Bacoma codend 105mm / 120mm

Gear ID: Bacoma_105_120

General description of the gear / selectivity device

This selectivity device is **one of the codends legally used** in the Baltic trawl fisheries targeting demersal species (status 02/2021), which was introduced in its current configuration in 2010. This codend is designed to catch as much cod >MRCS as possible while reducing the catch of undersized cod.
The Bacoma-codend is made of netting in standard orientation (T0) with 105mm nominal mesh opening. A square mesh escape panel, made of knotless netting with 120mm nominal mesh opening, is mounted in the upper rear part of the codend to keep the meshes open during towing.

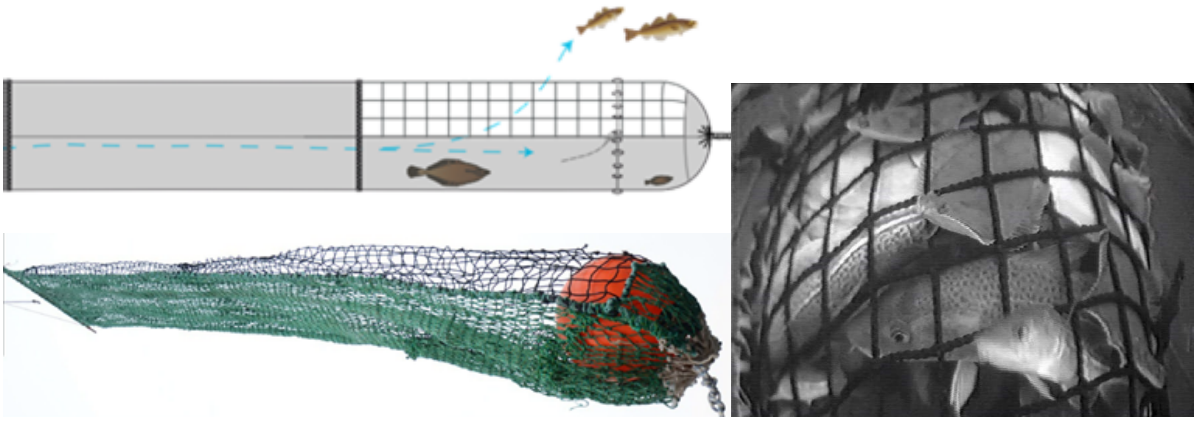

Figure 1: Bacoma-codend. Top-left: schematic drawing of the Bacoma codend and its basic functional principle. Bottom-left: photograph of Bacoma codend with the two types of netting (green: standard T0 netting with 105mm mesh opening; black: knottless square mesh panel with 120mm mesh opening) . Right: Underwater photograph showing fish accumulation and escapees through the Bacoma window.

Basic functional principle

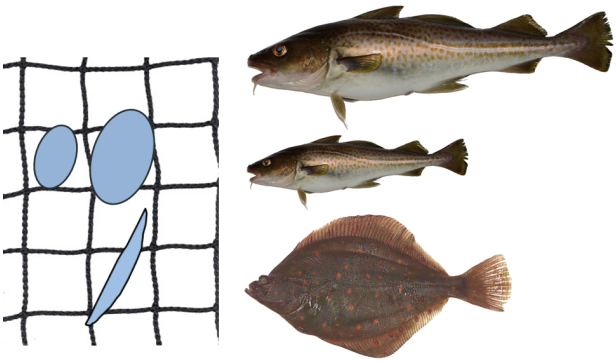

Figure 2: Schematic illustration of size selectivity in the square mesh panel of a Bacoma codend

The Bacoma 105mm / 120mm codend (Bacoma_105_120) 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. 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 selective properties of this gear have been extensively tested in the Baltic Sea and also in other marine regions of the world, with technical specifications adapted to specific characteristics of the targeted fishery. The results presented here are based on the most recent trials conducted in the Baltic Sea.

