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Cruise report from Havfisken, June 2020

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Colophon

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Key Findings

A covered codend experiment was conducted onboard R/V Havfisken to look at **the effect of panel placement and the use of stimulation devices on catch efficiency**.

1

Panel placement and the addition of **scaring floats** were found to have **little effect** on selectivity.

2

Moving the SELTRA 300 panel further away from the codline **had little influence on selectivity**, not only for the target species *Nephrops*, but also for round and flatfish.

3

The addition of scaring floats to stimulate fish escape **did not** significantly **increase** the **efficiency** of the panel.

4

The **addition of scaring floats** resulted in an **increased retention** across a small number of length classes for **plaice and lemon sole**.

5

Further trials looking at panel placement and alternatives to the SELTRA 300 are needed.

6

Content

Introduction

Cod (*Gadus morhua*) stocks within EU waters (North Sea, eastern English Channel, Skagerrak and Kattegat) are in poor condition. Consequently, new management regulations have been introduced in the Kattegat, Skagerrak, North and Baltic Seas. Among others, the main technical measures introduced have been in relation to gear designs, namely demersal trawls.

In the Kattegat, new technical measures were introduced in August 2020 to protect the cod stock (BEK nr 1249 af 24/08/2020). The traditional SELTRA 270 diamond mesh panel has been replaced with a SELTRA 300 square mesh panel, and its placement moved 1 meter closer to the codline (3-6 m rather than the previous 4-7 m). Additionally, a modified version of the scaring floats design that was developed under Fast Track II together with FN 459 M Jerup was also introduced into legislation. Here, the scaring floats with small grid in the bottom was combined together with a SELTRA 300 square mesh panel placed 4-7 m from the codline.

In the Skagerrak and North Sea, a new national cod plan was implemented in August 2020 (BEK nr 1204 af 12/08/2020), where a suite of additional gears were introduced, including a SELTRA 300 square mesh panel and a modified version of the original scaring floats design. Both designs are however slightly different from what has been introduced into the Kattegat. In the Skagerrak and North Sea, the SELTRA 300 does not have a small grid mounted below the scaring floats.

The position of panels is known to effect the selectivity for a number of species (e.g. Graham et al., 2003). Therefore, the aim of the trial was to test the SELTRA 300 panel placed at two different positions (4-7 m and 7-10 m), as well as test the inclusion of the scaring floats, and see to what extent panel placement and the addition of scaring floats can help reduce the catch of round fish without affecting the catch of the commercial target species Norway lobster (*Nephrops norvegicus*).

Material and Methods

Fishing operations and gear

The trial was carried out on board R/V Havfisken, a 17 m research vessel built to fish with twin-rig trawls (Figure 1) operating in ICES Divisions IIIa (Figure 2). A total of 21 valid hauls were carried out from May 29th to June 5th 2020. All hauls were carried out on commercial fishing grounds in the Skagerrak and Kattegat. Small-meshed covers were used to capture individuals that escaped the codend, consequently hauls durations were shorter than what is typically observed in the fishery for Norway lobster. During the trial, average haul duration was 2.1 hours. The vessel engaged in twin-rig trawling, where the modified and legal SELTRA codends were towed in parallel.

Figure 1. The vessel, R/V Havfisken.

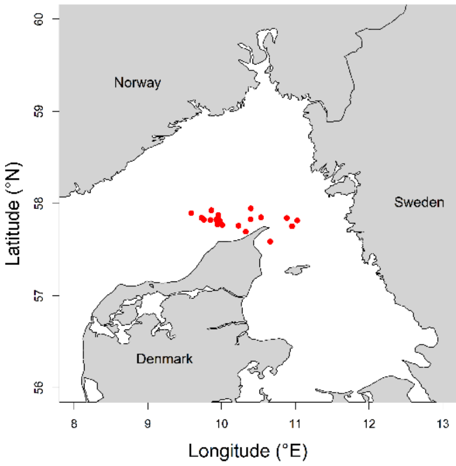

Figure 2. Trial location (21 valid hauls).

The aim of the trial was to determine how selectivity changes when the placement of the SELTRA panel is moved further away from the codline and how the addition of scaring floats effects selectivity. Therefore, for each of the two positions of interest, one trawl had a standard SELTRA 300 codend and the other had an identical SELTRA 300 codend but with the addition of scaring floats.

