International Council for the Exploration of the Sea.

C.M. 1980/B3
Fish Capture Committee

ICELANDIC BOTTOM TRAWL AND DANISH SEINE CODEND SELECTION EXPERIMENTS ON COD, HADDOCK, REDFISH AND PLAICE IN 1972-1976

by

Gudni Thorsteinsson
Marine Research Institute, Reykjavík

ABSTRACT

In this paper Icelandic selectivity experiments of polyethylene codends of bottom trawls and Danish seines carried out in 1972-1976 are reviewed. Special attention was paid to the influence of the codend chafer on selectivity. It is also described how the collected data were used to decide the minimum meshsize to be used for different fishing areas.

EXTRAIT

En ce document sont révisées les expérimentations de sélectivité effectuées en Islande en 1972 - 1976, sur les cul en polyethylene des chaluts de fond et des sennes danoise. Attention spéciale a été faite a l'influence du tablier pour cul de chalut sur la sélectivité. Aussi est-il expliqué comment les données recueillies ont servi pour décider la longueur minimale de la maille a utiliser pour divers fonds de peche.

INTRODUCTION

As commonly known Icelandic authorities increased the minimum mesh size in the codends of bottom trawls to 135 mm for all net materials in 1976. In 1977 the codend mesh size was again increased to 155 mm exept for the main redfish fishing grounds. These regulations were based on results of 7 selectivity experiments carried out by the Marine Research Institute in 1972 - 1975.

The minimum mesh size of the codends of white fish pelagic trawls made of polyamide was increased from 120 mm to 155 mm in 1978 without any Icelandic selectivity experiments. In 1978 the mesh size in the codend of Danish seines was increased into 170 mm based on some selection experiments carried out by the Marine Research Institute in 1974 and 1976. The codend mesh size of the Danish seines was decreased again in 1979 to 155 mm. The reason was that the seine net fishery was not economical possible with 170 mm meshes which almost only retained the plaice.

Special permission is given to limited numbers of vessels to use smaller mesh size for trawling. Thus the minimum mesh size in the Nephrops fishery is 80 mm, 36 mm in the Pandalus fishery and 16 mm on Norway pout, blue whiting and capelin.

The above selectivity experiments were mentioned in the Icelandic administrative reports in 1975 and 1976. Since no questions arose concerning the effect of the large mesh the author believed that other countries did not take interest in the results at that time. Encouraged by interest by participants of the Fish Capture Committees working group meetings in Reykjavík last May, an attempt will be made to review these experiments. The practical effect of the increased mesh size for the concerned fish stocks will not be dealt with in this paper. It should be kept in mind that several other restricting fishery laws and regulations have been put into force simoultanously complicating the calculation of the true effect of each factor.

MATERIAL, METHODS AND PURPOSE

In carrying out selection experiments it is of vital importance to use the same gear and the same rig as the commercial vessels. In particular this applies to the rig of the codend. On the other hand the aim of such experiments should be to improve the rigging of the codend to achieve better selection and oblige the commercial vessels to use such rigging.

Of course there exist many different designs of bottom trawls in the Icelandic fisheries. As to the stern trawlers the gear used is very similar. Almost generally two seam trawls are used with a headline length of some 31-35 m. In towing the distance between the wing tips is approximately 20 m and the headline height 3-4 m. In the last years, as a result of experimentation, some bigger trawl types have been taken in use but the difference only lies in the front parts of the trawls hardly effecting the selectivity of the codend. The side trawlers to a great extent consisting of small multi purpose vessels, use some different designs and sizes of bottom trawls. The use of four seam trawls is increasing.

All trawlers use braided polyethylene for their trawls exclusively. The stern trawlers use double netting for the codend R 10400 tex and the smaller side vessels most frequently R 8900 tex.

