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Development and testing of rope and large meshed
midwater trawls in Norway

by

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INTRODUCTION

The first Norwegian "rope trawl" for the blue whiting fishery was constructed in 1974/75 by converting an ordinary 572-mid-water trawl. The main purpose of the ropes was to get a trawl more suitable for fishing in close proximity to the bottom than the conventional trawls. Unfortunately, the decision to make the "ropes" from 6 mm diam. steel wire proved to be a mistake, as twisting of the steel wires caused severe handling problems and rendered impossible more adequate performance trials during the experiments in 1975.

In 1976 a big trawl with 2 metres meshes in the wings and first body panel was constructed and some tests were made with this in practical fishing, both with a research and a commercial vessel. The trawl proved successful in fishing and the commercial vessel had single hauls of more than 250 tons of blue whiting. The experiments were, to a great extent, hampered by very rough weather conditions during the trial

period in March/April 1976. Measurements of propulsion requirements for towing this trawl were therefore scarce, and the recordings made indicate that the trawl had very favourable (i.e. low) resistance compared to the conventional trawls of the same size with 1 metre meshes in the forepart.

In late May and early June this year (1977) further experiments with the 2-metres meshed trawl were carried out on the blue whiting grounds south and west of Faroe Islands.

Subsequently a 572-trawl, fitted with short (max. 7 metres) 20 mm (diam.) polyethylene ropes instead of meshes in the forward part of the lower panels only, was tested in the North Sea when fishing in bottom contact.

Both trawls were operated from the chartered research vessel M/S "Havdrøn" of 633 GRT with main engine of 1500 HP at 480 RPM.

TRAWL NETS AND RIGGING

Constructional drawings of the two trawls tested in 1977 are given in Figs. 1 and 2, page 3 and 4. Twine thickness (Tråd nr.) is according to Norwegian practice given for one of three strands only. The large meshed part of the 2000 m/m trawl therefore has thread thickness of 130 x 3 x 23 (polyamide) = 8970 Tex (about 5 mm diam.). In size this trawl is similar to most conventional trawls for blue whiting, except for the codend which is smaller.

Both trawls were tested with the following rigging:

Trawl warps of 2 3/4 inches (circumference) wire (22 mm diam.),
WACO doors of 6 m² area and 1000 kgs weight,
Sweep lengths of 100 - 150 metres, 18 mm diam. wire,
Chain weights of 370 kgs suspended as parts of the sweeps, 15 metres in length, in front of the lower bridles, 4 metres being additional lengthening of the lower sweeps. Additional 125 kgs weights were partly used.