Experimental setup

Period tested	February 2019
Fishing area	Baltic, SD24, SD25
Vessel	FRV "Solea" [https://tinyurl.com/2bfjhpzt]
Trawl	Solea Double Belly Trawl

Experiment type, aim	paired-gear, size selection (control codend made of 60 mm inner mesh size)
Number of hauls	14
Towing time [minutes]: average (min-max)	30 (30-40)
Fishing depth [meters]: average (min-max)	56 (19-92)
average measured mesh size [mm] (s.d)	NA

Fish caught/sampled

Species	**Number individuals**			**Weight [kg]**		
	in catch	**measured**	**factor**	**in catch**	**measured**	**factor**
cod	777	777	1,00			
plaice	393	393	1,00			
flounder	4691	4691	1,00			

Selectivity estimates

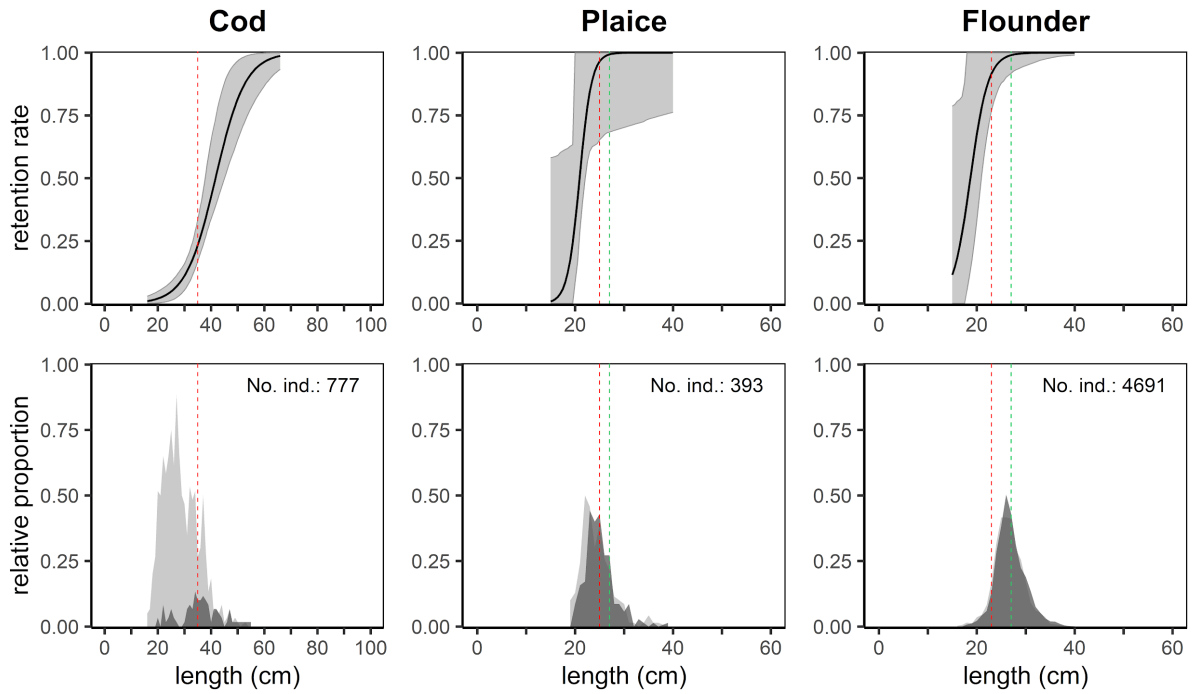

Figure 3: Selectivity results for Bacoma codend 105mm / 120mm (Bacoma_105_120) for cod, plaice and flounder. Top panel: selectivity curves and corresponding confidence intervals for the size ranges found in the experiment. Bottom panel: Length distribution of the population encountered during the experiment. 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 (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 reduction 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. 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

