9th Joint Russian-Norwegian Symposium
Technical Regulations and By-Catch Criteria in the Barents Sea Fisheries
(PINRO, Murmansk, 14-15 August 2001)

SIZE- AND SPECIES SELECTION IN DANISH SEINE

by
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Abstract

The Norwegian seine fishery has traditionally been performed in relative shallow water close to the coast, and this as inevitable led to a high proportion of small fish in the catches. A work on size selectivity was therefore started in the early 90'ies. Based on earlier experience with grid in trawls, similar experiment was conducted with seine nets. Grids in seine nets gave selectivity results similar to those obtained for trawl, but grids turned out to be difficult to handle onboard seine net vessels. Further experiments were performed with square mesh codends, which gave similar good selectivity results. The square mesh codends were much easier to handle, and from 1997 square mesh codends with a minimum mesh size of 125 mm has been used by the seine net fleet on a temporarily basis.

In the last few years the seine net fleet has got problem with bycatch of strict regulated species. A project on species selectivity was initiated some years back in order to sort out unwanted species. With a big meshed horizontal square mesh panel in the extension piece, it is possible to shift the species composition in the codend compared to the normal composition on the fishing ground.

Introduction

Danish seine was introduced as a fishing gear for the Norwegian coastal fleet in the early 1930s, and was primarily used during the three first decades for flatfish like plaice (*Pleuronectes platessa*) and sole (*Microstomus kitt*) in relatively shallow waters. In the late 1960s, the gear was gradually introduced in the fishery for cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*), mainly in the Lofoten area. The gear is now primarily used for cod, haddock, saithe (*Pollachius virens*), and to a lesser extent flatfish. Other species that are occasionally caught by seine net are redfish (*Sebastes marinus*), herring (*Clupea harengus*), capelin (*Mallotus villosus*), and catfish (*Anarhichas minor*).

During the last two decades the seine net method has become a very popular in the costal fleet (vessels shorter than 90 feet). The gear is now larger and the ground gear has been modified to fish on rougher bottom than before, and most of the boats are using 8-10 coils of rope (of 220 m)

on each side. The fishing method used by the Norwegian seine boats is now more like fly dragging. When fishing without anchor, as in Scottish seining, the vessels are stationary or slowly mowing forward by means of the propeller.

The seine net fishery has traditionally been performed close to the coast in shallow waters. This has inevitably led to a high proportion of small fish in the catches. With the introduction of the discard ban, many of the traditional fishing grounds have been temporarily closed due to a to high proportion of fish below minimum landing size. In order to prevent that juvenile fish from being discarded, and also to give the fishermen access to closed but otherwise good fishing grounds, a work on size-selective devices for seine net was initiated in the early 1990s, first with grids (Isaksen 1993) and later with square-meshed codends.

The strict quota regulations the last few years have caused problems for the seine net fleet when the accessibility for the different species has not been proportional with the size of the quotas. The seine net fishery is a mixed fishery for cod, haddock and saithe, and consequently the quota for one species may be taken before the whole quota for another species are caught, and thereby creating a bycatch problem when fishing for the other species. In order to make the seine net more species selective, the Fish Capture Division started a work on the development of a species-selective device for seine net in late 1990s (Engås and Isaksen 1998; Isaksen and Jørgensen 1999).

Size selectivity in the Norwegian seine net fishery

Experiments with grids 1991-1995

Materials and methods

Inspired by the promising results with grid sorting devices in shrimp trawls (Isaksen et al. 1992) and bottom trawls for ground fish (Larsen and Isaksen 1993), grid experiments were initiated in 1991 (Isaksen 1993). The first grid device tested was a series of three steel grids of 70x70 cm, hinged together by hammerlocks (Figure 1). The grids were mounted in the upper panel and replaced an equal length of this panel. To give the grids some angle of attack, most of the floats used to make the grid system a bit buoyant was mounted in front part of the system (Figure 2). Later (1992-1994) the grids were mounted in a square mesh extension piece at a theoretical angle of 30 degrees (Figure 3). Most of the selectivity experiments in 1994 and 1995 were performed with this configuration (Table 1a-c).