The standard SELTRA 300 codend consisted of four panels with a total circumference of 100 meshes, a nominal mesh size of 90 mm diamond mesh and a 3 meter long panel with a nominal mesh size of 300 mm square mesh. In the first experiment, the panel was placed 4-7 meters from the codline, while in the second experiment it was moved to 7-10 meters from the codline by adding a 3 m long extension after the panel (Table 1).

The scaring floats used consisted of three elastic bands, each 80 cm long and with four floats mounted on each, and were attached to the upper and lower netting panels (Table 1, Figure 3). The lines of floats were meant to scare the round fish out of the codend through the panel.

The codend covers had a mesh size of 39.68 mm (SD = 1.16 mm) and a series of kites, weights and floats were used to keep the covers from contacting the codends (Figure 4).

Table 1. The technical specifications of the gears tested.

	Characteristic	Standard	Modified
Codend	Mesh orientation	Diamond	Diamond
	Nominal mesh size (mm)	90	90
	Measured mesh size ±standard deviation (mm)	98.14 ± 2.5	93.87 ± 3.4
	Codend circumference (mesh no.)	100	100
	Twine thickness	3 mm double	3 mm double
	Material	Polyethylene (PE)	Polyethylene (PE)
	Codend stretched length (m)	5.3	5.3
	Extension piece stretched length (m)	2.5	2.7
	No. of selvedges	4	4
Panel	Panel stretched length (m)	3	3
	Number of meshes across (length x width)	16 x 3	16 x 3
	Distance from the codline to the panel (m)	4 / 7	4 / 7
Floats	Size of floats (grams of flotation)	-	130
	Number of lines with floats		3
	Number of floats per line		4

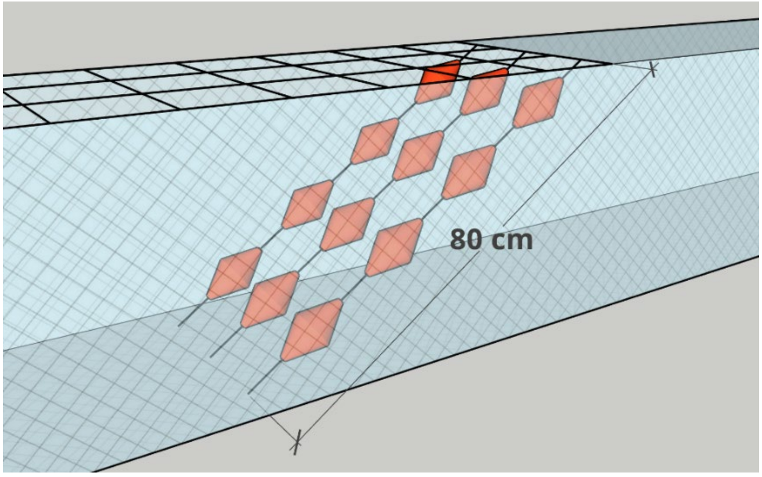

Figure 3. The scaring floats.

Figure 4. The codend covers.

Sampling and Analysis

Fishing was conducted following full commercial conditions in terms towing speed and fishing areas. The use of covers typically results in large numbers of small fish being caught. To avoid damage to the covers, the haul durations during the trial were shorter than what is typical for this fishery. The total catch, in weight, of each trawl codend and cover was recorded prior to sorting. All catches of the target species Norway lobster, the round fish cod, haddock (Melanogrammus aeglefinus), as well as the flatfish plaice (Pleuronectes platessa) and lemon sole (Microstomus kitt), were length-measured. Carapace length of Norway lobster and total length of fish were rounded down to the nearest millimetre and centimetre, respectively. To prevent any systematic effects between the trawls and their position (side of the vessel) on the catch, the codends were shifted from one trawl to the other after the sixth haul. For a given species, only hauls with a total of ten individuals for both gears were included.

