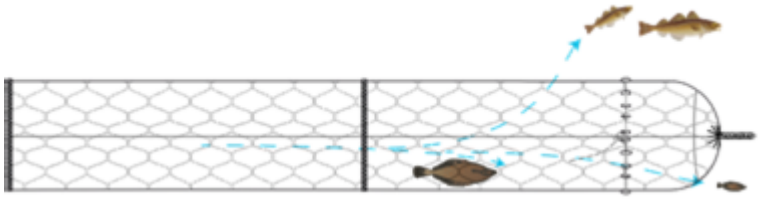
T90 codend 125mm / 2 panel

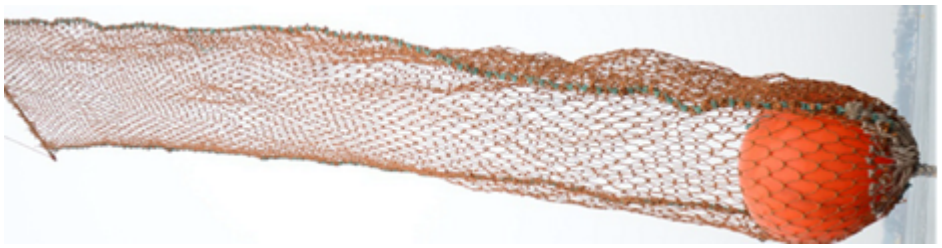
Gear ID: T90_125_2P

General description of the gear / selectivity device

This selectivity device introduces a small adaptation of the T90 codend, one of the two codends legally used in the Baltic trawl fisheries targeting demersal species (status 02/2021).

The change in design proposed by this T90 codend is an increase in minimum mesh size (inner mesh opening) from the current 120mm to 125mm. This legal change might not require great technological adaptations in the fishery, as it has been reported that mesh sizes ~125 mm are already in use.





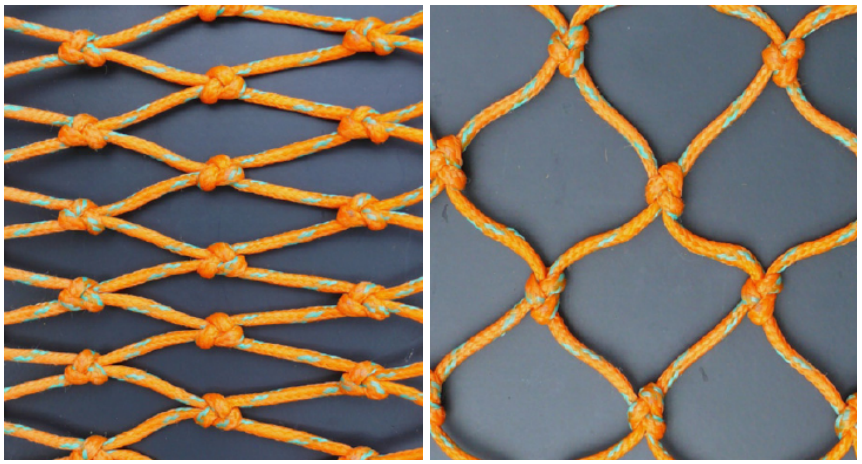


Figure 1: T90 codend 125mm / 2 panel (T90_125_2P). Top: schematic drawing of a T90 codend and its basic functional principle. Middle: photograph of a T90 codend. Bottom: Illustration of the effect of turning the meshes 90 degrees in working conditions. The left picture shows a piece of netting with the knots oriented in the standard way (0 degrees turn, T0) relative to the longitudinal towing direction (here tow direction from left to right). The tension created by the towing forces closes the meshes in T0 configuration. Turning the netting 90° (right) forces the meshes to remain more open under the same longitudinal towing forces, providing better escape possibilities for roundfish such as cod than T0 codends.

