

T90 codend 125mm / 2 panel / lastridge ropes

Gear ID: T90_125_2P_LR

General description of the gear / selectivity device

This selective device represents a further development of the T90 codend, one of the two codends legally used in the Baltic trawl fisheries targeting demersal species (status 02/2021). A T90 codend is made of standard netting, turned by 90° to keep the meshes more open.

Compared to the legal T90 codend, two modifications were introduced:

- an increase in minimum mesh size (inner mesh opening) from 120mm to 125mm;
- the addition of lastridge ropes in the selvages (shortening ropes) to force the meshes of the codend to stabilize the opening of the T90 meshes during towing.

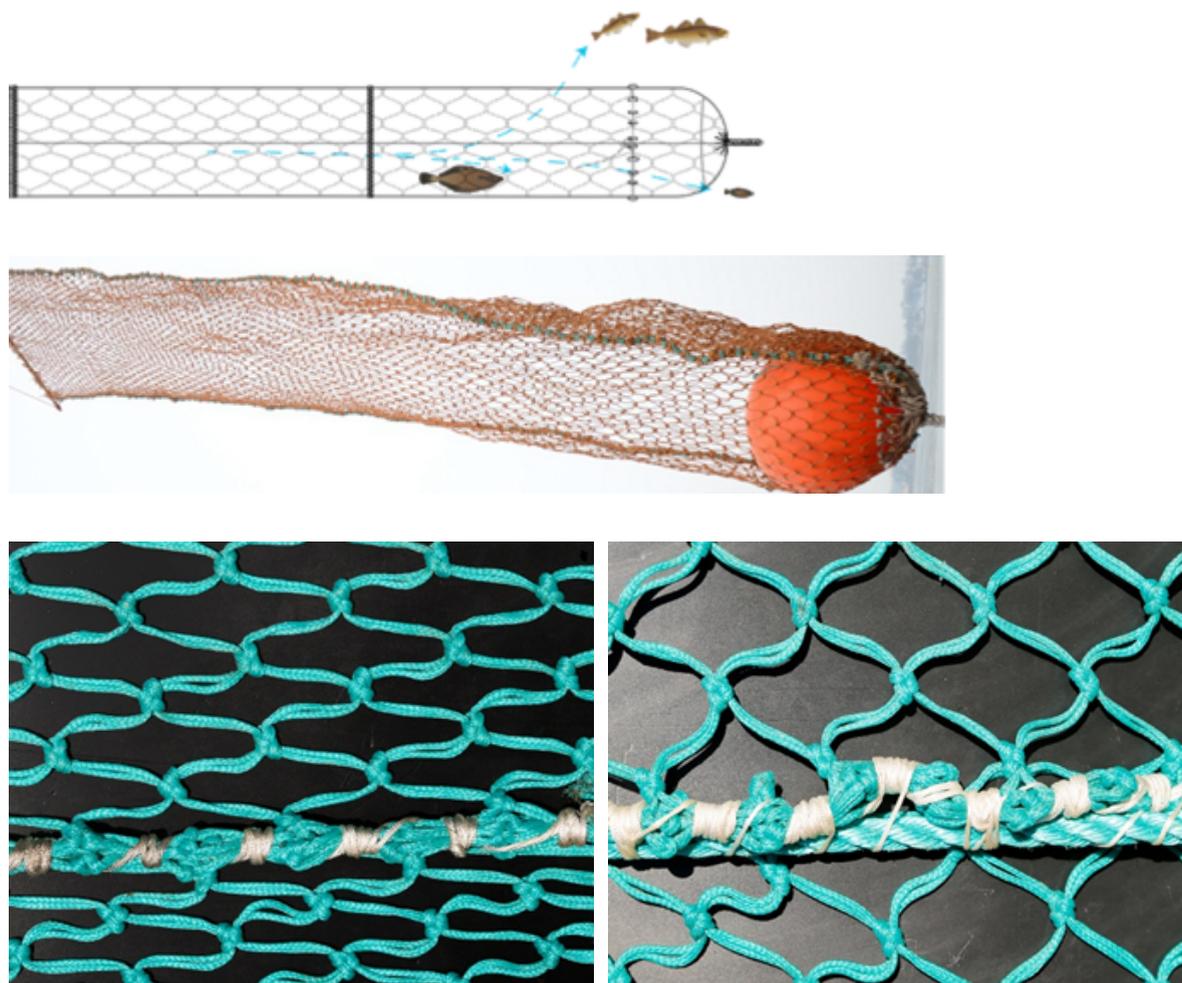


Figure 1: T90 codend 125mm / 2 panel / lastridge ropes (T90_125_2P_LR). Top: schematic drawing of a T90 codend and its basic functional principle. Middle: photograph of a T90 codend. Bottom: Illustration of the effect of lastridge ropes on the shape of T90 meshes. The left image shows T90 netting under tension (as during towing, here tow direction from left to right). The tension stretches the netting and closes the meshes. The right image shows the same netting with a lastridge rope (shortening rope), which takes the tension and prevents the stretching of netting and closing of meshes to ensure optimal escapement of roundfish, such as cod.

Basic functional principle

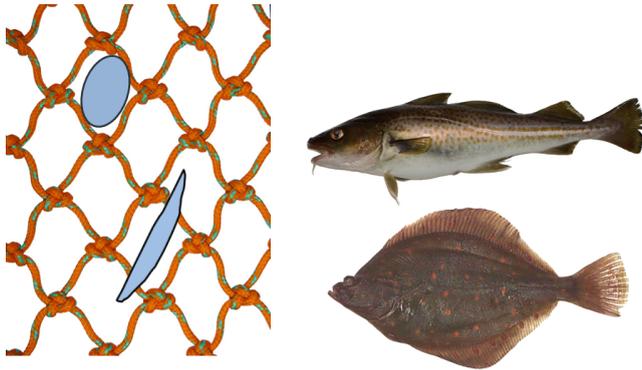


Figure 2: Schematic illustration of size and species selectivity in a T90 codend

The T90_125_2P_LR 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. It has been demonstrated that applying lastridge rope increases the escapement possibilities of small and medium cod, while the effect on flatfish is neutral or slightly negative when compared to the same codend without lastridge ropes. 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	Experiment type, aim	Cover codend, size selection (60 mm inner mesh size)
Fishing area	Baltic, SD24	Number of hauls	6
Vessel	FRV "Solea" https://tinyurl.com/2bfjhpzt	Towing time [minutes]: average (min-max)	79 (67-82)
Trawl	TV300/60	Fishing depth [meters]: average (min-max)	33 (29-37)
		Average measured mesh size [mm] (SD)	127 (2.0)

Fish caught/sampled

Species	Number individuals			Weight [kg]		
	in catch	measured	factor	in catch	measured	factor
cod	1010	1010	1,00	482	482	1.00
plaice	2436	2436	1,00	444	444	1.00
flounder	4703	4703	1,00	890	890	1,00