The covered codend method implies that all individuals that entered the trawl were caught in either the codend or the cover. We were interested in estimating the length-dependent probability for an individual to be retained in the codend. Therefore, for each species and each trawl separately, we used the count data for the different length groups and tested different parametric models to estimate the retention rate at length, $r(l, \boldsymbol{v})$, where $\boldsymbol{v}$ is a vector consisting of the parameters of the model. We chose the model with the lowest individual Akaike information criterion (AIC) value (Akaike, 1974). 95% Efron confidence intervals (Efron, 1982) accounting for between and within hauls variation in selectivity were estimated using a double bootstrapping method with 1000 iterations. To fully exploit the experimental design with two trawls towed simultaneously and in parallel, for each experiment we synchronized the hauls selection during the bootstrap procedure. This increased the power of the analysis in determining the effect of adding the scaring floats, at each SELTRA position. The analyses were performed using the software SELNET (Herrmann, 2012).

Results

During the trials, a total of 21 valid hauls were carried out; 10 and 11 hauls with the panel placed at 4-7 m and 7-10 m, respectively. The towing time varied from 0.5 to 4.3 hr with an average and standard deviation of 2.1 ± 0.9 hr. The depth varied from 19.4 to 112.2 m with an average and standard deviation of 60.1 ± 25.3 m. The total estimated catch weight varied between 36 and 315 kg with an average and standard deviation of 128 ± 66 kg.

Here we examine whether the position of the SELTRA 300 panel and the addition of scaring floats affects the selectivity of the main commercial species.

Effect of panel placement on selectivity of cod, plaice and *Nephrops*

No significant differences were observed for cod and *Nephrops* across all length classes when the position of the panel was changed from 4-7 to 7-10 meters from the codline (Figure 5). For plaice, however, there is a significant increase in the retention of large individuals when the panel is placed further from the codline.

Effect of adding scaring floats to the SELTRA 300 on selectivity

The addition of scaring floats did not have any effect on the selectivity of *Nephrops*, cod, and haddock (Figure 6). For the two flatfish species, plaice and lemon sole, the addition of scaring floats results in an increased retention across a small number of length classes when the panel was placed at 7-10 m for plaice and 4-7 m for lemon sole.