Basic functional principle

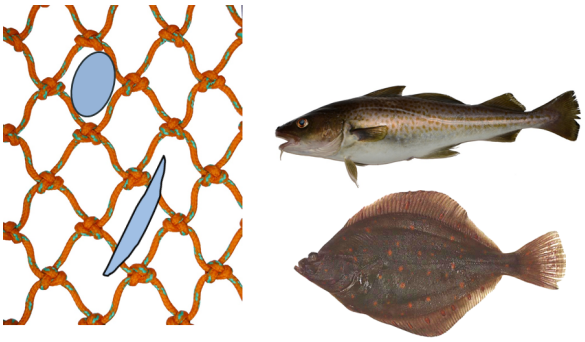


Figure 2: Schematic illustration of size and species selectivity in a T90 codend

The T90_125_2P codend selects for species and sizes of individuals by mechanical selection (species specific size selection). Different species are selected based on differences in their morphology and the corresponding size and shape of the meshes, while different size classes are selected mainly by the size of the meshes. Compared to T0 codends, It has been demonstrated that T90 codends increase the escapement possibilities of small and medium cod, while the effect on flatfish is neutral or slightly negative. Since the functional mechanism of this codend is mechanical selection, the efficiency strongly depends on the size structure of the population available. This means that the escapement probabilities of cod will decrease if larger individuals become more abundant.

Experimental data

The gear have been recently developed and tested in the Baltic Sea. The results presented here are based on the most recent selectivity trials.

Experimental setup

Period tested	October 2020
Fishing area	Baltic, SD24
Vessel	FRV “Solea” [link to vessel info]
Trawl	TV300/60 [link to trawl info]

Experiment type, aim	cover codend, size selection (cover made of 60 mm inner mesh size)
Number of hauls	5
Towing time [minutes]: average (min-max)	94 (81-114)
Fishing depth [meters]: average (min-max)	32 (29-36)

Fish caught/sampled

Species	**Number individuals**			**Weight [kg]**		
	in catch	**measured**	**factor**	**in catch**	**measured**	**factor**
cod	292	292	1,00	137	137	1.00
plaice	2326	2326	1,00	415	415	1.00
flounder	5103	5103	1,00	976	976	1,00