Selectivity estimates

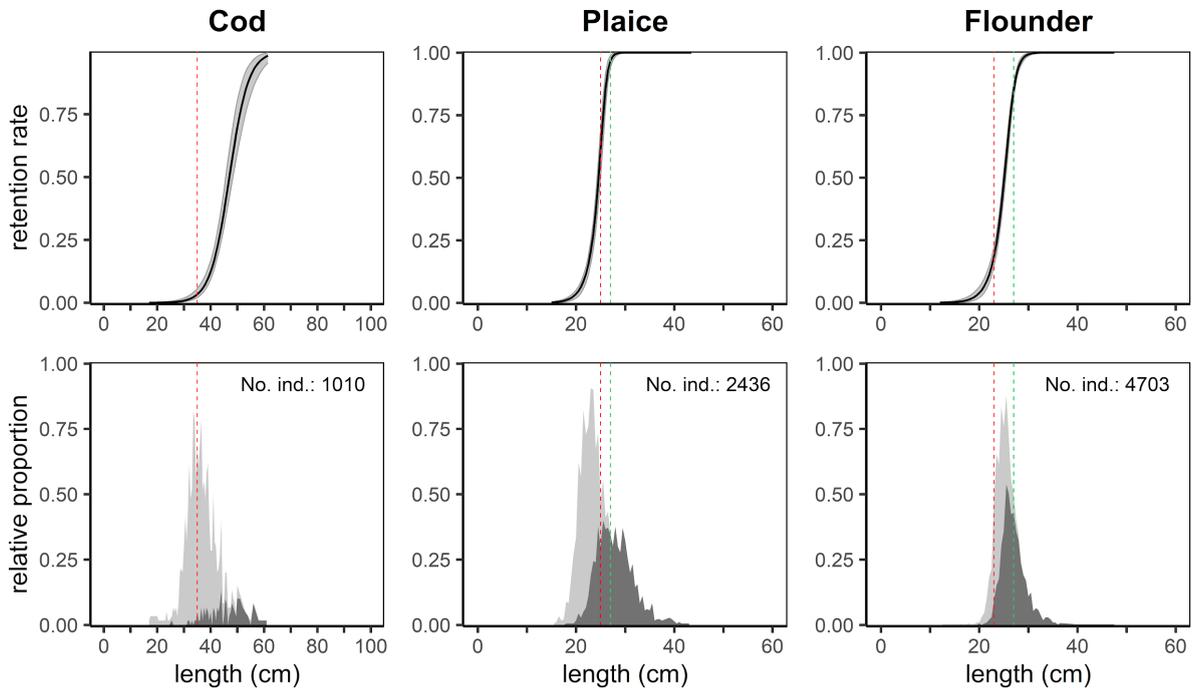


Figure 3: Selectivity results for the codend T90_125_2P_LR for cod, plaice and flounder. Top panel: selectivity curves and corresponding confidence intervals for the size ranges found in the experiment. Bottom panel: Length distribution of the population encountered during the experiment. The red vertical lines correspond to the current minimum conservation reference sizes (MCRS; cod = 35 cm; plaice = 25 cm; flounder = 23 cm, the latter depending on area). The green vertical line indicates a potential alternative commercial minimum size (27 cm) 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)