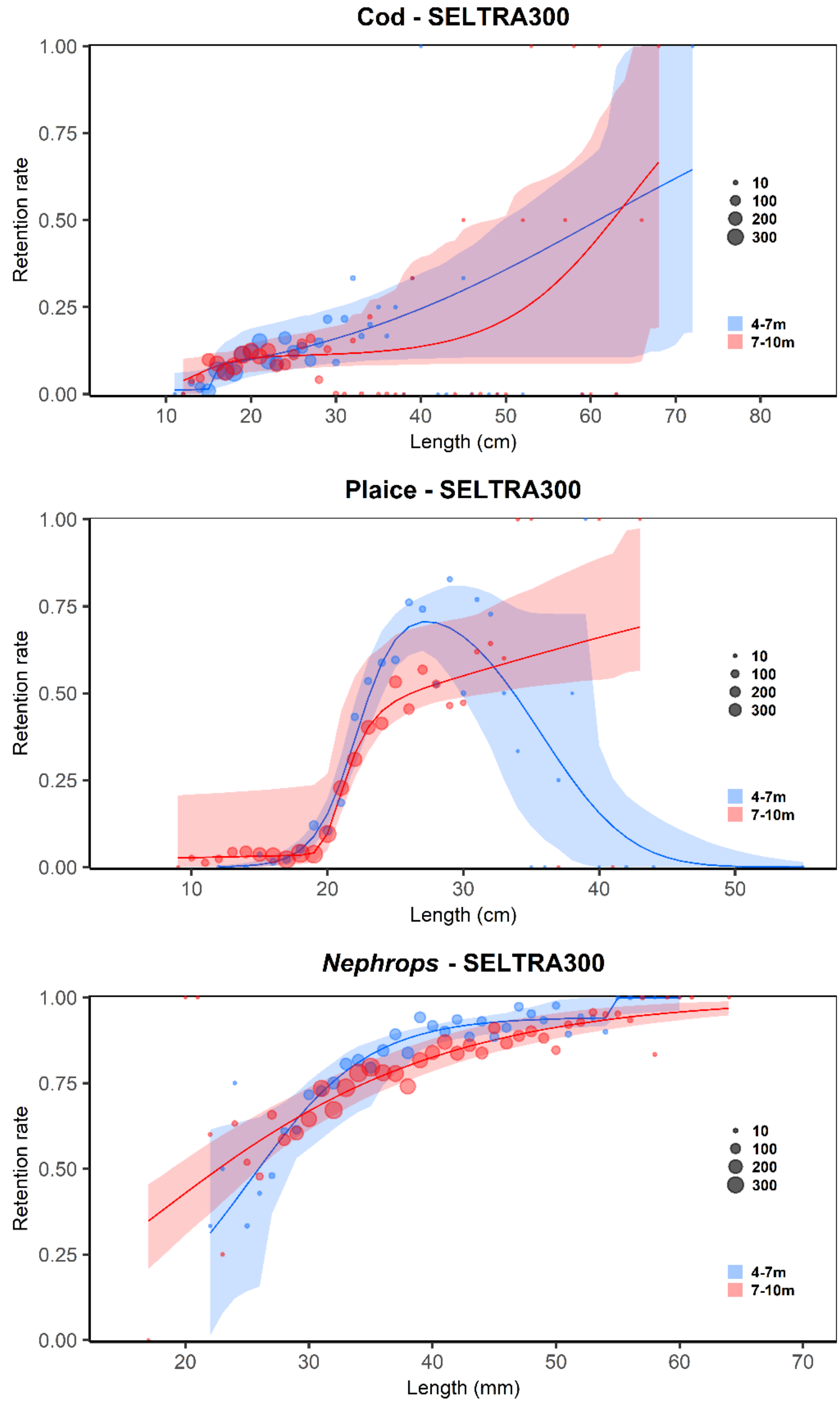

Figure 5. Absolute selectivity curves for cod (top) plaice (middle) and *Nephrops* (bottom) comparing the selectivity for the three species when the position of the panel is changed. The 95% confidence interval is represented by the shaded areas. The solid lines represent the mean retention rate for each of the two positions; blue (4-7 m) and red (7-10 m).