Selectivity estimates

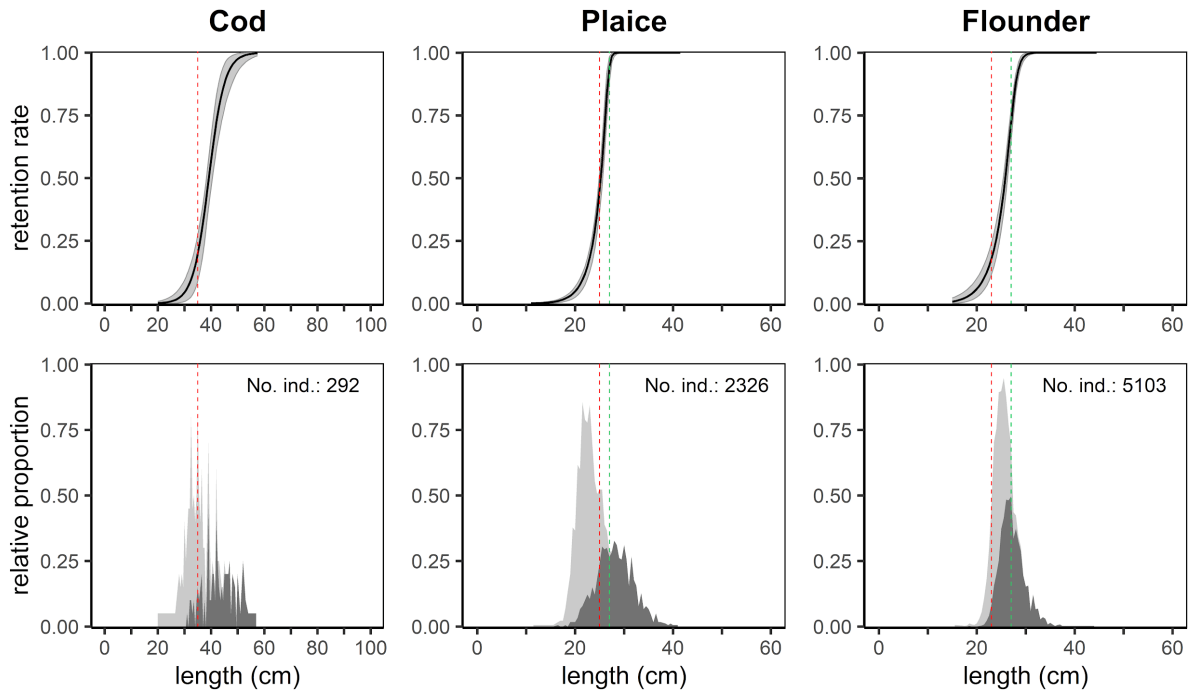


Figure 3: Selectivity results for the codend T90_125_2P for cod, plaice and flounder. Top panel: selectivity curves and corresponding confidence intervals for the size ranges found in the experiment. Bottom panel: Length distribution of the population encountered during the experiment. The red vertical lines correspond to the current minimum conservation reference sizes (MCRS; cod = 35cm; plaice = 25cm; flounder = 23cm, the latter depending on area). The green vertical line indicates a potential alternative commercial minimum size for flatfish (27cm) used frequently in the fishery. The dark shaded area in the population structure plot, indicates those individuals retained by the gear, while the lighter area indicates escapees.

Performance indicators

An important decision criterion for specific gear designs is the effect on the catch. This includes two main aspects:

• the potential low retention of cod catch;

• the ability to keep catches of flatfish (mainly plaice and flounder) high.

The performance indicators provide such information. For each studied species, the indicators express the catch efficiency of the gear as a percentage of individuals retained out of a specific population that entered the trawl. The indicators are estimated for the catch fractions below and above Minimum Conservation Reference Size (MCRS), as well as for the total catch.

A value of 100% for a given catch fraction refers to full retention, whereas 50% means that half of the individuals escape capture.

For the purpose of avoiding cod catches regardless of length size, it is desirable to obtain low values of all indicators for cod and high values for flatfish above MCRS.

This section gives performance indicators based on two types of calculation

1) by numbers (e.g. relevant for mortality estimates)
2) by weight (e.g. relevant for quota usage of fishery)