During the main test period in 1994 and 1995, bar spacing of 50 and 55 mm were used. To establish selectivity parameters for the grids alone the main codend was blinded and a collecting bag of the «top cover» design was mounted above the grid (Anon 1996). The program CC-Selectivity was used to calculate the different important parameters (Holst 1994).

Results – selectivity parameters

The results from the main test periods in 1995 with two boats involved are given in Table 1a-c. An example of the analysis reports from the selectivity program is given in Appendix I. The selectivity parameters for cod, haddock and saithe are quite in accordance, or actually slightly better than those obtained for grids in bottom trawls for the same bar spacing and species. This

can partly be explained by the relatively slow towing speed of the seine net. Underwater observations indicate that nearly 100% of the fish escape actively; i.e. head first through the grids.

Results – handling aspects

The pilot experiments in 1991 revealed that it was relatively easy to shoot the grids from middle and large seine net boats. However, the grid was difficult to haul through the power block when retrieving the gear. The extension piece with the grid device had to be lifted out of the power block, the grids had to be carried in front of the block before the extension piece could be put back in the power block (Figure 4). Experiments with hinging the grids both across- and lengthwise using six grids did not improve the performance of the hauling procedure; the grids still had to be taken out of the power block when hauling the gear.

In 1995 the grid device for seine net was tested onboard a vessel who used a Triplex instead of a power block. As for the power block, the hauling of the grid through the triplex was difficult.

Many of the Norwegian seine net vessels are relatively small fishing boats (40-90 feet). For the smaller ones, and especially the older ones with the wheelhouse aft, it became evident that using grids on a regular basis would cause problems. In bad weather and with good catches of haddock and subsequent «sinking codend», a procedure including removal of the extension piece from the power block (or triplex) was out of the question, mostly of safety reasons.

Experiments with square-meshed codends 1993-1996

Materials and methods

Due to the handling problems with grids in the seine net fishery, pilot experiments with square-meshed codends started in 1993 and continued in 1994. Due to the relatively poor results from square-mesh experiments in the late 1980s with normal knotted and relatively thin twinned netting (Robertson and Stewart 1988; Isaksen and Larsen 1988), the square mesh codend was now made of 7 mm Ultra Cross netting. This braided, knotless netting made from polyethylene is relatively expensive, but nevertheless one of the best nettings to be used in a square mesh configuration.

In 1995, it was believed that the square-meshed codend had got its final design, and it was tested against seine net grids (Table 1 a-c). To obtain selectivity parameters for this codend, the trouser trawl method was used (Figure 5) (Isaksen et al. 1990).

Results – comparison of square-meshed codends and grids

The comparison of grids and square-meshed codends for seine net in 1995 were performed onboard two typical seine nets boats, one with a power block (M/S «Heidi Anita») and one with a Triplex (M/S «Skulbaren»).

As can be seen from Table 1a-c, a square-meshed codend of 122 mm gave selectivity parameters both for cod and haddock similar to those for grids with a bar spacing of 50 and 55 mm. For most of the experiments, the square-meshed cod end gave a more narrow selection range than the grid device.

Results - handling aspects

It soon became evident that the square-meshed codend had far better handling properties than the grids. Although the net panels are cut on bars and joined, thus making the codend more bulky, it can still be handled as a normal codend.

Recommendations and introduction

In late 1995, representatives from the Directorate of Fisheries, Institute of Marine Research and the seine net fleet met and agreed upon a temporary introduction of a 125 mm square-meshed codend in the seine net fishery inside the Norwegian 12 nautical mile zone (Isaksen 1997). The main objective of this decision was first to give the fishermen a possibility to get acquainted to the codends, secondly to introduce a device that would help the fishermen to get access to otherwise closed grounds.

Fishermen have used the 125 mm square-meshed codend from the summer of 1997 and till this date, and there have been few complaints on the device (Figure 6). One of the few complaints is on the price. Other comments are on the design of the codend. Due to a given length and width on a square-meshed codend, there is relatively poor elasticity in this type of codend compared to diamond mesh codend.

Today quite a few fishermen are even claiming that the mesh size used for square codends should be increased, and actually a few fishermen are using square mesh codends up to 160 mm Ultra-Cross.