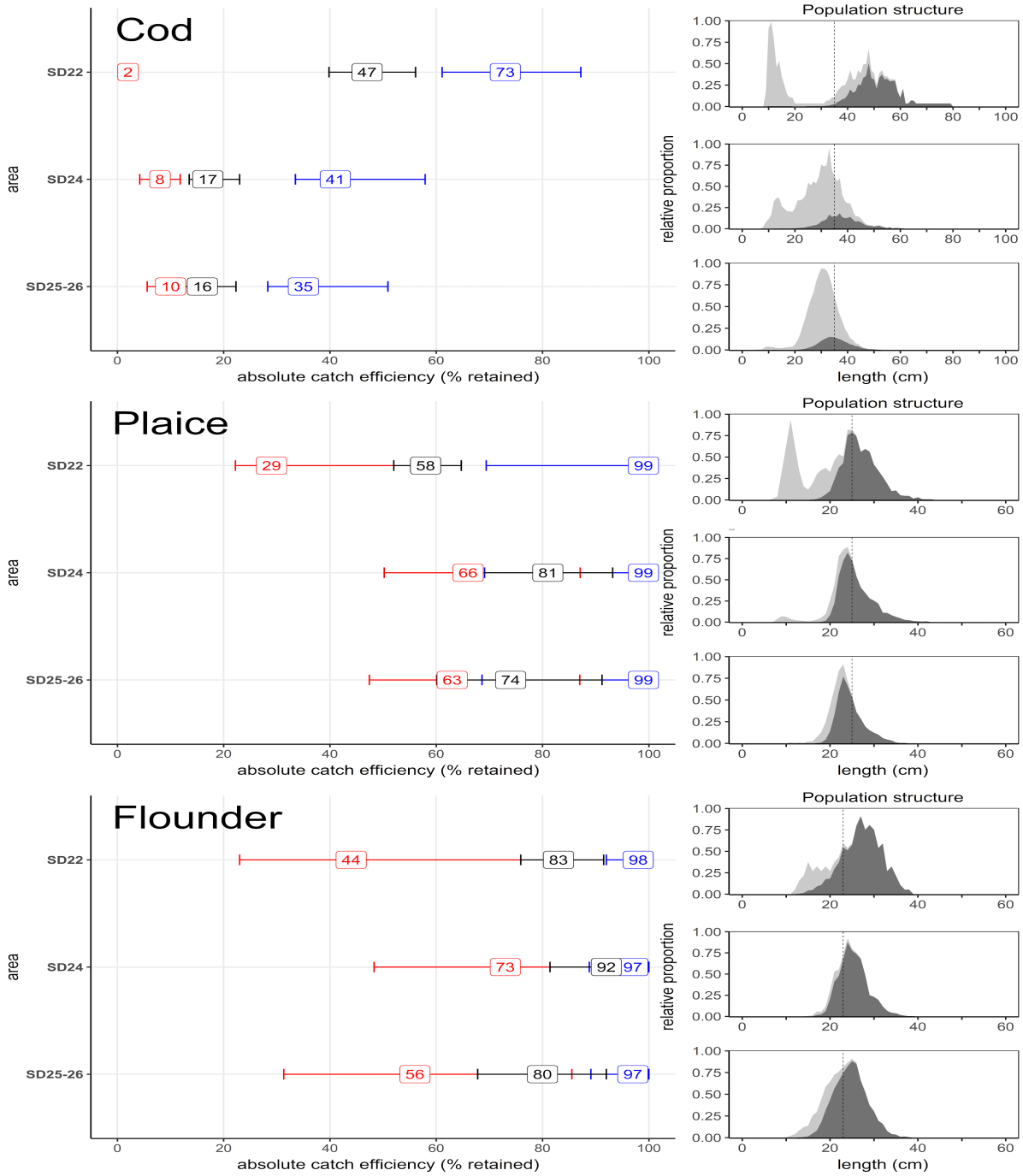

Figure 4: Performance selectivity indicators (**based on number of fish**) for the Bacoma codend 105mm / 120mm (Bacoma_105_120) in three different areas of the Baltic Sea (SD22; SD24; SD25-26). The calculation of the indicators is based on a simulated catch using the specific gear (Bacoma_105_120) fishing 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

