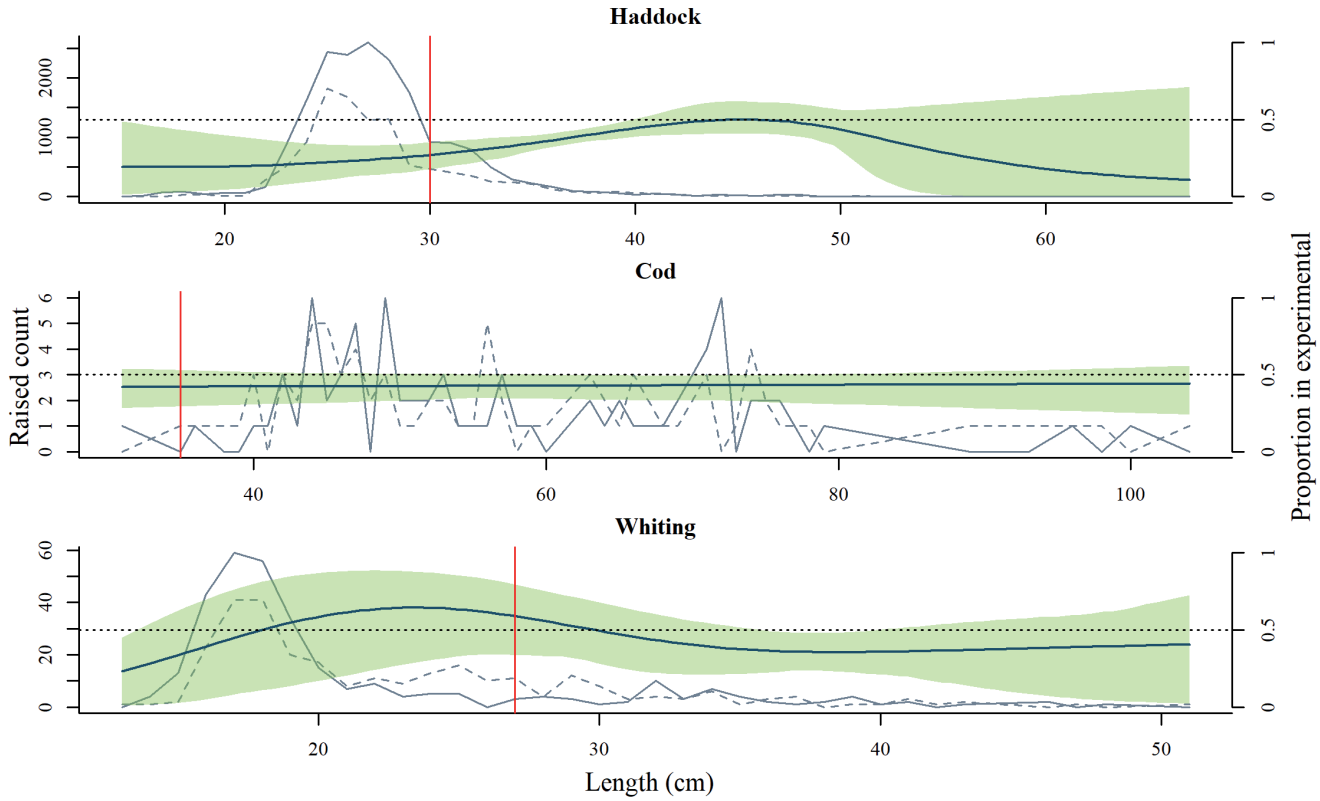

Figure 2. Proportional catch at length for key species in T90 100. Fitted average (solid) and 95% confidence intervals (shaded areas) come from the GAM model. Length frequencies are grey dashed (T90 100) and solid grey (T0 120) lines. Red vertical lines denote minimum conservation reference size (MCRS).