Further work

The square-meshed codend for the seine net has so far been temporarily used in the NEZ inside the 12-nautical mile zone. During a seine net cruise in the autumn 2001, the final mesh size will be set for the square-meshed codends as well as other details of design for this type of codend (lifting bag, strengthening ropes and wedge-shaped sidepanels).

Species selectivity in seine net

The Norwegian seine net fishery is often a multispecies fishery, with cod, haddock and saithe as the most common fish species. Up to the late 1980s, the conventional fleet, i.e. the coastal fleet, had quite good quotas of all these species, and it was seldom a question to try to avoid any of these species. Except for delivery problems in summer for haddock, the coastal fleet caught and sold what they got.

With the introduction of individual boat quotas for cod and haddock for the larger coastal vessels the situation changed, and the species composition became a problem for this fleet. With very low cod quotas in the early 1990s, quite a few seine net boats tried to catch plaice, and with the use of 170 mm square-meshed codends all haddock escaped and only very large cod (overall length > 70 cm) were retained in the cod end. In addition, some experiments with a horizontal separating panel in trawl in the early/middle 90s showed promising results with regard to separating cod from haddock (Engås et al. 1998). However, the separating device did not work very well in combination with the grid devices (Sort-X, Sort-V) that were made compulsory in demersal trawl from 1997.

Pilot experiments

In 1996/1997 a pilot experiment with a horizontal separating net was performed. The net was about 15 m long and split the extension piece in two equal halves, an upper and a lower part (Figure 7). The split net had a mesh size of 60 mm and the fish that entered the net on one side would eventually end up in the respective codend. The experiments indicated that there was a relatively even distribution of fish in the extension piece. Video observations showed that all fish had to be forced down under a separating net and then hopefully one of the species would escape up through the separating net.

Full scale experiments

From 1999 and up to now four cruises have been performed on species selectivity in seine net. Prior to the design of the nets, Scanmar equipment was used to measure the dimension of the extension piece where the separating panel was to be installed.

The extension piece used in the last cruises (2000-2001) has dimensions as given in Figure 8. In front of the separating net, a small-meshed half-moon shaped leading panel will force all fish down under the main separating panel of either 200 or 300 mm square-meshed knotless netting with a twine thickness of 5 mm. Knotted netting with a thinner twine has been tried but ended up with a lot of fish getting meshed in the separating panel.

The fishing experiments indicated that about 70-80% of the haddock escaped up through the separating panel and ended in the upper codend, while only 30% of the cod would escape up through the panel. With regard to saithe, the results are not consistent.

Video observations from the extension piece with the panel showed that haddock started to swim up through the panel as soon as they passed the small-meshed leading panel. A tendency of panic was observed among the haddock while cod swam relatively slowly beneath the separating netting. Both cod and haddock swam in the towing direction, but both species fell back towards the codend relatively quick. Saithe escaped up through the separating net stayed just behind the small-meshed netting. When hauling the seine net, most of the saithe swam back down through the net, thus making the results difficult to interpret.

The separation of cod and haddock through a horizontal panel has so far been regarded as a behavioural function. Closer analyses of the data revealed that the species separation is a combined function of behaviour and size. This is clearly demonstrated in Figure 9, where the larger individuals of both cod and haddock tended to stay behind in the lower part of the extension piece.

Further work

The work on species separation will continue for at least another year. The main objectives will be to get better observations of fish behaviour towards the separating net, and hopefully creating new ideas of how to improve the system. Planned experiments in 2002 with big meshed square mesh codend (160 mm) to get rid of saith and haddock during the Lofoten cod fishery , has already been accomplished by 10-15 seine net fishermen that have seen the true benefits of applying selective devices.