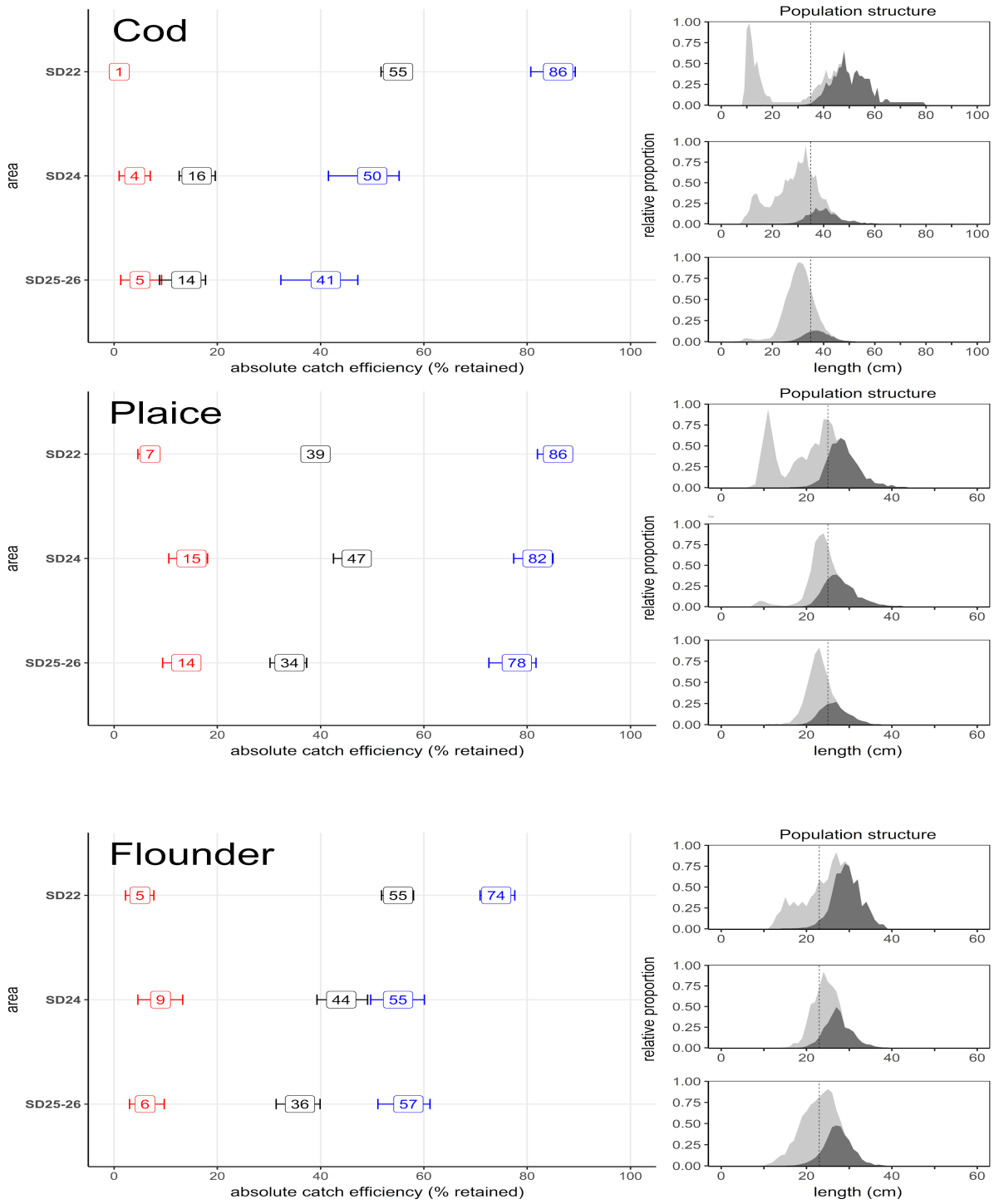


Figure 4: Performance selectivity indicators (**based on number of fish**) for the codend T90_125_2P in three different areas of the Baltic Sea (ICES SD22; SD24; SD25-26). The calculation of the indicators is based on a simulated catch using the specific gear (T90_125_2P) fishing on the population structure of cod, plaice and flounder in the specific areas. The population structures are derived from DATRAS-database (combination of Q4 2019 and Q1 2020). The performance indicators give the absolute catch efficiency (as % of individuals retained) of a certain fraction (**red**: fish < MCRS; **blue**: fish ≥ MCRS; **black**: total) of the specific population and their corresponding confidence intervals. Example: a catch efficiency of 40% means that 60% of the individuals of the specific species and size category was able to escape the codend, while 40% were retained. The dark shaded area in the population structure plot, indicates those individuals retained by the gear, while the lighter area indicates escapees.