Table 4. Catch values

Species	Grade	T0 120 (€)	T90 100 (€)	Difference (%)
Haddock	Large gutted	519	449	-13
	Small round	581	315	-46
	All	1100	764	-31
Cod	All	670	710	6
White pollock	All	348	298	-14
Plaice	All	147	208	41
Turbot	All		180	>100
Monkfish	All	94	80	-15
Black pollock	All	7	61	>100
Whiting	All	25	27	8
Lemon sole	All	10	39	>100
Totals		2401	2367	-1

Table 5. Catch value scenarios

	Observed trip		Full trip scenario		10 t quota	
	T0 120	T90 100	T0 120	T90 100	T0 120	T90 100
Haddock catch (t)	4.2	2.5	8.4	5.0	10	10
Trips (N)	0.5	0.5	1.0	1.0	1.2	2.0
Total catch value (€)	2401	2367	4802	4734	5762	9468

Haddock was the most valuable species caught during the trial (Table 4). Reduced haddock catches in T90 100 corresponded to a 31% reduction in haddock value. This was mainly associated with a loss in value of smaller grade round haddock (46%) rather than larger grade gutted haddock (13%). The loss in haddock value was offset by increased catch values for species such as plaice and turbot resulting in a negligible 1% difference in total catch value between gears.

A 10 t haddock quota was available to the vessel in March 2020 (DAFM, 2020). The T0 120 caught 4.2 t in 0.5 trips, equating to an estimated 8.4 t in 1 trip, 10 t in 1.2 trips (10/8.4) and a total catch value of €5,762. The T90 100 caught 2.5 t in in 0.5 trips equating to an estimated 5 t in 1 trip, 10 t in 2 trips (10/5) and a total catch value of €9,468 (Table 5). Hence, the T90 100 catch value was 64% greater compared with T0 120 when the monthly haddock quota was exhausted and no further fishing was permitted that month.

In relation to potential choke points for other quota species, increased plaice catches in T90 100 were not an issue under the above scenario. Irish plaice catches are generally well below quotas in the Irish Sea and no plaice catch limit was included in the fishery management notice for March 2020. Monthly quotas of 4 t for cod and 6 t for whiting (DAFM, 2020) were substantially greater than observed catches and the vessel was not at risk of choking on these species.

Discussion

The main benefit of the T90 100 in the Irish Sea whitefish fishery was a significant reduction in < MCRS haddock. A significant reduction in small market sized haddock also occurred in the T90 100. The loss in haddock value was offset by increased catches of flatfish species such as plaice and turbot in T90 100. Also fishing effort was extended from 1.2 to 2 trips under the 10 t haddock quota scenario resulting in a 68% increase in total monthly catch value with T90 100. This was a simple analysis which did not take account of vessel profitability. Profitability would likely have been further reduced in T0 120 given costs associated with travelling to and from the fishing grounds for relatively small catches during the shortened second trip.

Minimal retention and little difference in catches between the two gears for whiting was not surprising given the mesh sizes and orientations employed and the small size composition of whiting in the Irish Sea. Difference in cod catch was also minimal and insignificant across all size classes. The T90 100 caught substantially more flatfish species compared with the T0 120. This is not surprising as diamond mesh is generally more selective and retains fewer smaller flatfish compared with T90 mesh (e.g. Browne et al., 2017; Lomeli et al., 2017). There is "no one size fits all" gear modification and any attempt to improve selectivity must be appropriate for the season, fishing area, and individual vessel (Condie et al., 2014). Hence, any need to reduce unwanted catches of flatfish species could be addressed by using T0 120 diamond mesh, a current gear option in the Irish Sea.

There was a paucity of larger haddock caught during the trial. This is supported by data from the Marine Institute sampling programme which shows a median catch at length of 39 cm by otter trawlers targeting fish species in the Irish Sea in 2019 (Unpublished data, MI). This is substantially greater than the median lengths of 25 cm observed in the current study. Also, ~ 58% of haddock catches were < MCRS across both gear types in the current study. This is substantially greater than the overall mean haddock discard rate of 21% from 2016 to 2018 in the Irish Sea (MI, 2019) and is likely due to the trial occurring relatively early on in the year.