Performance indicator by numbers

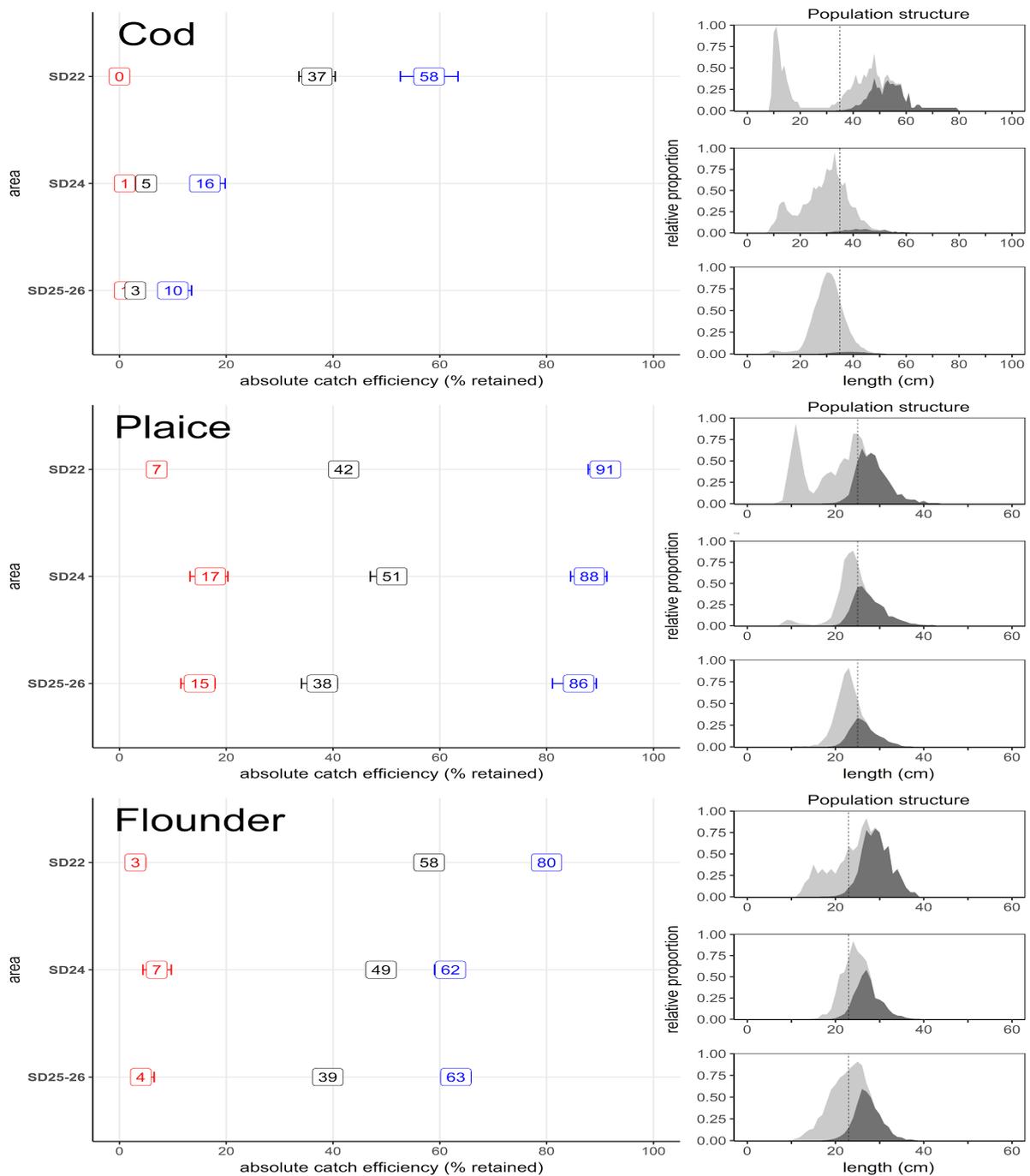


Figure 4: Performance selectivity indicators (**based on number of fish**) for the codend T90_125_2P_LR in three different areas of the Baltic Sea (ICES SD22; SD24; SD25-26). The calculation of the indicators is based on a simulated catch using the specific gear (T90_125_2P_LR) fishing on the population 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 escapes.