A special problem arose in the early seventies concerning the top side chafer of the codends used by the stern trawlers. The conventional chafer, used by the sidetrawlers in order to increase the abrasion resistance of the codend against the side of the vessel, proved unfavourable on the stern trawlers since the codend tended to break when heaving big catches up the ramp. A top side chafer increasing the strength of the codend was needed. The apparent solution of this problem was to use the Polish type of chafer where one mesh of the chafer covers four meshes of the codend panel. The rigging of the chafer in order to reduce the selection of the codend as little as possible was the first problem to deal with.

Some of the stern trawlers use twin codends attached to each other side by side. The purpose of this is to reduce the danger of breaking the net in the ramp. Additionally this system is of advantage on stony bottom where the codend netting sometimes is chopped by stones inside the codend. When this occurs there is a good chance of saving the catch in one of the codends. This system cannot be practised in the redfish fishery since it is very difficult to empty such narrow codends because of the resitance of this spiny species. Vessels with narrow ramps have to use a single codend.

Experiments were carried out with single and double codends.

The experiments already mentioned had the purpose of finding the appropriate mesh size and rigging system for the stern trawlers as regards the most important species, i.e. cod, haddock and redfish. Actually saithe should also be included but we never succeeded in collecting any data on that species.

It should have been adviseable to carry out another series of experiments for the smaller side trawlers since the results obtained in stern trawling are not necessarily valid for side-trawling on much smaller vessels, especially if the conventional top side chafer is used. Unfortunately very few experiments were carried out on side vessels since it was considered infeasible to use different mesh size for different types of vessels. On one occation however comparative experiments were carried out on a stern trawler and a side trawler with the same codend (with Polish chafer).

The codend cover was attached to the upper panel of the codend with the usual 50% slack in the cover netting. The lower panel was covered on the inside with netting of small meshes preventing escape through the lower panel. The mesh size in the cover varied between 36 and 45 mm.

All mesh measurements were made with the ICES mesh gauge using 4 kgf pressure. It should be emphasized that all regulations concerning the minimum mesh size refer to measurements made with

a mesh plate of 2 mm thickness. These methods are not in agreement with each other the latter one giving approximately 2.5% higher figures as measured by Icelandic controllers.

Graphs were drawn after the selection data had been smoothed by the three point method. No fish girth measurements were made since comparative tests showed extremely big individual variations.

RESULTS

The first problem to deal with was the meshsize of the Polish chafer relative to the codend. A chafer meshopening exactly twice as big as that of the codend proved, in the first two trips in 1972 and 1973, inadequate. Each chafer mesh did not cover completely 4 meshes of the codend because of the more numerous knots in the codend netting. This means that two meshes in a row-in the N-direction- of x mm meshsize are longer than one mesh of 2x mm meshsize. By sewing the chafer to the codend along some bars the selectivity could be increased but neverless this codend rig was not appropriate for a fair selection. The highest selection factors obtained by this system was 2.5 for cod and haddock and 1.8 for redfish. The codend meshsize was 140 mm.

Comparative experiments with the same codend in the fall of 1973 with a conventional side trawlers chafer and a 50% slack in the netting relative to the codend gave a selection factor of 2.44 for redfish and 3.03 for cod.

In 1974, experiments to find an adequate meshsize and chafer rig for redfish were carried out. The minimum size of redfish that may be landed in Iceland is 500 g- (the only species regulated by weight) which roughly corresponds to 33 cm in length. This can be obtained by using a single codend of 132.0 mm meshsize measured with the ICES gauge and a Polish chafer with a meshsize of 264 mm + the length of one knot. Thus, a netlength of 2 n meshes in the N-direction equals the netlength of n meshes of the chafer. The chafer was sewn to the codend along some bars in both directions (crosswise) to secure that each chafer mesh covered 4 meshes of the codend as accurately as possible.

The selection factor for redfish proved to be 2.61 and the selection curve is illustrated in Figure 1. As this curve was considered adequate for redfish it was decided to use 135 mm meshsize (measured with a plate) with the chafer rigging already described.

At the same time efforts were made to analyse the influence of the towing speed and catch quantity on selectivity. No correlation could be found, however, but it should be mentioned that the redfish catches never exeeded 1 ton/h.