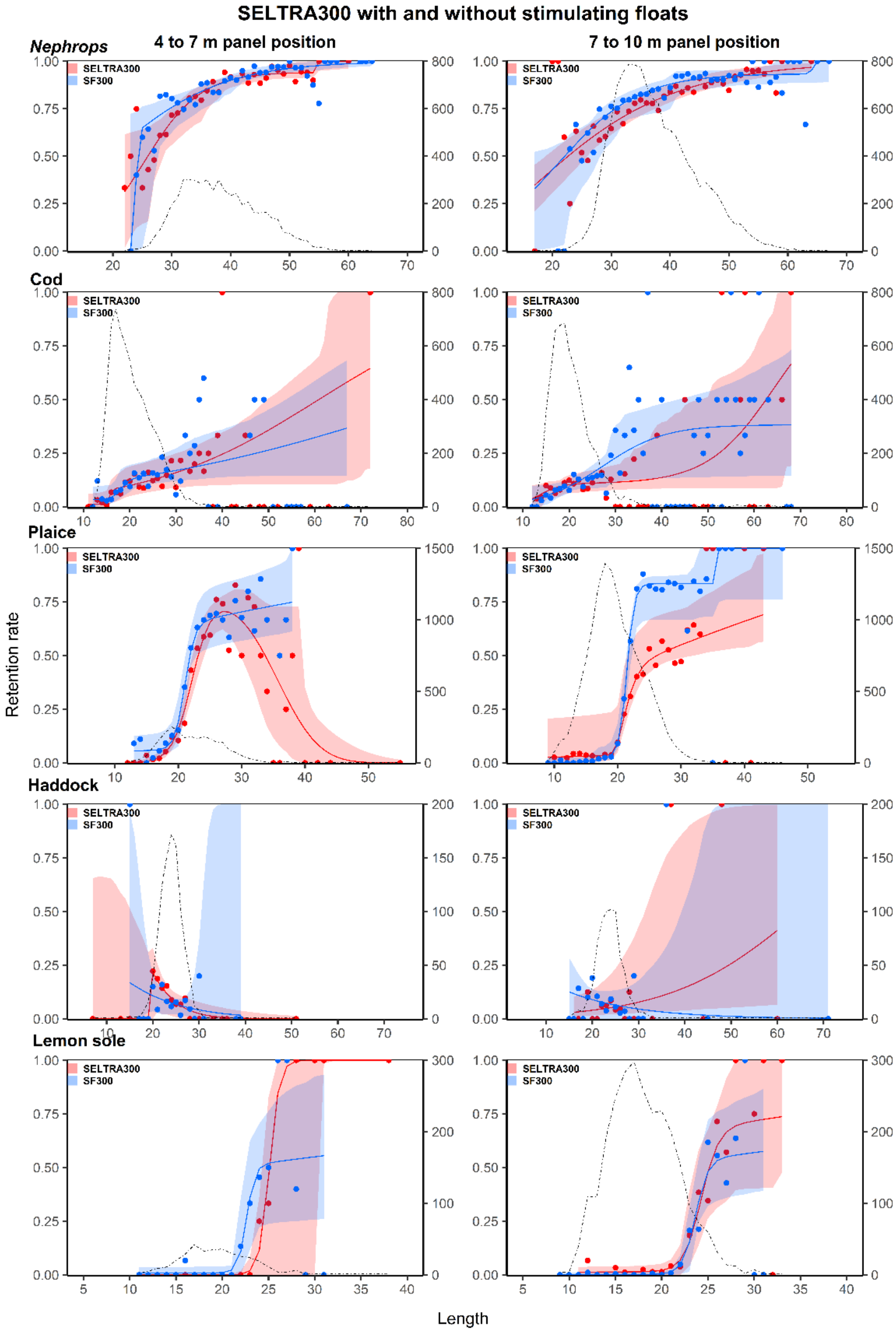

Figure 6. Absolute selectivity curves for *Nephrops,* cod, plaice, haddock and lemon sole comparing the selectivity for the five species when scaring floats were added to the SELTRA 300. The 95% confidence interval is represented by the shaded areas. The solid lines represent the mean retention rate for the SELTRA 300 (red) and SELTRA 300 with scaring floats (blue). In the left column, the panel was placed at 4-7 m and in the right column at 7-10 m from the codline.

Discussion

The results from the trial show that moving the position of the panel further away from the codline has little influence on selectivity, not only for the target species *Nephrops*, but also for cod. For plaice, panel position had a significant effect for larger individuals. In particular, at 4-7 m we have a bell shaped selection, suggesting a length-dependent contact with the panel. This disappears at 7-10 m, suggesting that plaice stay closer to the bottom netting when they are far away from the catch accumulation zone. Here we tested the version of the SELTRA 300 that is described in legislation for the Skagerrak, where the panel is placed 4-7 meters from the codline. In the Kattegat, the SELTRA 300 panel is positioned closer to the codline at 3-6 m. It should also be examined whether there is a difference in selectivity between these two legislated codends.

The SELTRA 300 tested during the trial was designed according to legislation. However, many fishermen use floats along the selvedges of the panel to ensure the panel section does not collapse and catch lost through the panel. The height of the panel section is known to influence the selectivity for a number of species. For example, Krag et al. (2016) found that changing the height of the panel section from approximately 20 to 50 cm resulted in a significant increase in the retention of cod, saithe and plaice. Therefore, it may be that a SELTRA 300 with floats mounted along the selvedges would retain more of these species. During this trial, depth sensors were used to determine the height of the panel section. Unfortunately, there were problems with the sensors and these data were not able to be used.

The results from the trial also showed that the addition of scaring floats to the SELTRA 300 resulted in very little improvements in selectivity for all 5 species examined. This is contradictory to what has been observed in the past where scaring floats have been tested on board a commercial vessel. One explanation for this could be the fact that the SELTRA 300 is already highly selective, leaving little room for further improvement. Alternatively, the scaring floats design tested on board FN 459 M Jerup also had a large diamond shaped opening cut out of the existing SELTRA 270 panel. It would also be of interest to describe the selectivity of a large diamond opening, to see whether this was in fact what resulted in the improvements in selectivity observed during the original scaring floats trial.

Based on the results obtained during this trial, the SELTRA 300 is effective at avoiding catches of round fish, and especially cod, while retaining the target species, Norway lobster. The use of the scaring floats in conjunction with the SELTRA 300 was not effective at further reducing the capture of cod.

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Technical
University
of Denmark

DTU Aqua
Willemoesvej 2
DK-9850 Hirtshals

www.aqua.dtu.dk