Performance indicator by weight

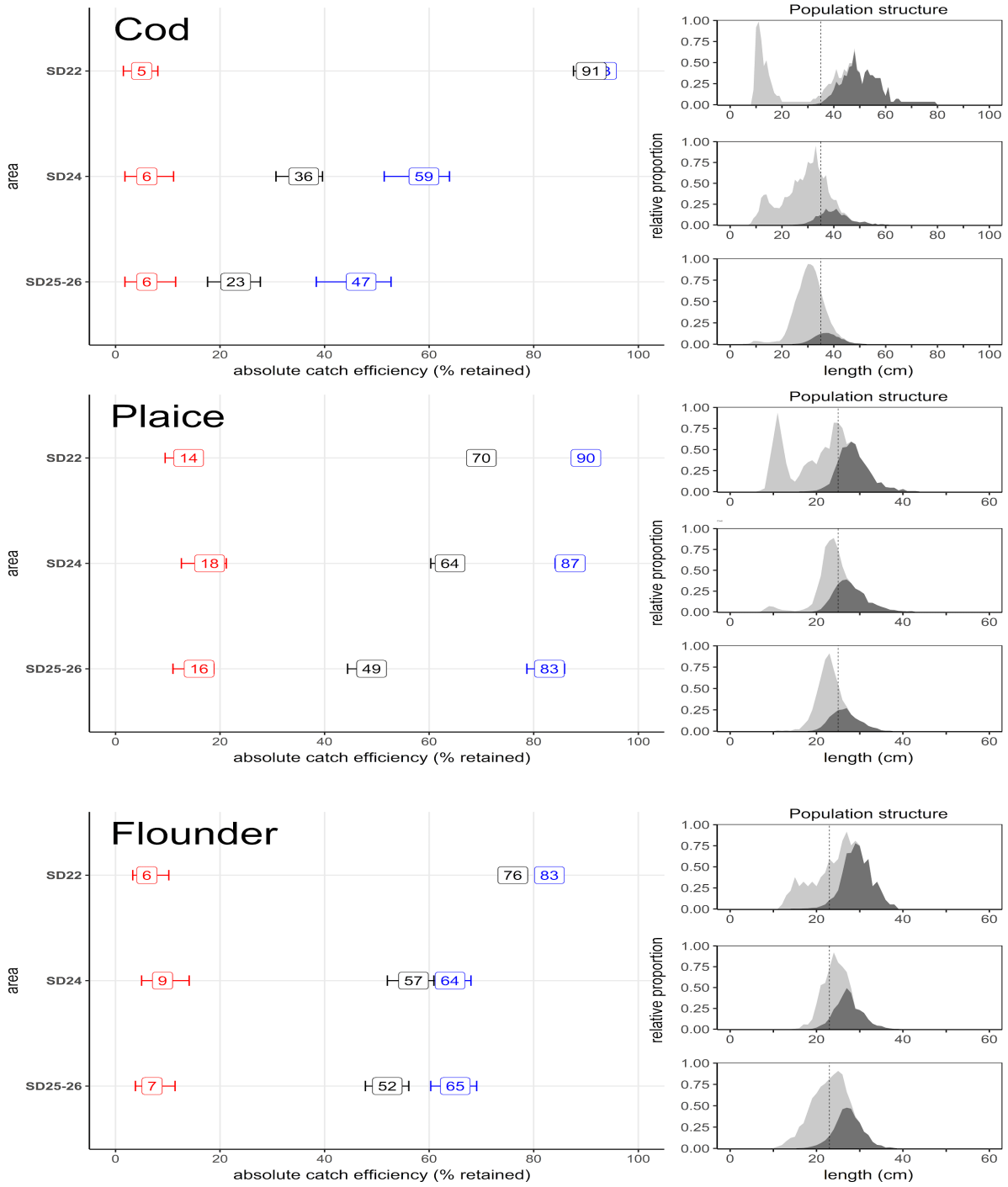


Figure 5: Performance selectivity indicators (**based on weight**) for the codend T90_125_2P in three different areas of the Baltic Sea (ICES SD22; SD24; SD25-26). The calculation of the indicators is based on a simulated catch using the specific gear (T90_125_2P) fishing on the population structure of cod, plaice and flounder in the specific areas. The population structures are derived from DATRAS-database (combination of Q4 2019 and Q1 2020). The performance indicators give the absolute catch efficiency (as % of individuals retained) of a certain fraction (**red**: fish < MCRS; **blue**: fish ≥ MCRS; **black**: total) of the specific population and their corresponding confidence intervals. Example: a catch efficiency of 40% means that 60% of the individuals of the specific species and size category was able to escape the codend, while 40% were retained.The dark shaded area in the population structure plot, indicates those individuals retained by the gear, while the lighter area indicates escapees.