It should also be mentioned that the selection factor for cod proved to be 2.97 in the codend described and 3.0 for haddock. Since the minimum size of cod that may be landed in Iceland is 50 cm the adequate meshsize for redfish was definitely too small for a rational utilization of the cod stock.

As twin codends were gradually getting common on stern trawlers in 1974-75 it was decided to experiment with this type of codend. In 1975 the selection factor for cod proved to be 3.08 with a meshsize of 151.0 mm and a Polish chafer as already described. This refer to grouped hauls where the catches of cod was up to 1 t/h. On two occations the catches were approximately 4 t/h of small cod and selection in these hauls was definately poorer. The selection curve for the grouped hauls is shown in Figure 2 and the curve for the two larger hauls combined is shown in Figure 3. It is frustrating to see how much selectivity is affected by the quantity of fish. Actually two different 50% retension lengths are evident on Figure 3. The novelty cannot be accepted without explanation. It is indeed very probable that a significant part of the smallest fish which succeed in escaping are not collected by the codend cover since they escape through the front parts of the gear and the belly. This small fish might be too exhausted to avoid those parts of the netting. This theory is supported by many other selection curves in our experiments. Almost always, the retension length of the smallest fish is somewhat higher than for fish some 5-10 cm larger.

In Figure 4 the cod length distributions for the grouped hauls and the 2 larger hauls combined are shown. As can be seen the fish is much smaller in the latter case.

The selection factor for haddock of the twin codend already described proved to be 2.97. The mean meshsize was 151.5 mm. The selection curve is shown in Figure 5.

A little later this twin codend was tested again on a 250 BRT (39 m, 800 hp) sidevessel. The bottom trawl used was rather small (19.8 m headline length). In this experiment one half of the twin codend was made 4 meshes broader and used as a single codend. The purpose was to compare the selectivity obtained on a big stern trawler (777BRT, 52 m, 1400 total hp) and a relatively small sidetrawler.

In this experiment the selection factor for cod was 2.98 and 2.60 for haddock. As already mentioned the factors were 3.08 for cod and 2.97 for haddock in the former experiment. These unexpected results can be explained by an increased fish girth caused by having eaten large quantities of capelin and probably connected with decreased activity of that fish.

After these experiments a decision had to been made concerning the minimum codend meshsize for cod and haddock to be put into force. The Marine Research Institute and some other authorities recommended a minimum meshsize of 155 mm (measured with a plate) for cod with the codend rig already described. For haddock this meshsize seemed to be too large since the minimum size of that species which may be landed in Iceland is 45 cm which is identical to the 50% retention length. As the 75% retention length is 52 cm this meshsize certainly would result in a rather large immediate loss. The Marine Research Institute recommended this meshsize since it would result in the maximum sustainable yield for this species. The final decision was, as already mentioned, that the minimum codend meshsize on the fishing grounds where redfish is mainly caught should be 135 mm elsewhere. In consequence the actual meshsize for haddock became 155 mm.

Danish seining is not very common in Iceland. As this gear may be used in some areas where trawling is forbidden, to utilize the plaice stock, many peole think that the mesh size of this gear should be adjusted to this species. Therefore, some experiments

were carried out to examine the selectivity of the Danish seine for plaice and cod. For comparison the selectivity of a bottom trawl for the same codend meshsize was also examined. In both cases no chafers were used at all. The meshsize in both cases was 166 mm.

As shown in Figure 6 selection for plaice was rather similar for both gears with a selection factor of 2.0. The curve for the Danish seine was on the other hand much steeper as it is especially less retentive on small fish. In the case of the cod selectivity was definitly higher for the Danish seine with a selection factor of 3.48 as compared to 3.24 for the bottom trawl. Both graphs are illustrated in Figure 7. The selection factor for haddock in the bottom trawl selection experiment was 3.24 but no value is available for the Danish seine.