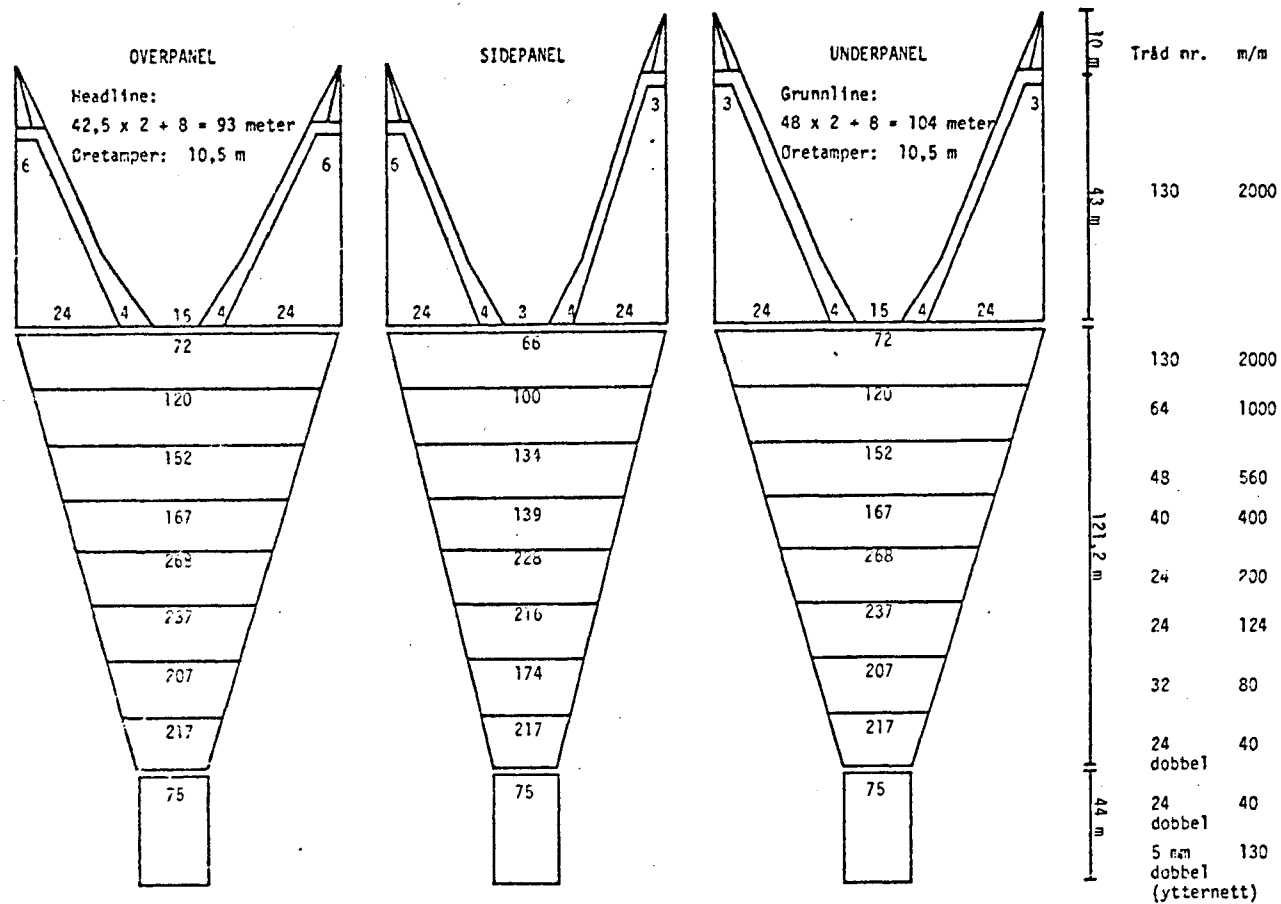


Fig. 1. 2000 m/m polyamide midwater trawl for blue whiting.
 265 meshes \times 2000 m/m = 2650 meshes \times 200 m/m.
 530 metres stretched circumference.