Description/Discussion of results

Selectivity estimates (Figure 3)

During the experimental trials, the T90 codend T90_125_2P showed very stable selective properties, as expressed by the very narrow confidence intervals of the selectivity curves estimated for cod, plaice and flounder (figure 3). The design combining T90 geometry and mesh size of 125 mm provided escape possibilities for cod individuals up to ~45 cm length, revealing relative high retention of marketable cod. The escapement of plaice ≥MCRS (25cm) is very limited and mainly occurs between 25cm and 27cm (red and vertical green line, respectively). The 27 cm reference size represents an alternative commercial minimum size frequently used in the fishery. For plaice and flounder larger than this size, the retention probability is nearly 100%, resulting in little or no commercial loss.

Performance indicator cod (Figure 4 and 5)

The population structure for cod differs between areas (ICES SDs). In SD22 (Western Baltic Sea), the population consists of two distinct size groups. The smaller one (between 10-20cm) is completely selected out by the codend T90_125_2P (99% in numbers, 95% in weight). Most of the larger fish group (35-60 cm) is retained in the codend. Therefore, the performance indicators reveal a very high catch efficiency for cod above MCRS in SD22 (86% by numbers and 93% by weight).
In SD24, SD25 and SD26, the population structure is truncated and mainly comprises fish between 20 and 50cm. These size classes are within the size selective length range of the codend T90_125_2P (see figure 3). Therefore, a significant amount of all cod entering the trawl can escape (around 84-86% by number and 64-77% by weight). For cod above MCRS, between 41% and 50% cod entering the trawl, are retained and bycaught (47% - 59% by weight)

Performance indicator flatfish (Figure 4 and 5)

The catch efficiency for flatfish of the codend T90_125_2P is relatively high, resulting in little loss of plaice and flounder above minimum conservation reference size (MCRS; plaice = 25cm; flounder = 23cm, depending on area). For plaice, the loss is between 14% and 22% in numbers and between 10% and 17% by weight.
Due to the low MCRS of flounder, the loss of flounder above MCRS is significantly higher, but it consists mainly of individuals between 23 and 27 cm.

Conclusion/Summary

General summary

The results obtained with the codend T90_125_2P can be considered representative of the current exploitation patterns in the fishery, at least for the segment of the fleet using T90 codends. The size selection of this codend has been optimized to catch cod, therefore large catches of marketable cod should be expected when exploiting cod populations consisting of a wide range of length classes (SD22).
As all codend designs, the selectivity of the codend T90_125_2P is length dependent and its performance changes when the size structure in the population changes. Therefore, the performance (catch and bycatch reduction) of the codend need to be evaluated regularly.

Evaluation matrix

Pro	**Caution**	**Contra**
Simple adaptation of traditional codend designs, with proven benefits in terms of bycatch reduction of small roundfish such as cod	Design potentially sensitive to external factors (e.g. handling, catch volume)	Reduced selectivity if meshes blocked by flatfish, but compared to (e.g. Bacoma codends), the selectivity area is not limited to a specific window.
Easy handling Easy reparation Less sensitive to external factors compared to T0 codends		Performance depending on the available population structure. Therefore, performance need to be evaluated regularly
Provides stable selectivity Selectivity properties of T90 codends are difficult to manipulate		
Potential for further improvement (e.g. combination with other selectivity devices)		

Cost indication

type of cost	**amount**	**comment**
material	around 800€	codends are replaced regularly
mounting time	less than 1h	

Legal status

The T90_125_2P is a legal codend in the Baltic Sea and currently used in commercial fisheries.