As the minumum length of plaice which may be landed in Iceland is 35 cm the meshsize used is rather convenient whereas it is obviously too large for a cod fishery. It was decided to use 170 mm (measured with a plate) meshsize in codends of the Danish seine underlining that this gear should predominantly be used to catch plaice. As Danish seining did not prove economical on many fishing grounds because of the big loss of cod and haddock the meshsize was decreased again to 155 mm.

REFERENCES

Gudni Thorsteinsson: Kjörhæfni varpna (The selection of trawls). Sjávarfréttir 4 (2) p: 20-31. 1976.

Gudni Thorsteinsson: Að glefsa í gjafatonnin (on Danish seining). Sjávarfréttir 4 (11) p: 12-18. 1976.

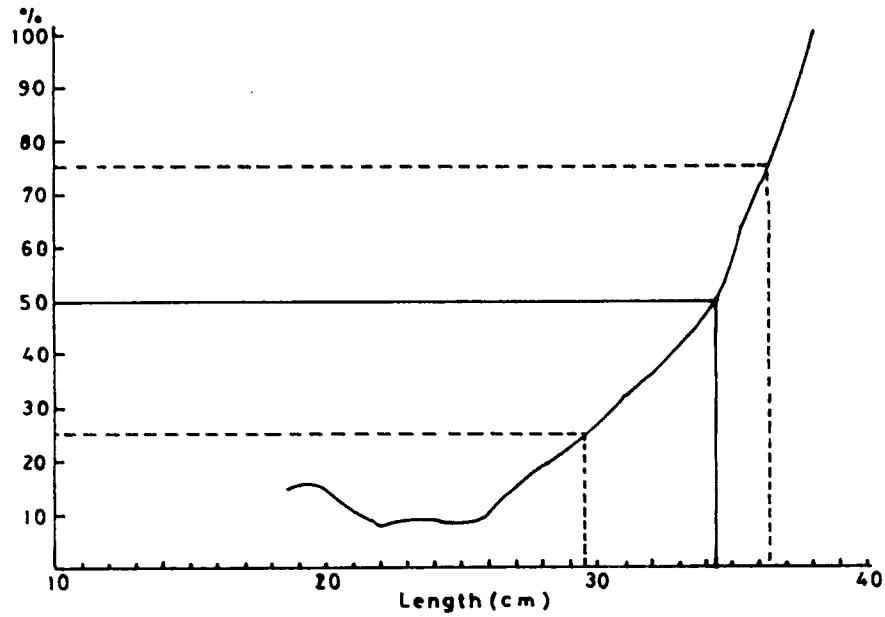

Figure 1 : Selection curve in the cruise B 5-74 for redfish. Meshsize 132.0 mm, Polish chafer. 50% retension length 34.4 cm, sf= 2.61. Grouped tows.