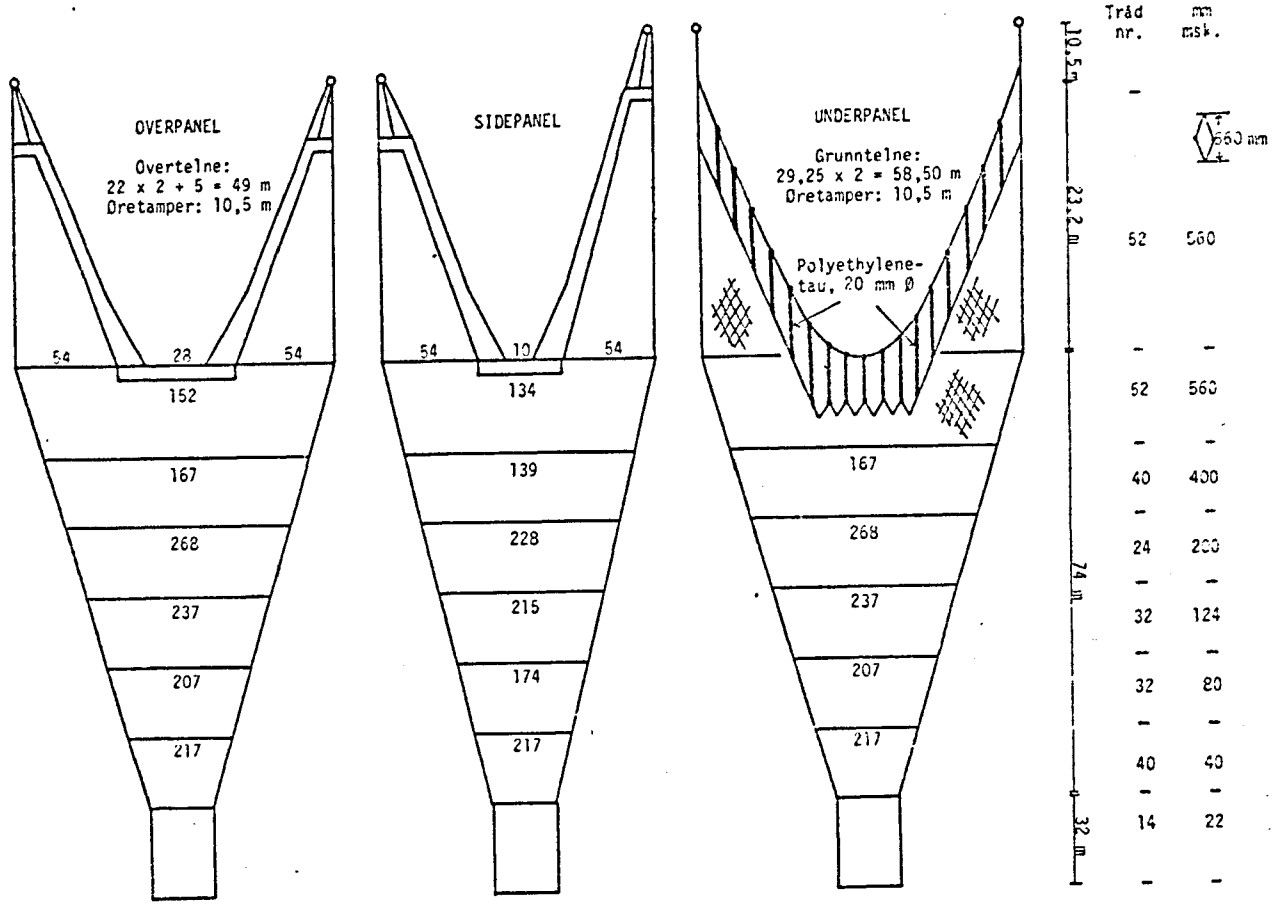


Fig. 2. 572-trawl for blue whiting with polyethylene rope droppers in lower panel.
572 meshes à 560 m/m = 1600 meshes à 200 m/m.
320 metres stretched circumference.

MEASUREMENTS AND EQUIPMENT

The engineering measurements, that in most cases had lower priority than the fishing activities, included the following:

Engine parameters (RPM, pitch, exhaust temperature and super-charged air pressure) as recorded from the bridge indicators,

Towing speed: Ship's hull propeller log - bridge indicator,

Warp tension: FTFI-developed deflection meter (hydraulically operated) with 1-channel paper recorder. The meter had to be transferred from one warp to the other during measurements,

Vertical warp angles: Simple even level angle meter,

Warp divergence: Measurement system based on rods slid 8 metres down the warps,

Headline height, vertical net opening and fish concentrations in trawl mouth: Simrad netsonde,

Bottom depth and fish concentrations: Simrad Scientific Echo sounder (EK).

RESULTS AND DISCUSSION

On the Faroe Banks the large meshed trawl proved its good catching qualities, and single hauls of about 90 tons of blue whiting were obtained when fishing rather scattered concentrations. The vertical net opening ranged from 30 (high speed) to 36 metres, while the net spread was estimated from door spread measurements to range from 36 to 42 metres. For a maximum towing speed of about 3 knots total warp tension was about 11 tons, which means a total gear drag of about 10 tons. The last days on the grounds, when fish recordings were very scattered, our average catches of about 10 tons an hour compared very favourable to those of the commercial trawlers in the area. Netsonde recordings indicated very limited fish reactions to the trawl and no downward escapement was observed, contrary to what has been formerly reported.