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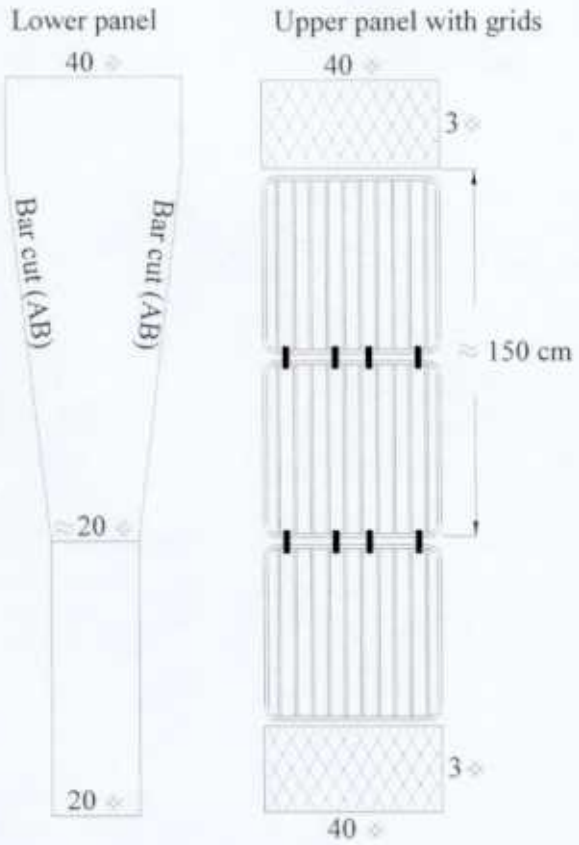


Figure 1. Illustration of extension pice with three hinged grids mounted in the upper panel (netting: 2x7 m/m PE, mesh size 137 mm).

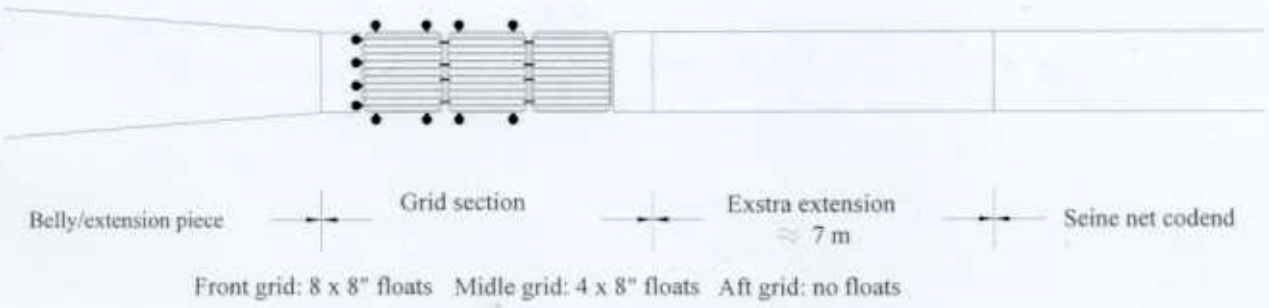


Figure 2. Illustration of rigging of the grid system for seine net boats.
Front grid: 8 pcs. 8" floats; middle grid: 4 pcs. 8" floats; aft grid: no floats.