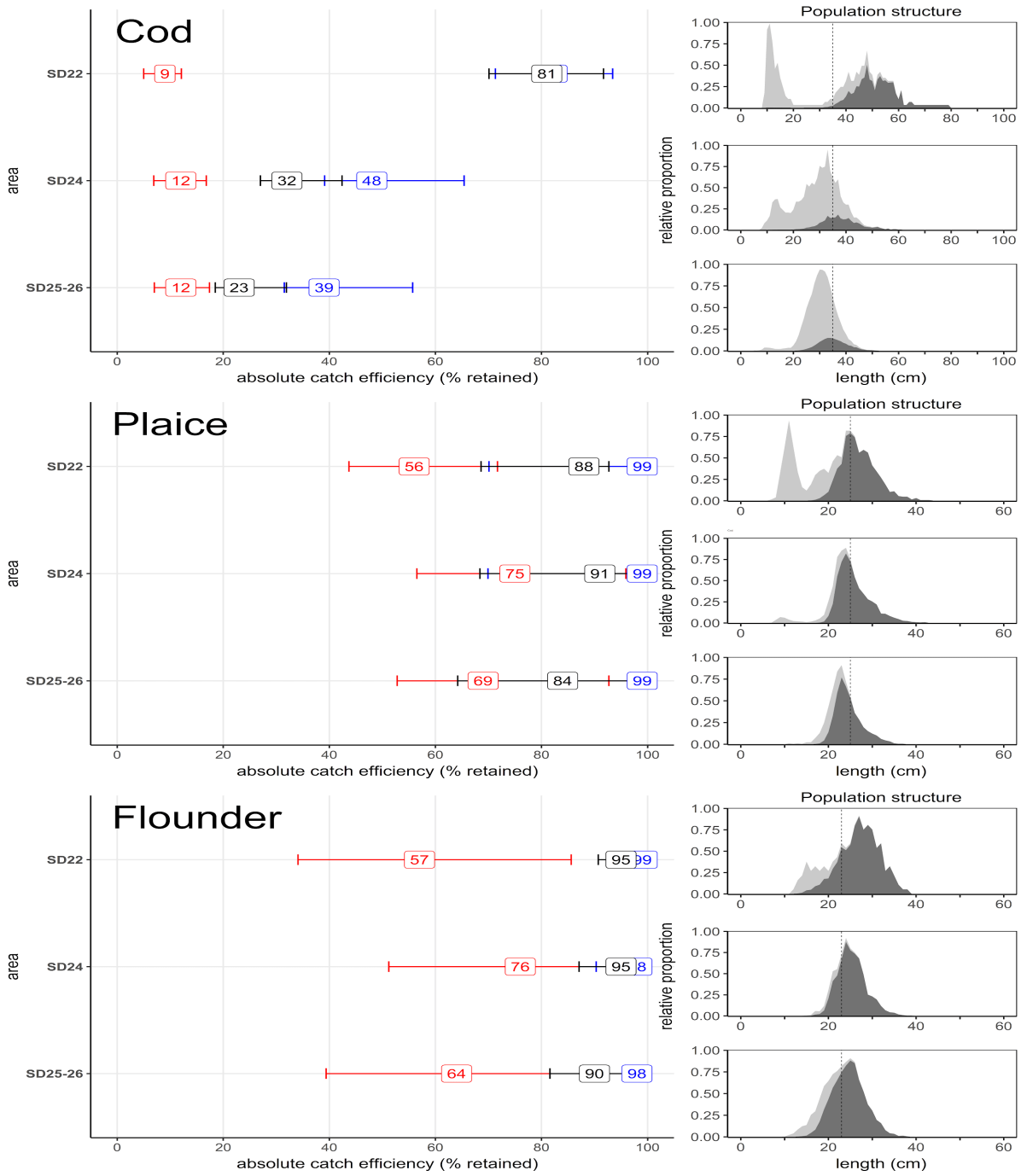

Figure 5: Performance selectivity indicators (**based on weight**) for the codend Bacoma_105_120 in three different areas of the Baltic Sea (SD22; SD24; SD25-26). The calculation of the indicators is based on a simulated catch using the specific gear Bacoma_105_120 fishing on the population structure 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)