During the 572-trawl trials in the North Sea very small concentrations of blue whiting were found. In midwater condition the vertical net opening ranged from 20 to 26.5 metres while estimated spread ranged from 26 to 30 metres. When towed at bottom headline height was measured from 18.5 to 25 metres. In bottom condition the footrope was found to be 0.5 - 1 metre above bottom, stabilized by the bottom contact of the weights. Even when fishing at relatively uneven bottom, no damage to the net or gear occurred. A maximum speed of 3.7 knots was measured for a warp tension of about 10 tons.

In Figs. 3 to 7, page 7 to 9, measured parameters at different engine RPMs for the two types of trawls are presented. For each trawl the series of measurements presented were taken during the same haul with the following identical rigging specifications:

Warp lengths: 500 metres,

Sweep lengths: 150 metres,

Weights at each side: 370 kgs.

Bearing in mind that the accuracy in our speed measurements is not good, it is nevertheless concluded that a considerable higher towing speed was obtained with the smaller 572-trawl than with the big large meshed trawl, as shown in Fig. 3, page 7. However, for blue whiting fishing towing speeds of 2.5 to 3.0 knots as obtained with the big trawl is regarded sufficient.

The higher measured warp tension (Fig. 4, page 8) for the big trawl might be due partly to the lower speed and thereby lower ship resistance, and partly to the fact that the heavier trawl goes deeper (Fig. 5, page 8) resulting in larger warp angles and thereby larger warp tension/drag ratio.

As shown in Fig. 6, page 9, the otterboard spread is considerably larger when towing the smaller net. This is primarily due to the sustained higher speed.

For both trawls the vertical net opening is considerably reduced with increased speed (Fig. 7, page 9). With the actual

rigging the vertical net opening for the large trawl is reduced with speed about proportionally to the increase in wing spread, i.e. about the same mouth area is sustained over a considerable speed range. However, as the normal pattern of blue whiting is to concentrate in vertical layers of 50 to 150 metres thickness, a relatively high net opening might be more important than a large spread.

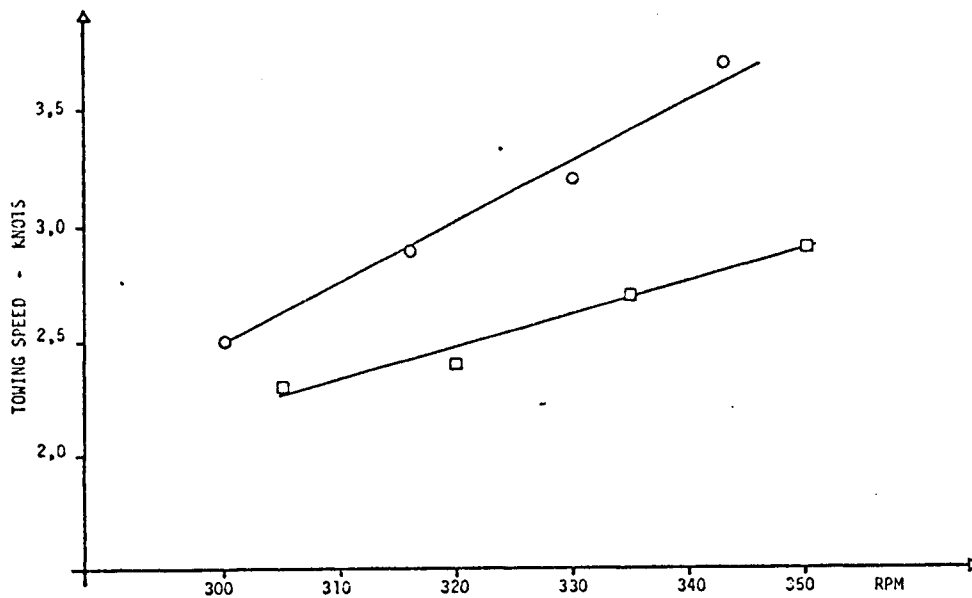


Fig. 3. Towing speed versus RPM. Constant pitch.