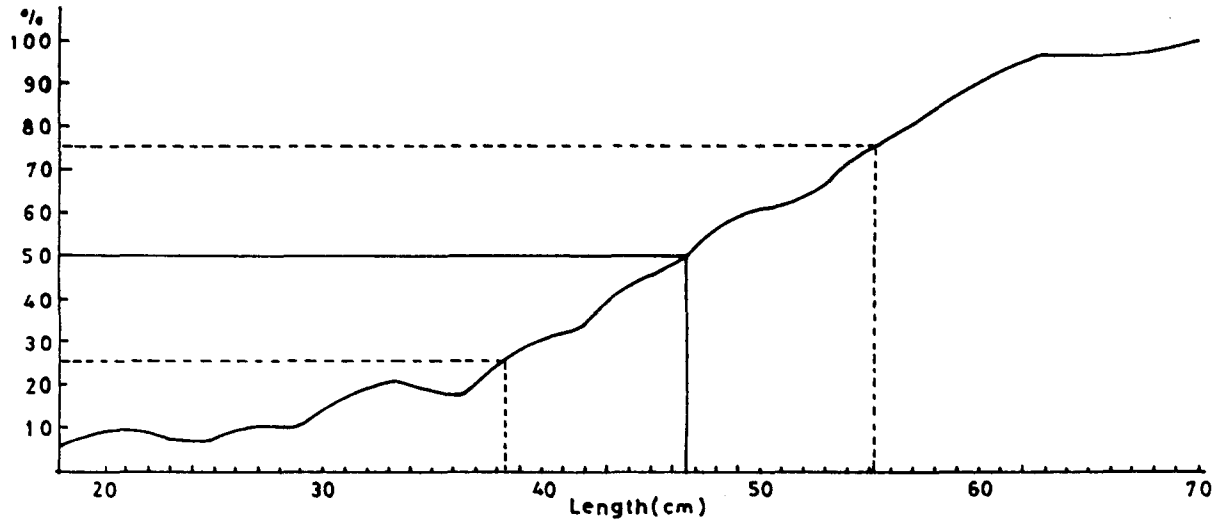

Figure 2 : Selection curve in the cruise B13-75 for cod. Grouped tows (exept two), moderate catches. Meshsize 151.0 mm, Polish chafer, twin codend. 50% retension length 46.6 cm, sf = 3.08.

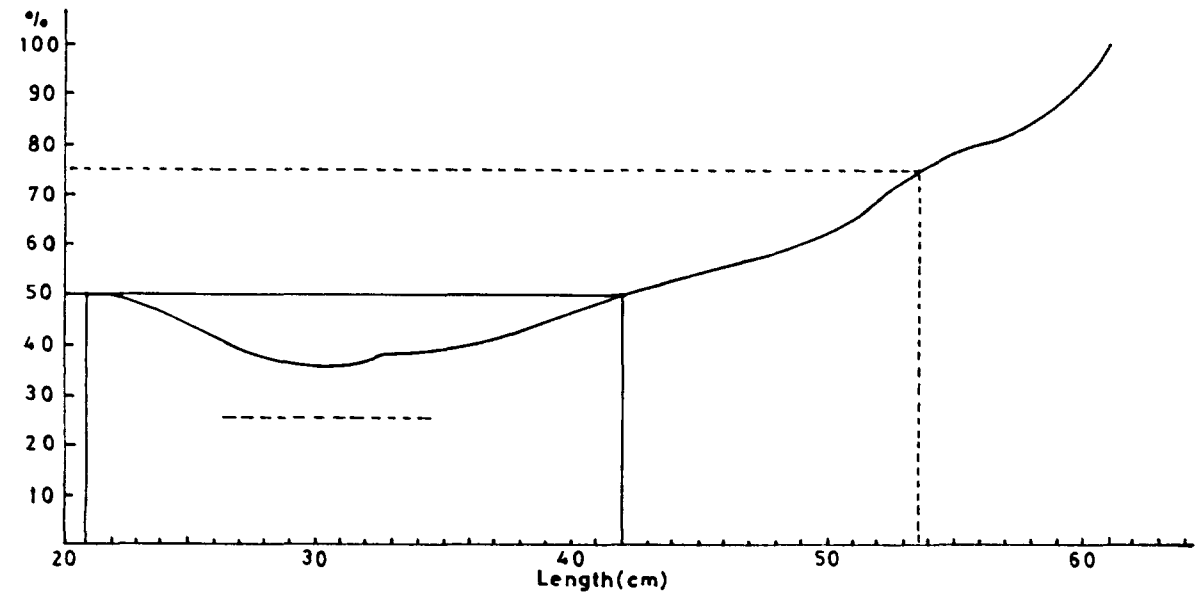

Figure 3 : Selection curve in the cruise B13-75 for cod. Two hauls with good catches (4t/h). Meshsize 150.4 mm, Polish chafer, twin codend. 50% retension lengths 21.0 and 42.0 cm. sf = 1.39 and 2.79.