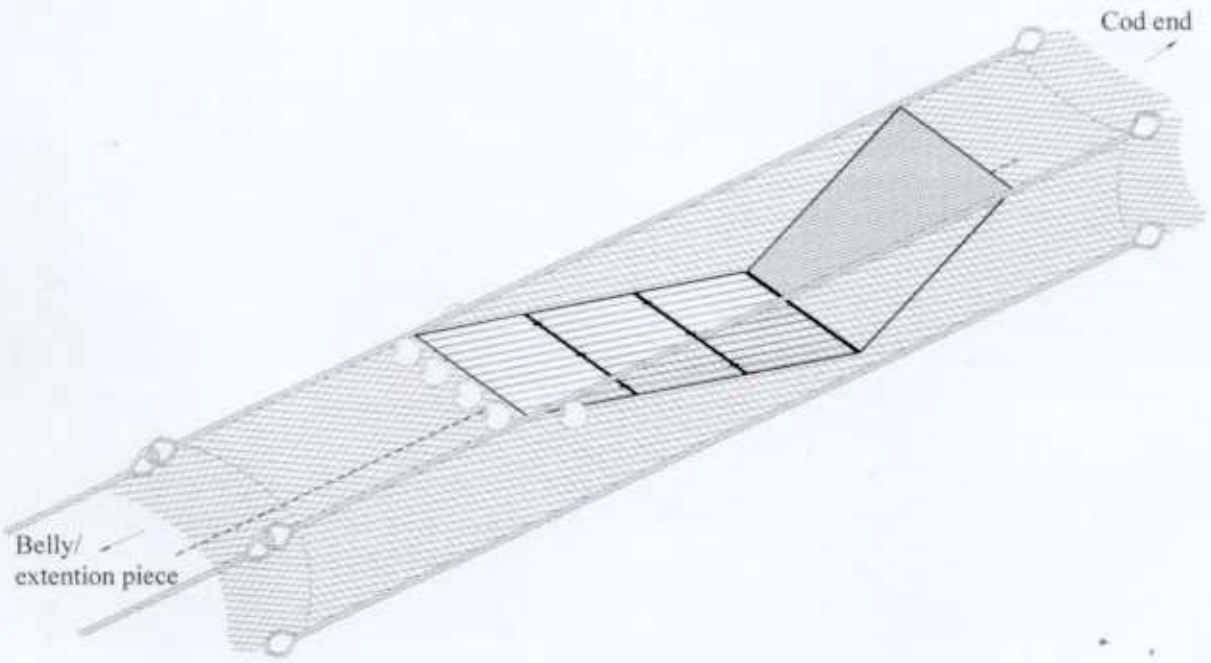


Figure 3. Seine net grid mounted in a square-meshed extension piece (final version).

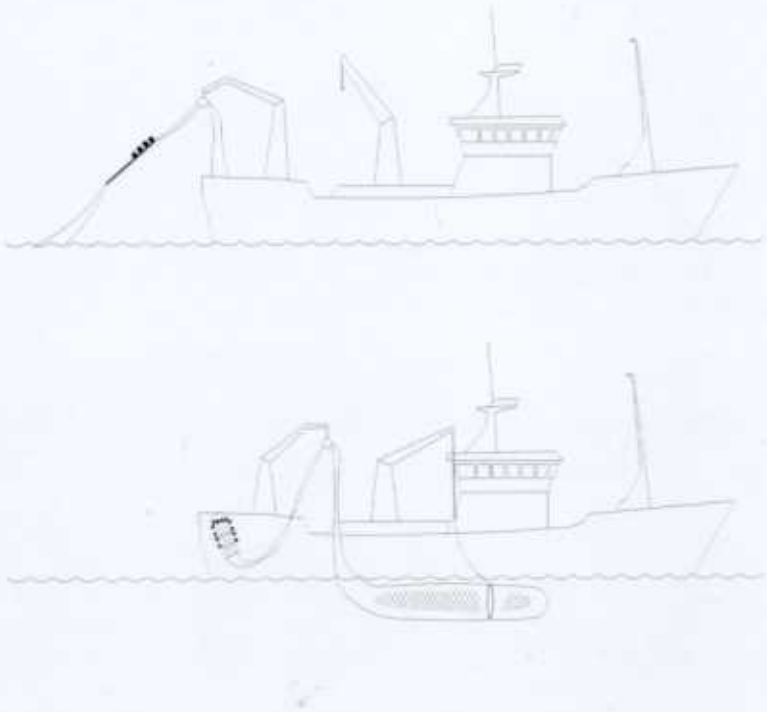


Figure 4. Hauling procedure for seine net and lifting the catch on board.