Performance indicator by weight

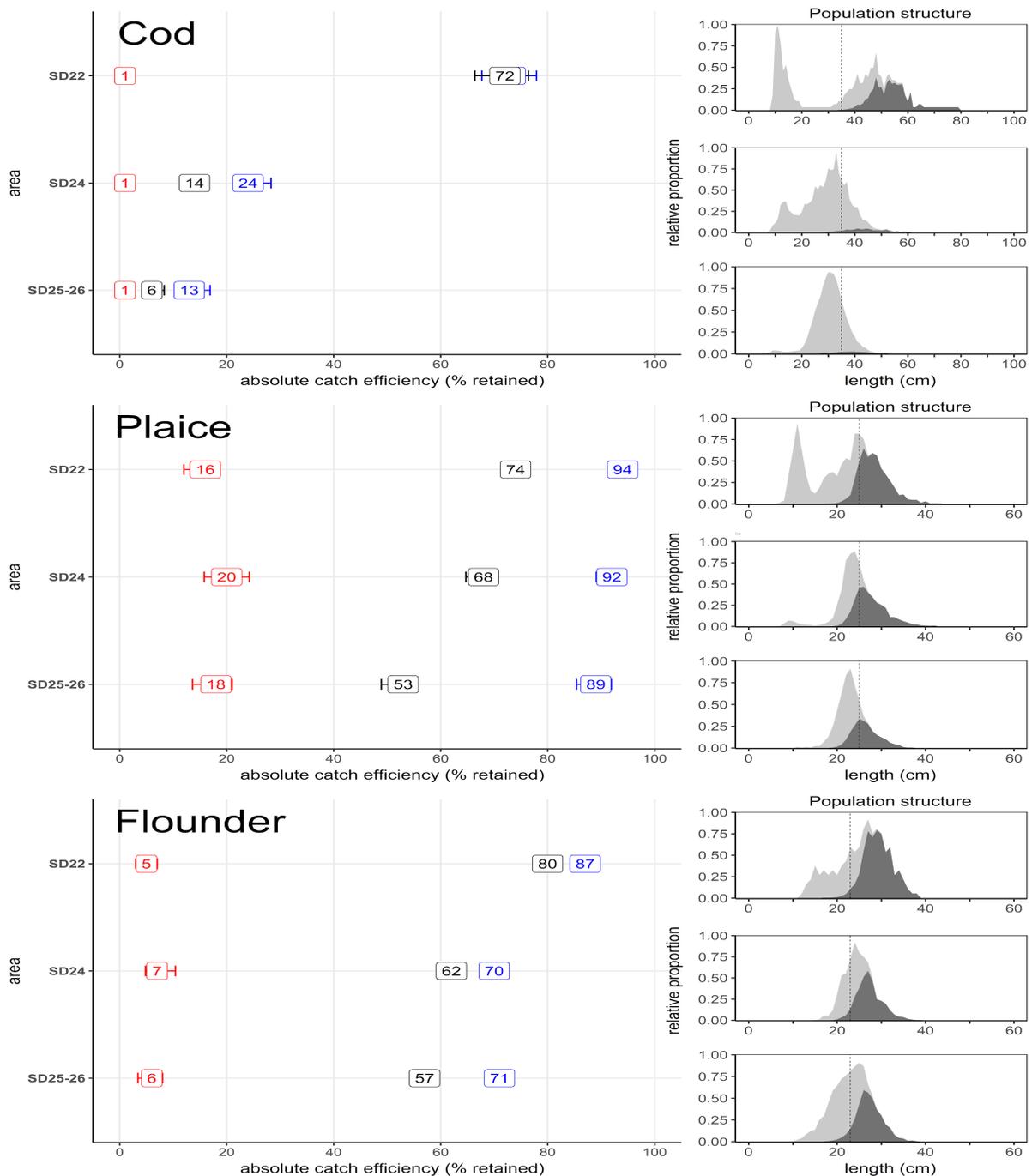


Figure 5: Performance selectivity indicators (**based on weight**) for the codend T90_125_2P_LR in three different areas of the Baltic Sea (ICES SD22; SD24; SD25-26). The calculation of the indicators is based on a simulated catch using the specific gear (T90_125_2P_LR) fishing on the population structure 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_LR) showed very stable selective properties, as expressed by the very narrow confidence intervals of the selectivity curves (figure 3).

The lastridge ropes forced the meshes to be open during towing.

The escapement of plaice \geq MCRS (25 cm) is very limited and mainly occurs between 25 cm and 27 cm (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 100%, resulting in no escapement and hence 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 10-20 cm) is completely selected out by the codend T90_125_2P_LR. A fraction of the fish between 35 and 50 cm is selected out, while fish above 50 cm are mostly retained in the codend. Therefore, the performance indicators reveal a relatively high catch efficiency for cod \geq MCRS in SD22 (58% in numbers and 73% in weight). In SD24, SD25 and SD26, the population structure is truncated and mainly comprises fish between 20 and 50 cm. These size classes are within the size selective length range of the codend T90_125_2P_LR where the retention probability is relatively low (see figure 3). Therefore, a significant amount of all cod entering the trawl can escape (around 95-97% in numbers and 86-94% in weight). For cod \geq MCRS, between 10% and 16% cod entering the trawl, are retained in the codend and bycaught (13% - 24% by weight)

Performance indicator flatfish (Figure 4 and 5)