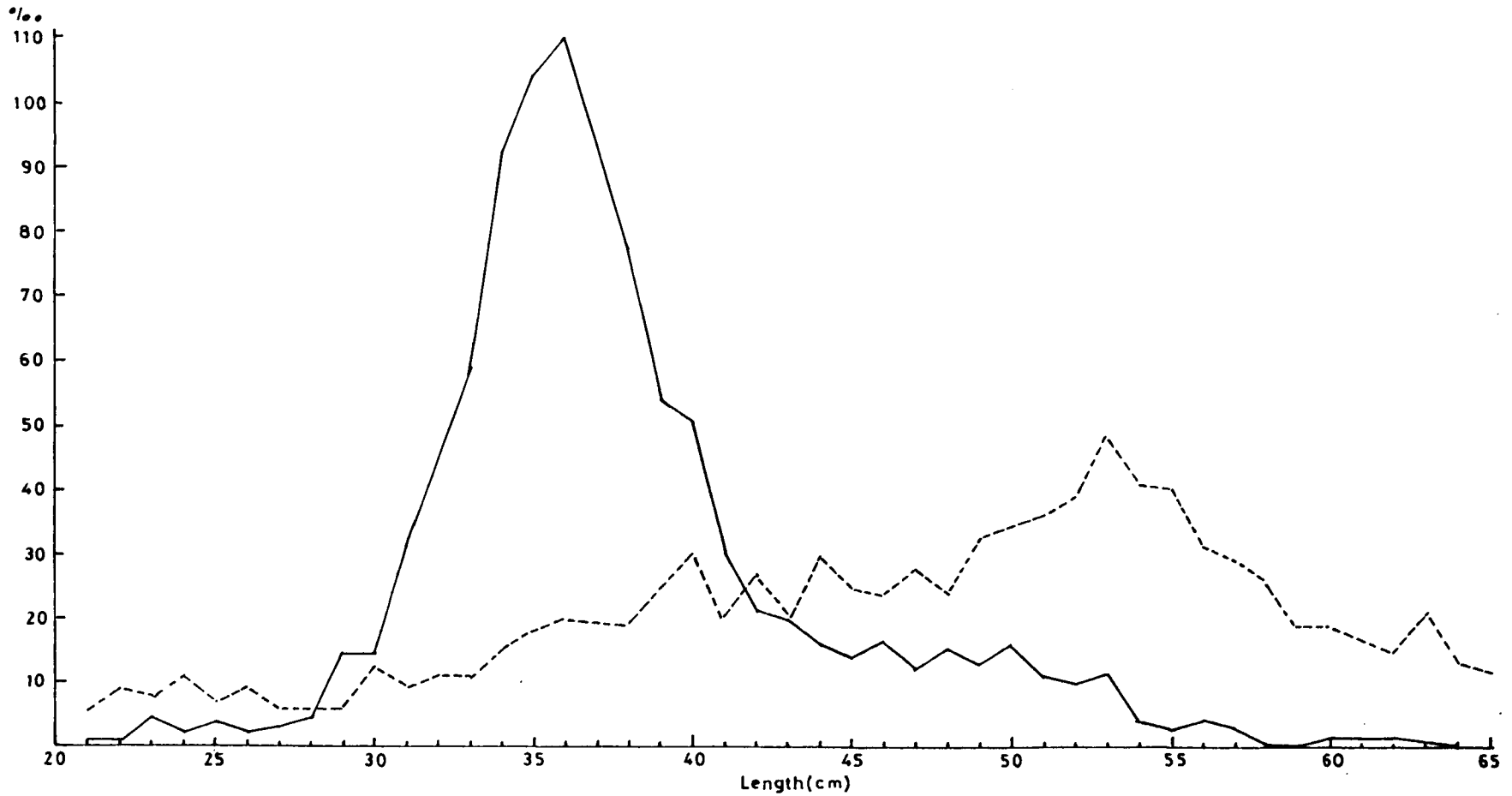

Figure 4: Length distribution of cod up to 70 cm. Interupted line: grouped tows (corresponding to figure 2). Solid line: 2 combined tows (corresponding to figure 3).