While the number of cod and plaice caught in the experiment are relatively low, the selectivity estimates are in line with previous experiments. As shown in figure 3, the retention probability for flatfish above MCRS is high, and it reaches 100% for individuals above 27 cm (an alternative commercial minimum size frequently used in the fishery). Therefore, the use of the codend Bacoma_105_120 does not lead to commercial losses of plaice and flounder.

Performance indicator cod (Figure 4 and 5)

The population structure for cod differs between ICES SDs. In SD22 (Western Baltic Sea), the population consists of two distinct size groups. While the smaller one (between 10-20cm) is completely selected out by the Bacoma codend 105mm / 120mm (Bacoma_105_120), most fish of the larger size group (35-60cm) are retained by the codend. Consequently, the performance indicators reveal a high catch efficiency for cod above MCRS in SD22.
In SD24, SD25 and SD26, the population structure is truncated and mainly comprises fish between 20 and 50cm - well within the size selective length range of the Bacoma codend 105mm / 120mm (Bacoma_105_120). Therefore, a significant amount of all cod entering the trawl can escape (around 80% by number and 70% by weight). For cod above MCRS, between 35% and 41% cod entering the trawl, are retained and bycaught (39% - 48% by weight).

Performance indicator flatfish (Figure 4 and 5)

The catch efficiency for flatfish of Bacoma codend Bacoma_105_120 is very high, resulting in little loss of plaice and flounder above minimum conservation reference size (MCRS; plaice = 25cm; flounder = 23cm, depending on area). In numbers, the loss is between 1% and 3%, while the loss in weight is maximum 2%.

Conclusion/Summary

General summary

The codend BACOMA_105_120 is designed to release small cod, while catching large cod (above MCRS). Therefore, this gear has its limitations when the target is the bycatch reduction of cod of all size classes.
As all codend designs, the selectivity of the codend BACOMA_105_120 is length dependent and therefore the 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**
Easy handling	Design potentially sensitive to external factors (e.g. handling, catch volume)	Poor catch reduction of cod (codend was designed to catch cod)
Easy implementation		Reduced selectivity if meshes blocked by flatfish
Potential for further improvement (e.g. combination with other selectivity devices)		Performance depending on the available population structure. Therefore, performance need to be evaluated regularly

Cost indication

type of cost	**amount**	**comment**
material	around 1000€	codends are replaced regularly
mounting time	less than 1h	

Legal status

The codend Bacoma_105_120 is currently one of the codends legally used in the Baltic mixed trawl fisheries (EU 2019/1241), although the gear is described very vague in the current regulation .

Additional information

Contact data

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Media available

Type	Source
reports	cruise report “SO759” [https://tinyurl.com/52sz6v4s]
scientific papers	Madsen et al. 2021 [https://tinyurl.com/5a9p2hka] Herrmann et al. 2014 [https://tinyurl.com/fekf95t4] Wienbeck et al. 2014 [https://tinyurl.com/kfb5wuz4] Madsen 2007 [https://tinyurl.com/hsjrh25a]
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