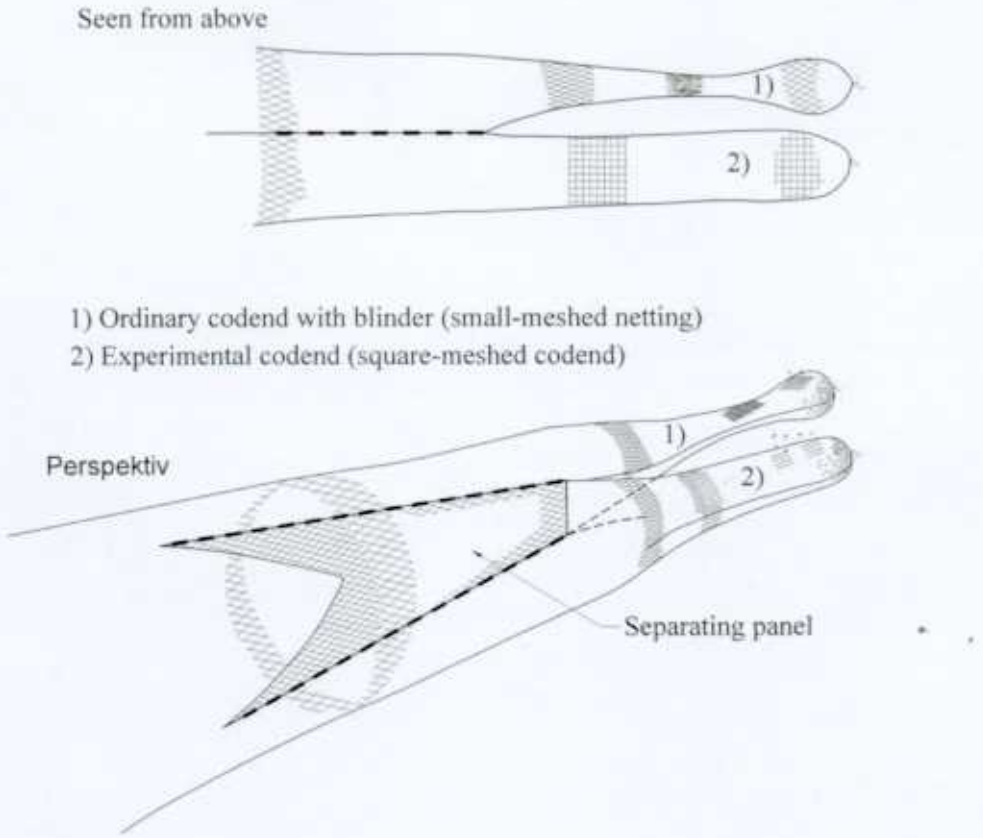
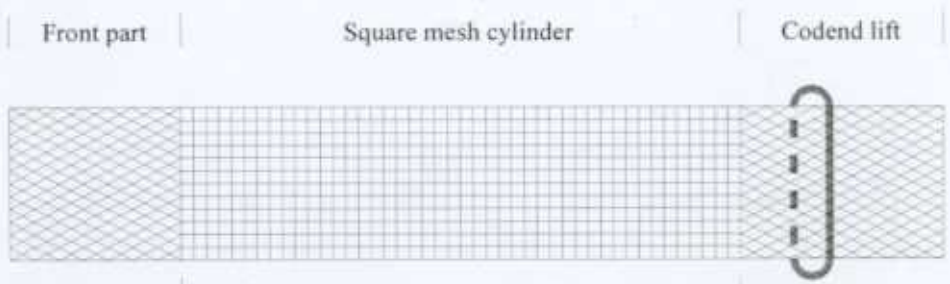


Figure 5. Experimental set-up "trouser trawl"-method.
1) Standard codend with blinder (small-meshed netting)
2) Experimental codend (square-meshed codend)



	Front part	Square mesh cylinder	Codend lift
Material:	PE - Knotted netting	PE - Knotless netting, twisted or braided	PE - Knotted netting
Twire:	Max 2x4 mm	Max 7.5 mm	Max 2x5 mm
Mesh size:	Min 135 mm	Min 125 mm	Min 150 mm
Length:	5-8 '	Min 12.5 meter	Max 4 ' between lifting strop and square mesh cylinder
Width:	Max 100 '	Max 100 bars	Max 80 '

Figure 6. Specifications for the square mesh codend used by the seine net fleet since 1997.