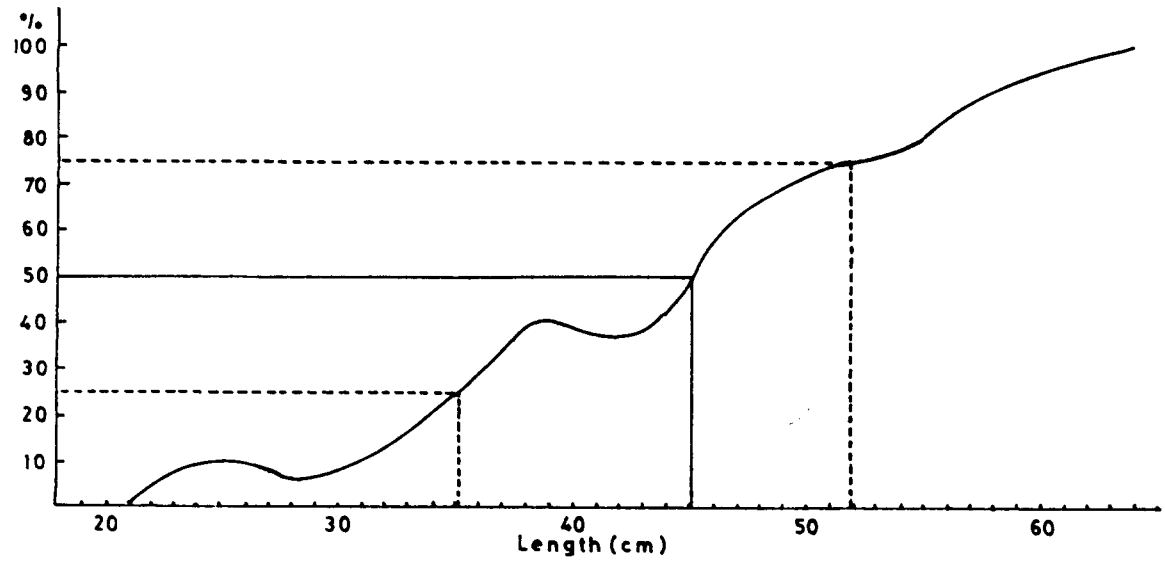

Figure 5 : Selection curve in the cruise B13-75 for haddock. Grouped tows. Meshsize 151.5 mm, Polish chafer, twin codend. 50% retension length 45.1 cm, sf = 2.97.