It is likely that the T90 100 would have caught more larger haddock if greater quantities were available on the fishing grounds. McHugh et al. (2019) also observed reductions in < MCRS haddock and smaller market sized haddock < 40 cm in T90 100 compared with T0 120. However, with a median catch at length of ~ 48 cm in both gears, larger haddock made up a much greater catch component in the Celtic Sea trial. The T90 100 was much more effective in catching these larger fish with almost twice as much retained compared with T0 120 (McHugh et al., 2019). With a median length of ~ 37 cm, an ~ 200% increase in ≥ MCRS haddock was observed in 80 mm T90 compared with 80 mm diamond-mesh gear in the Celtic Sea. This increase was attributed to increased water flow through the gear associated with greater T90 mesh openings (Browne et al., 2016).

Conclusion

Improved selectivity was demonstrated for haddock while equivalent selectivity was shown for cod and whiting in a 100 mm T90 codend compared with a 120 mm diamond-mesh codend. A reduction in smaller market sized haddock quantities and value in the 100 mm T90 gear was offset by increased catches of flatfish species. Furthermore, due to reductions in < MCRS haddock, the 100 mm T90 gear was shown to substantially increase total catch value under a scenario where the monthly haddock quota was fully utilised. The 100 mm T90 codend is likely to catch more larger haddock when available in greater quantities. Further demonstration of the gear's benefits to the fishing industry is planned. The 100 mm T90 codend should be added to the list of gear options in the Irish Sea to reduce unwanted catches and optimise quotas in the commercially important directed fishery for haddock.

Acknowledgements

BIM would like the owner and crew of the trial vessel for their assistance during fishing operations. The vessel name was excluded due to use of economic data. Thanks also to Hans Gerritsen from the MI for provision of data from their fisheries sampling programme. This work was funded by the Irish Government and part-financed by the European Union through the EMFF Operational Programme 2014-2020 under the BIM Sustainable Fisheries Scheme.

References

Browne, D., Cosgrove, R., and Tyndall, P., 2016. Assessment of T90 mesh in a fishery targeting whiting in the Celtic Sea, Irish Sea Fisheries Board (BIM), Fisheries Conservation Report, June 2016. 8 pp.

Browne, D., Tyndall, P., Jackson, E., and Cosgrove, R., 2017. T90 mesh improves selectivity and addresses the landing obligation for Celtic Sea whiting. Poster presented at the XXIII Conference of the European Association Fisheries Economists, Dublin, April 2017.

Condie, H.M., Grant, A., and Catchpole, T.L., 2014. Incentivising selective fishing under a policy to ban discards; lessons from European and global fisheries. Mar. Policy 45, 287-292.

DAFM, 2020. Fisheries Management Notice No. 11 of 2020. (March Over 55 ft Boats Demersal Quota Management Notice). 9 pp.

EU, 2019. Commission Delegated Regulation (EU) 2019/2239 of 1 October 2019 specifying details of the landing obligation for certain demersal fisheries in North-Western waters for the period 2020-2021.

Lomeli, M.J.M., Hamel, O.S., Wakefield, W.W., and Erickson, D.L., 2017. Improving Catch Utilization in the U.S. West Coast Groundfish Bottom Trawl Fishery: an Evaluation of T90-Mesh and Diamond-Mesh Cod Ends. Marine and Coastal Fisheries, 9: 149-160.

McHugh, M., Oliver, M., Browne, D., Minto, C., and Cosgrove, R., 2019. Benefits of 120 mm diamond and 100 mm T90 codends in the Celtic and Irish Seas, Irish Sea Fisheries Board (BIM), Fisheries Conservation Report, February 2019. 6 pp.

MI, 2019. The Stock Book 2019: Annual Review of Fish Stocks in 2018 with Management Advice for 2018, Marine Institute. 511 pp.

Silva, J.F., Ellis, J.R., and Ayers, R.A., 2013. Length-weight relationships of marine fish collected from around the British Isles. Science Series Technical Report, Cefas Lowestoft, 150. 109 pp.

Bord Iascaigh Mhara
An Cheannoifig,
Bóthar Crofton,
Dún Laoghaire,
Co. Bhaile Átha Cliath.
A96 E5A2

Irish Sea Fisheries Board
Head Office,
Crofton Road,
Dún Laoghaire,
Co. Dublin.
A96 E5A2

T +353 (0)1 214 4100
F +353 (0)1 284 1123
www.bim.ie