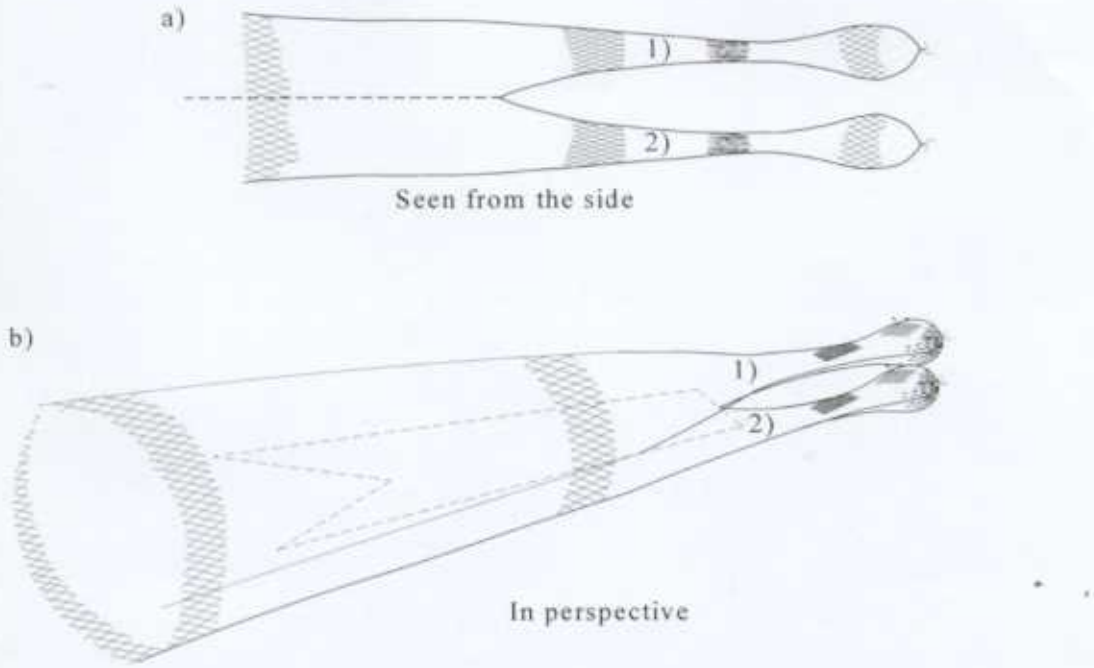


Figure 7. Extension piece with a horizontal small-meshed panel to examine natural fish distribution. a) Seen from the side; b) in perspective.

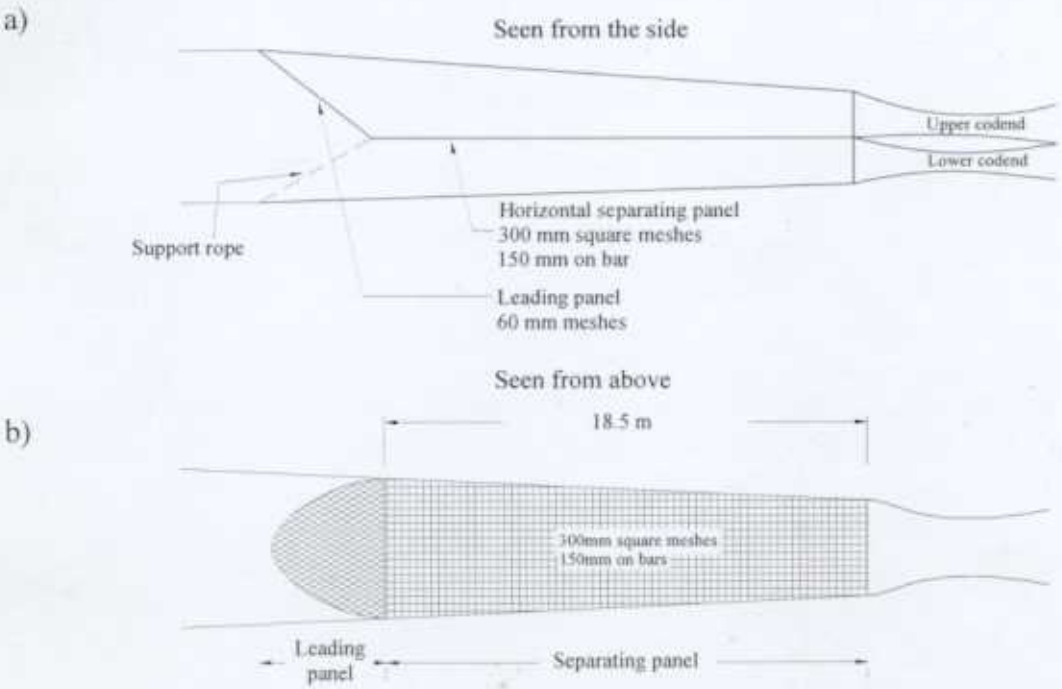


Figure 8. Seine net extension piece with species separator. a) Seen from the side; b) in perspective.