The catch efficiency for flatfish of the codend T90_125_2P_LR is relatively high, resulting in little loss of plaice and flounder above MCRS (plaice = 25 cm; flounder = 23 cm, depending on area). For plaice, the loss is between 9% and 14% in numbers and between 6% and 11% in weight.

Due to the low MCRS of flounder, the loss of flounder \geq MCRS is significantly higher, but it consists mainly of individuals between 23 and 27 cm.

Conclusion/Summary

General summary

The codend T90_125_2P_LR is very efficient in releasing cod.

As all codend designs, the selectivity of the codend T90_125_2P_LR 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

This evaluation is focused on the lastridge ropes technology. The more comprehensive evaluation of the general codend design can be obtained in the associated factsheet T90_125_2P.

Pro	Caution	Contra
Improved reduction of cod catches	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	Little research effort available on lastridge ropes applied to T90 codends. The use of lastridge ropes might require different handling in the haul back operations with very large catch volumes.	Performance depending on the available population structure. Therefore, performance need to be evaluated regularly
Easy implementation (requires only small changes from currently legal option)		
Little research effort available on lastridge ropes applied to T90 codends. The concept can be potentially improved based on further research		

Cost indication

type of cost	amount	comment
material	around 800€ for the entire codend only 30€ for new ropes	codends are replaced regularly
mounting time	less than 1h	

Legal status

The codend T90_125_2P_LR is currently not used in commercial fisheries.

The use of a codend with 125 mm mesh opening (inner mesh size) and 2 panel is legal in the Baltic Sea. Nevertheless, this codend uses lastridge ropes (shortening ropes, see figure 1) to stabilize the mesh opening. It needs to be clarified whether the use of lastridge ropes is legal in commercial Baltic fisheries.