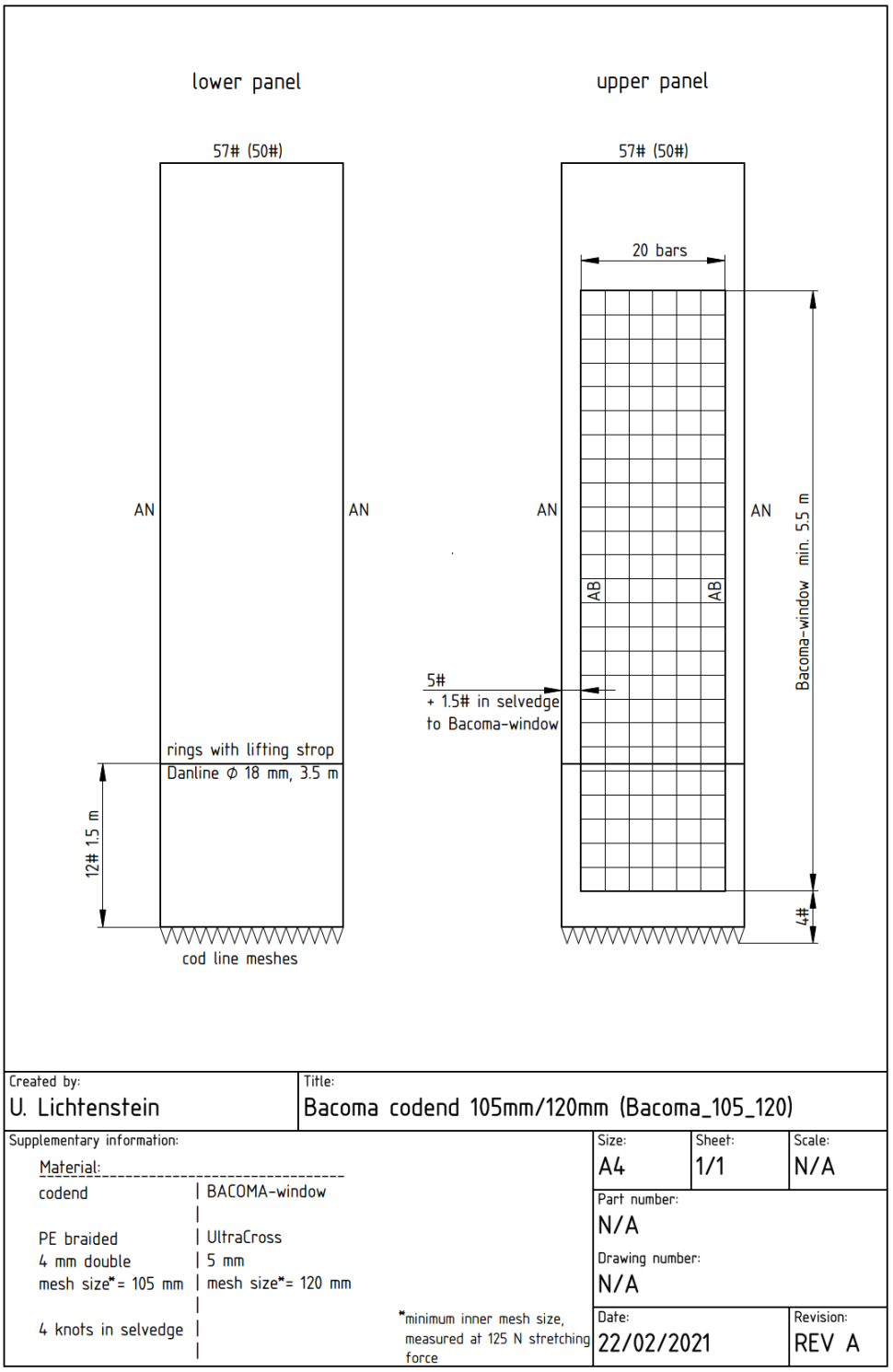

Figure 6: Technical drawing of Bacoma codend 105mm / 120mm (Bacoma_105_120), as used during the experimental fishing. Mesh sizes given are the nominal mesh size (minimum inner mesh size).

Technical description to be used in JR

Please, refer to current and previous technical regulations.