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# NORWEGIAN TRAWL MESH SELECTION EXPERIMENTS 1960.

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## Introduction.

The mesh selection experiments described below were carried out in the Barents Sea with the research vessel JOHAN HJORT (52.60 m, 697 Gross tons, 1300 HP) between August 9th and 26th 1960. The main aims of the experiments were to study the selectivity of a cod end made of polyester fibres (Terylene), and to test whether the multi-flap type of top side chafer described by Beverton (Paper No. 117, C. M. 1959) has any effect on the escapement of fish from the cod end. In addition the opportunity was used to study the selectivity of a double cod end (of double Manila), and to make some "covered hauls" on a redfish ground.

## Gears and methods.

In order to increase the validity of the data use was made of the same trawl that was used by JOHAN HJORT in the International Arctic Mesh Experiments 1959 viz. a Hamburg 140' trawl. This also applies to the Manila cod ends used, which were:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Cod end no. | M 11, | Double | Manila, | Mesh | size | appr. | 11 cm. |
| " " " | M 11 C, | " | " | " | " | " | 10 " |
| " " " | M 14 | " | " | " | " | " | 13 " |
| " " " | M 14 C | " | " | " | " | " | 13 " |

The meshes were measured with an Aberdeen pressure gauge (unmodified). The mean values used refer to the lower half part of the cod ends only.

The covers used were the standard covers of last years International Experiments, made of polyethylene, and with a mesh size of approximately 70 mm. In some hauls with the double cod end a more fine meshed cover of cotton shrimp net was used.

The fishing grounds worked were as follows:

| | | | |
|---|---|---|---|
| Locality | A. | South-east of Skolpen Bank, | Cod and haddock |
| " | B. | Goosebank , | Cod |
| " | C. | Off Vardø, East Finnmark, | Cod and haddock |
| " | D. | Off Nordkyn, Finnmark , | Cod, haddock and redfish |

Catches were moderate to poor, except the redfish hauls, which were good.

The Terylene cod end.

This cod end was made of continuous polyester fibre 1000 Denier, runnage of twine 136 m/kilo, diameter appr. 3 mm. The twine was double, and the net tarred so that the flexibility of the twine was probably low compared to unprepared twine of this fibre.

The summary table lists the results of eight hauls with the Terylene cod end and four control hauls with the Manila cod end M 14 C. When starting fishing all cod ends were equipped with rather heavy splitting straps. As it was feared that these straps might hinder the free flow of the cover during towing, they were removed after four hauls with the Terylene cod end and two hauls with the Manila cod end. The selection ogives for the hauls with - and without splitting straps are shown in figure 1. For both cod ends escapement was higher after the splitting straps were removed. It is thus probable that the straps caused an extra "cover effect" and that the last hauls show the least biased results. However, in both sets of hauls selection factors for Terylene are higher than those for Manila for both cod and haddock. The difference is about 10 per cent for cod and 8 per cent for haddock.

The following table compares the present data with previous data for Arctic cod and haddock:

Present data:

| | Manila no. M 14 C | | Terylene | |
|---|---|---|---|---|
| | Strap | No strap | Strap | No strap |
| Cod | 3.40 | 3.70 | 3.85 | 4.00 |
| Haddock | 3.00 | 3.30 | 3.25 | 3.50 |

Last years Intern. Exper.

| | Manila no. M 14 C |
|---|---|
| Cod | 3.20 to 3.85, mean 3.55 |

All previous data summarized by Mesh Selection Group:

| | Manila | Polyamide |
|---|---|---|
| Cod | 3.50 | 4.10 |
| Haddock | 3.25 | |

The results suggest that polyesters may be grouped with polyamids as "light trawl fibres".

As shown by figure 1 the selection ogives for the Terylene cod end are steeper than those for the Manila cod end M 14 C, and the selection ranges are correspondingly smaller. This may be an effect of the small variation of mesh size found in the Terylene cod end.

The double cod end.

A double cod end was made by lacing the half part of the Manila cod end M 11 C to the upper part of the Manila cod end M 11. Both nets were attached to the cod line. The mean size of the after 19 meshes of the inner net was 105.4 mm, while the corresponding mean for the outer net was 103.7 mm.

A few hauls with this double cod end uncovered gave a size distribution of cod very similar to that obtained in alternate hauls with covered cod ends indicating that escapement from the double cod end was similar to that from the Nymplex cover of 70 mm mesh size, see figure 2.

The double cod end was then fitted with a fine meshed cover of 35 mm cotton shrimp net. This cover was, however, considerably tighter than the Nymplex covers used on the other cod ends.

The selection data of eleven hauls with the covered double cod end are shown in figure 3 and in the summary table. In two different fishing grounds, A and B, the 50 per cent length's for cod were 25.5 cm and 29.5 cm respectively, which assuming a mean mesh size of 104 mm give selection factors of 2.50 and 2.85. However, if we use the known selection factor 3.5 found in the control hauls in locality A, the 50 per cent length's of the double cod end correspond to effective mesh sizes of 73 mm and 84 mm. Some scanty haddock data from locality A give a 50 per cent length of 24 cm, which assuming a selection factor of 3.3 corresponds to the same effective mesh size as that found for cod viz. 73 mm. These results suggest that a doubling of the top part of a cod end reduces the effective mesh size by 20 - 30 per cent.

The multi-flap topside chafers.

The cod end no. M 14 was fitted with multi-flap chafers by attaching four pieces of cod end netting, each 15 meshes deep at intervals of 8 meshes along the cod end starting at the eighth mesh from the cod line. The mean mesh size of the chafing pieces was 11 cm, that of the cod end 13 cm so that each piece overlapped well over half the interval below.