Additional information

Contact data

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Media available

Type	Source
reports	Cruise report "Solea 788" [not released yet] Cruise report "Solea 741" [to be uploaded]
scientific papers	
Web sites	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

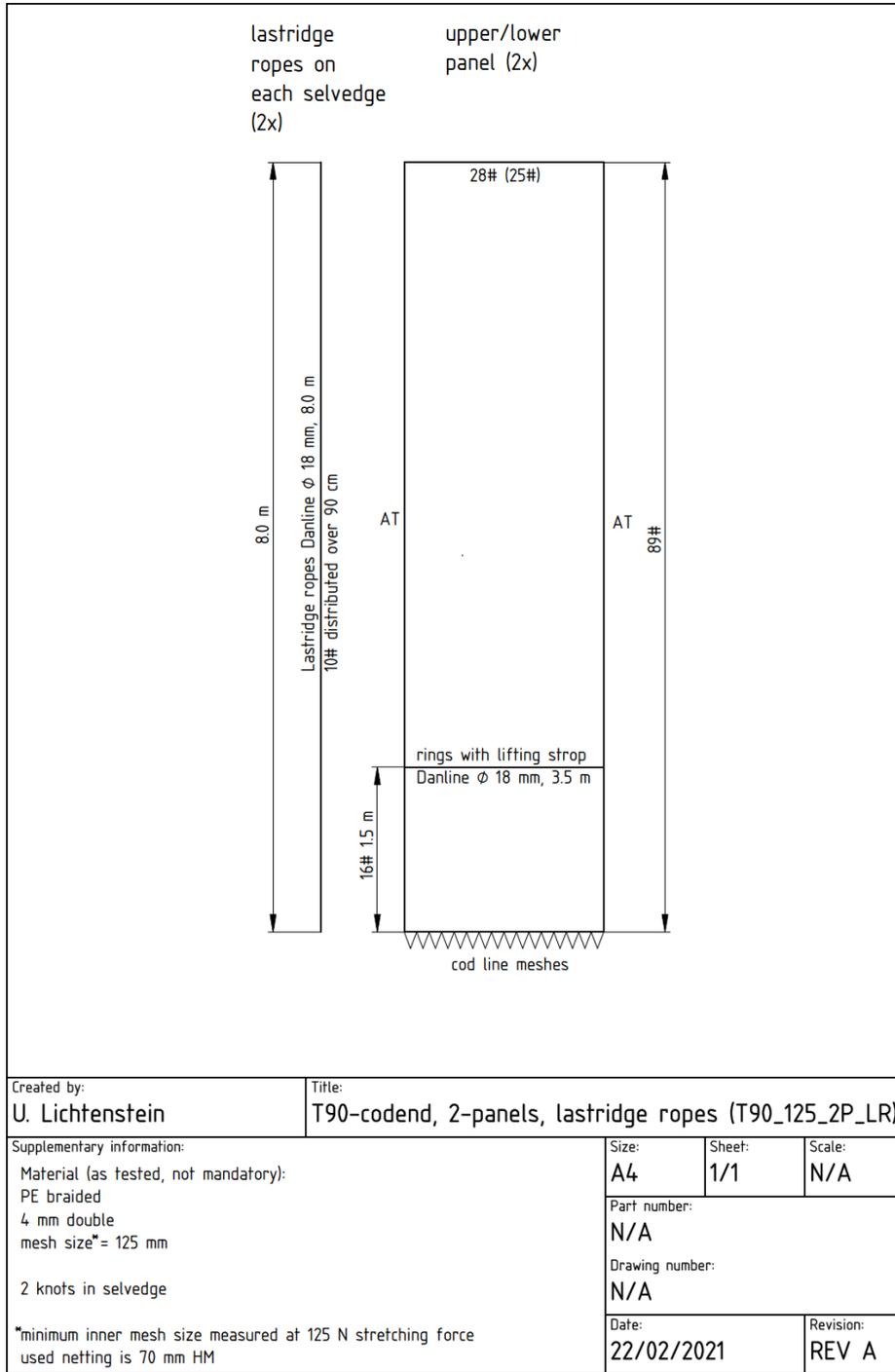


Figure 6: Technical drawing of T90 codend 125mm / 2 panel / lastridge ropes (T90_125_2P_LR), as used during the experimental fishing. Mesh sizes given are the nominal mesh size (minimum inner mesh size).

Technical description to be used in JR
to be discussed