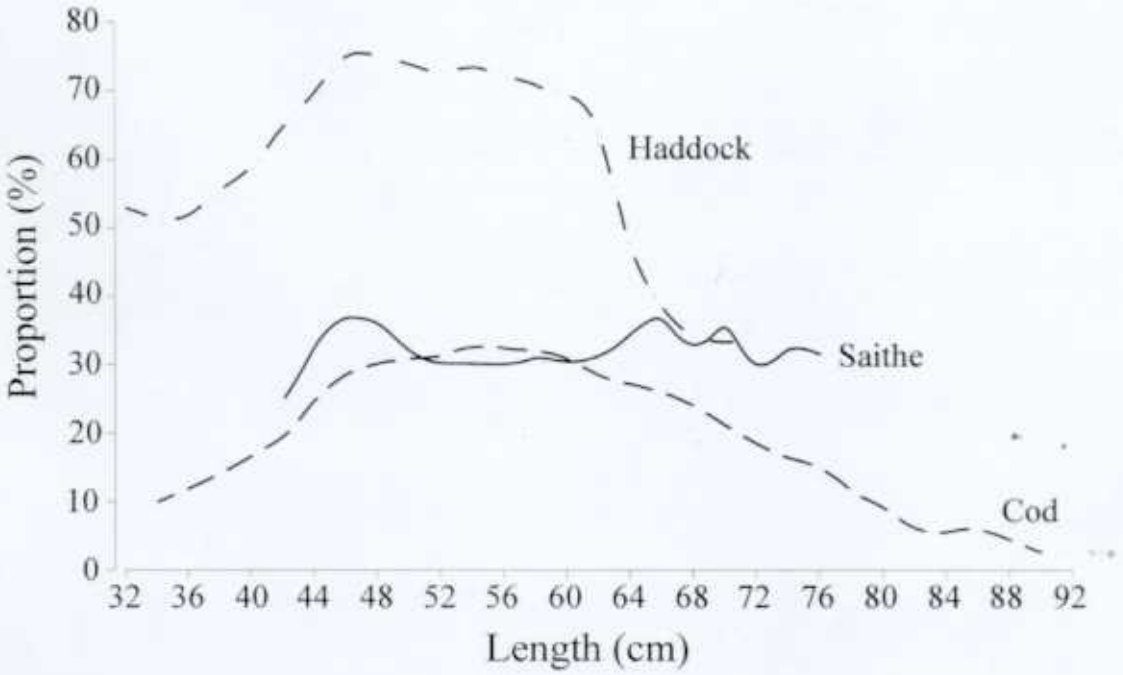


Figure 9. Proportion (%) of cod, haddock and saithe escaping upwards through a separating panel in seine net.

H A U L I N F O R M A T I O N

Date : 05/21/95 Reg. No : Torsk 30-37
Vessel : "Skulbaren" Fishery Ground : Øst-Finnmark
Gear : 55mm stålrist

Name : BI/KG
Institute : HI-Fangstseksjonen

Experimental Type : Covered Codend

FILES :	NAME	RESULT
	TORSK30.SEL	__/_
	TORSK31.SEL	__/_
	TORSK32.SEL	__/_
	TORSK34.SEL	__/_
	TORSK35.SEL	__/_
	TORSK36.SEL	__/_
	TORSK37.SEL	__/_

A N A L Y S I S R E P O R T
V A R I A N C E
C O M P O N E N T
M O D E L

ANALYSIS METHOD : MLE

LINK FUNCTION : C-LOG-LOG

Parameters

Intercept	-7.64784
Slope	0.13663

Variance of Parameters

$$\begin{bmatrix} 0.50642 & -0.00820 \\ -0.00820 & 0.00013 \end{bmatrix}$$

Variance Component

$$\begin{bmatrix} 3.13692 & -0.05016 \\ -0.05016 & 0.00081 \end{bmatrix}$$

Calibration-points with 95.000 % confidence limits

L-25%	46.855	36.826	-	56.075
L-50%	53.291	49.847	-	56.291
L-75%	58.364	55.584	-	60.988
SR	11.509	9.597	-	13.421