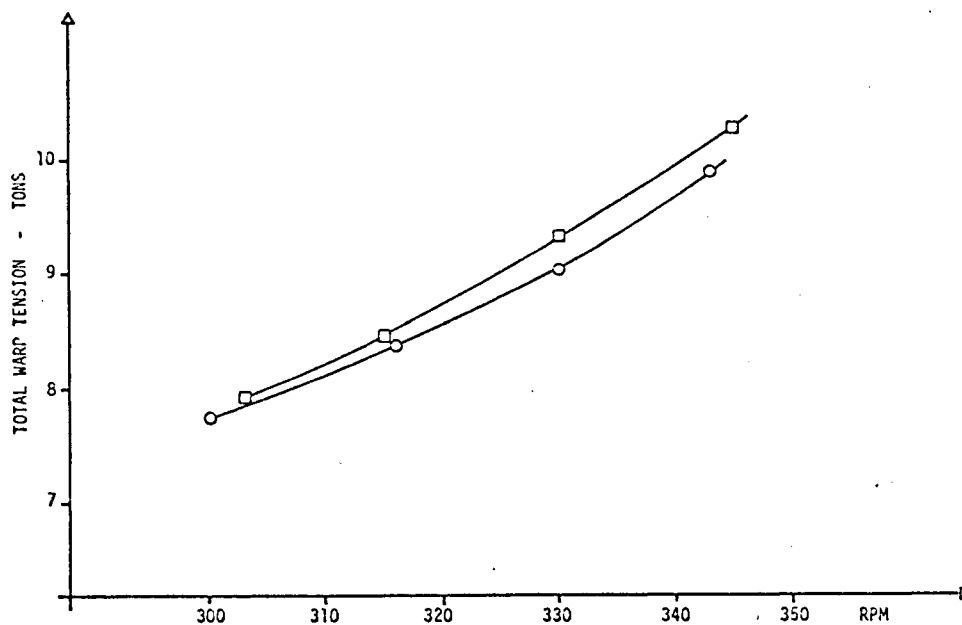


Fig. 4. Warp tension versus RPM. Constant pitch.

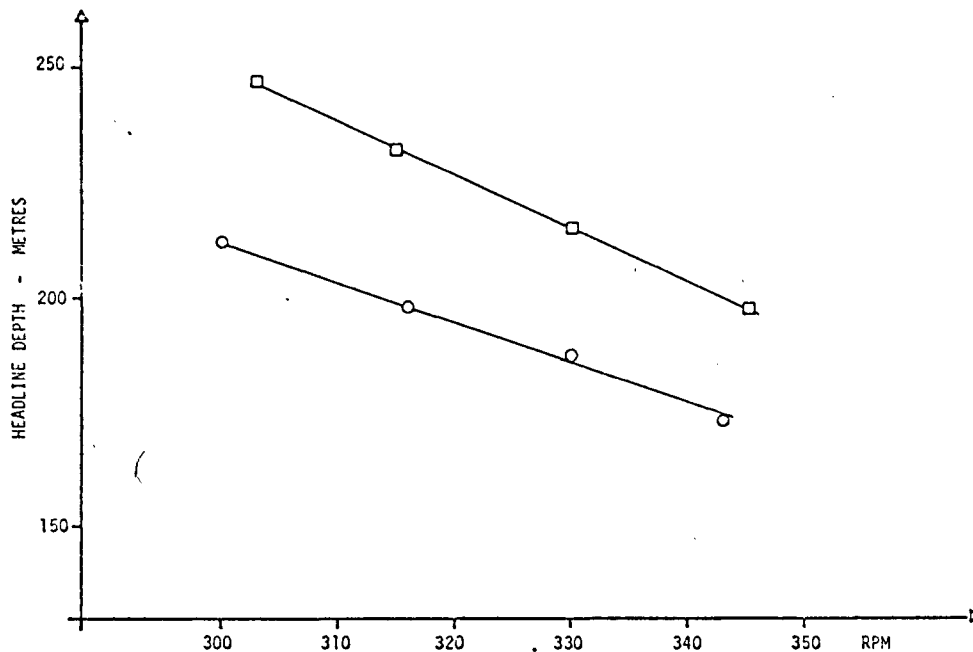


Fig. 5. Headline depth versus RPM. Constant pitch.