Additional information

Contact data

GER: Juan Santos, Thünen-Institute, juan.santos@thuenen.de

Media available

Type	Source
reports	Cruise report “Solea 788” [not released yet] Cruise report “Solea 741” [to be uploaded]
scientific papers	
Websites	Thuenen Institute of Baltic Sea Fisheries [https://tinyurl.com/1jefvi68]
Multimedia	Thuenen Institute of Baltic Sea Fisheries [https://vimeo.com/518996518]

Technical specification

Technical drawing

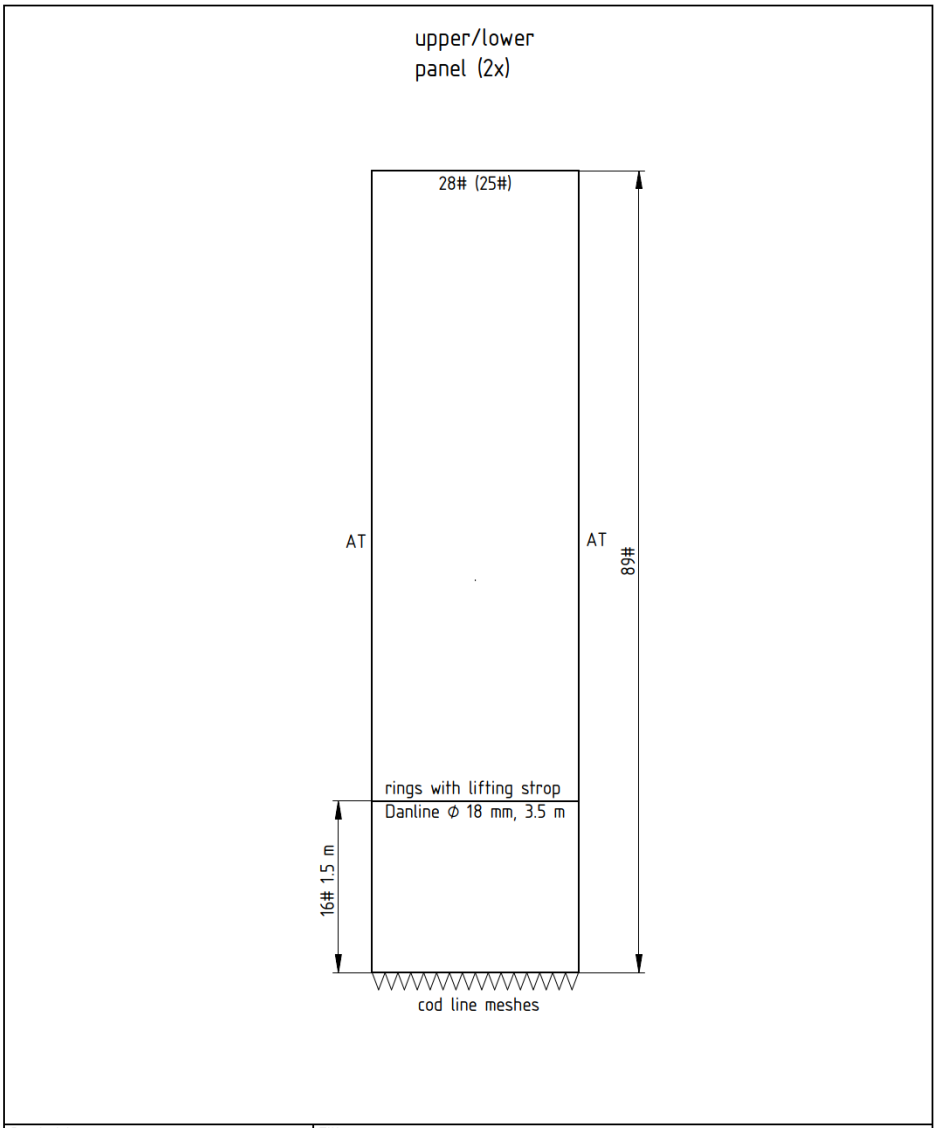


Figure 6: Technical drawing of T90 codend 125mm / 2 panel T90_125_2P, as used during the experimental fishing. Mesh sizes given are the nominal mesh size (minimum inner mesh size).

Technical description to be used in JR

to be discussed