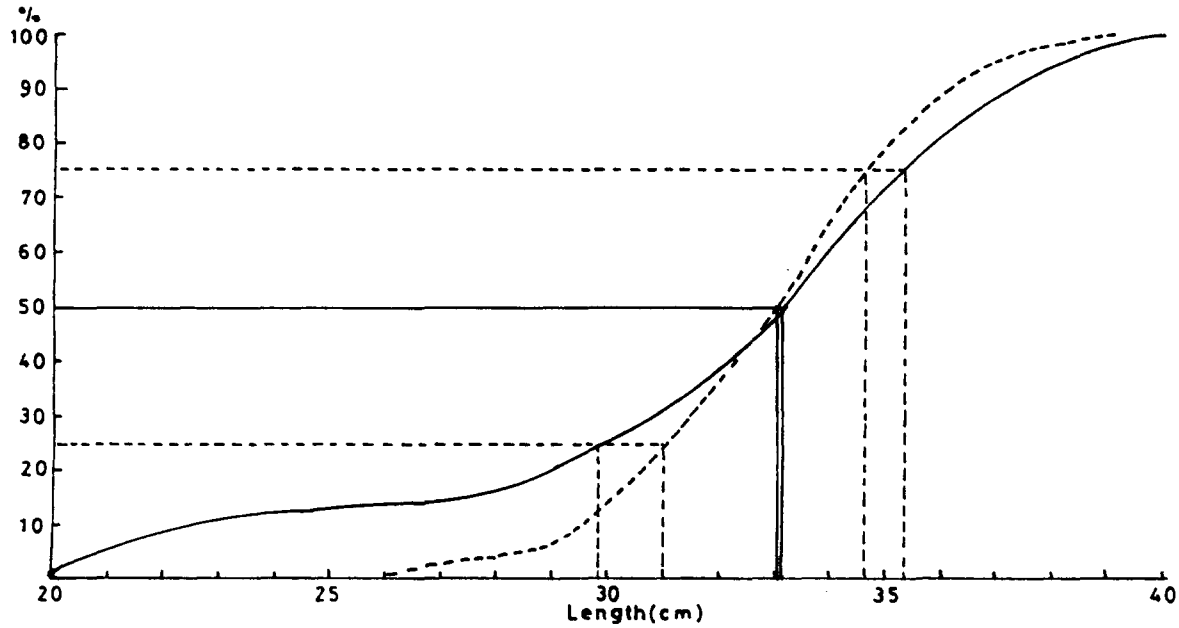

Figure 6 : Solid line: Selection curve for plaice in bottom trawl with 165.9 mm meshsize, without a chafer. 50% retension length 33.2 cm, sf = 2.00. Grouped tows. Interupted line: Selection curve for plaice in Danish seine with 166.0 mm meshsize, without a chafer. 50% retension length 33.1 cm, sf = 1.99. Grouped drags.

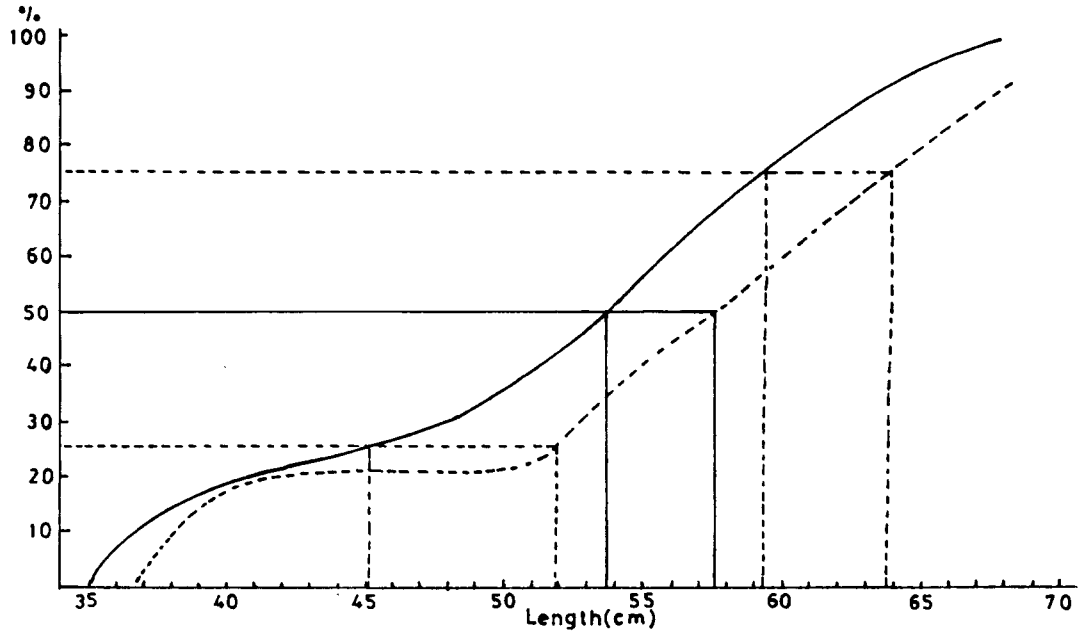

Figure 7 : Solid line: Selection curve for cod in bottom trawl with 165.9 mm meshsize, without a chafer. 50% retension length 53.8 cm, sf = 3.24. Grouped tows. Interrupted line: Selection curve for cod in Danish seine with 166.0 mm meshsize, without a chafer. 50% retension length 57.6 cm, sf = 3.48. Grouped drags.