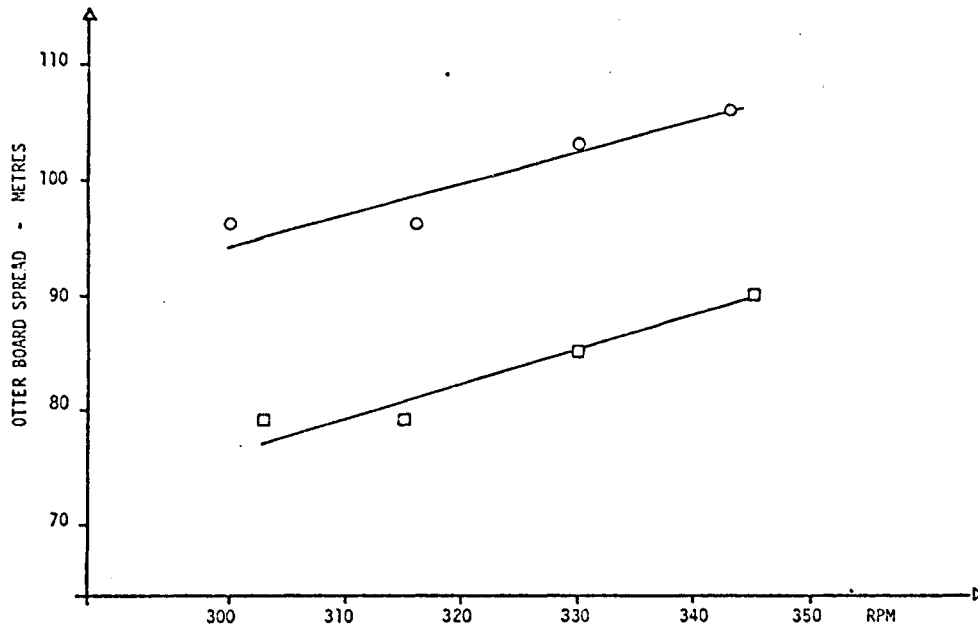


Fig. 6. Otter board spread versus RPM. Constant pitch.

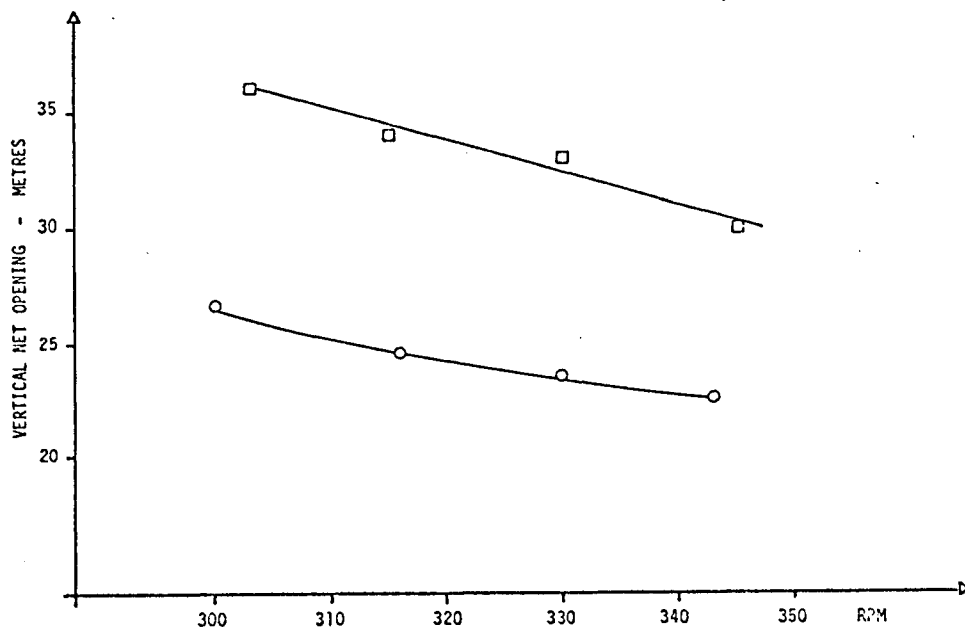


Fig. 7. Vertical net opening versus RPM. Constant pitch.