Since it was feared that a cover over the cod end might prevent the chafing pieces from floating freely during hauling, the cod end with the chafers was first fished in alternate hauls with the cod end M 14 C with cover, and the double cod end with cover. Figure 4 shows the size composition of cod in eleven hauls with the chafer cod end, and that from ten hauls with the other cod ends. The curves are adjusted to the same number of fish above 55 cm, and in this range they show a very good fit. The selection factor derived from these data is 3.70 compared to 3,50 for four control hauls with the covered M 14 C. The alternate hauls also gave small numbers of haddock. As shown in figure 5, for this species the size compositions of the two sets of data do not show a very good fit, indicating that changes took place in the population during fishing which were not recorded proportionally in the two sets of hauls. Therefore, further use has not been made of these haddock data.

The cod end with chafers was then fitted with a Nymplex cover and fished in locality C in alternation with M 14 C, and in locality D. The selection ogives obtained from the covered chafer cod end are shown in figure 6, and the details of the grouped hauls are listed in table 1.

A summary shows the following selection factors:

| COD | Loc. A | Loc. C | Loc. D |
|---|---|---|---|
| With chafers M 14 | 3.70 (alt.h.) | 3.75 | 4.05 |
| No chafers M 14 C | 3.50 | 3.75 | |

| HADDOCK | Loc. C | Loc. D |
|---|---|---|
| With chafers | 3.25 | 3.30 |
| No chafer | 3.35 | |

It thus seems justified to conclude that in these trials the multi-flap chafers have not influenced the escapement of fish from the cod end.

Redfish (Sebastes marinus).

Three redfish hauls were made with cod end no. M 14 C. Catches were from one to two tons in the cod end and 700 - 800 kilos in the cover. Figure 7 shows the selection curves. Haul no. 70 was broken off after 45 minutes' towing when heavy echo traces made us fear that the catch might burst the cod end. The big catch just before heaving is probably the cause of the abnormal selection curve of this haul. The selection factors estimated from the two $1\frac{1}{2}$ - hour tows: 3.05 and 2.90 are slightly higher than those from two previous redfish hauls from this area which were 2.6 and 2.8 (Sætersdal, Lisbon S-37).

Towing speed.

As shown by the summary table, there is a considerable variation in the selection factors between the various groups of hauls with the Manila cod ends especially for cod. A plot of the selection factors against size of catch shows no trend. Plotted against speed of towing there is for cod a tendency for the selection factors to increase with decreasing speed, see figure 8. This speed is not the true speed over the ground, but that recorded by the electric log. It was intended to standardize towing speed, but during the first part of the experiments speed was difficult to control. Later the speed was varied intentionally, and at locality D the recorded speed from the electric log was checked against true speed by the help of land bearings. These checks indicated that at speeds below 4 knots the recorded speed was too low. Thus a recorded speed of 2 knots corresponds to a true speed of 2.6 - 2.8 knots. This means that the scale of recorded speed shown in figure 6 is not proportional to the true speed, and the relation between selection and true speed may be somewhat better than that shown in figure 6. It thus seems probable that variations in towing speed may have caused at least some of the variations in selection found in these trials.

Table 1. Summary of mesh selection experiments, "JOHAN HJORT", Barents Sea, August 1960.

| Experiments with: | Species | Cod end specific. | Cover | Mesh m.m. | Selection factor | Range 25%-75% | No. of hauls | No. of fish in selection range (3) c.e. | cover | Mean weight of catch per haul (kilos) c.e. | cover | Mean haul durat. hr. | Mean towing speed knots (4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A. Terylene c.e. | Cod Loc. A | Terylene (1) | Nymplex | 107.7 | 3.85 | 5.5 | 4 | 663 | 745 | 530 | 180 | 1½ | 3.20 |
| " | " | Control hauls M 14 C (1) | " | 131.5 | 3.40 | 9.0 | 2 | 799 | 983 | 840 | 460 | 1½ | 3.40 |
| " | " | Terylene (2) | " | 106.4 | 4.00 | 6.0 | 4 | 741 | 811 | 570 | 200 | 1½ | 3.50 |
| " | " | Control hauls M 14 C (2) | " | 131.6 | 3.70 | 8.5 | 2 | 238 | 399 | 520 | 400 | 1½ | 2.90 |
| " | Haddock Loc. A | Terylene (1) | Nymplex | 107.7 | 3.25 | 4.0 | 4 | 127 | 115 | 530 | 180 | 1½ | 3.20 |
| " | " | Control hauls M 14 C (1) | " | 131.5 | 3.00 | 8.0 | 2 | 274 | 191 | 840 | 460 | 1½ | 3.40 |
| " | " | Terylene (2) | " | 106.4 | 3.50 | 4.0 | 4 | 187 | 123 | 570 | 200 | 1½ | 3.50 |
| " | " | Control hauls M 14 C (2) | " | 131.6 | 3.30 | 7.5 | 2 | 336 | 374 | 520 | 400 | 1½ | 2.90 |
| B. Double c.e. | Cod Loc. A | Double c.e. M 11 | Shrimp net | 104.0 | 2.45 | 6.0 | 7 | 301 | 149 | 870 | 11 | 1½ | 3.13 |
| " | " Loc. B | " " " | " | 104.0 | 2.85 | 8.0 | 4 | 1500 | 570 | 430 | 50 | 1½ | 2.95 |
| " | Cod Loc. A | Control hauls M 14 C | Nymplex | 131.6 | 3.50 | 7.0 | 4 | 162 | 210 | 270 | 100 | 1½ | 3.03 |
| " | Haddock Loc. A | Double c.e. M 11 | Shrimpnet | 104.0 | 2.30 | 4.0 | 6 | 67 | 57 | 980 | 13 | 1½ | 3.12 |
| C. Multi-chafer | Cod Loc. A | M 14 with chafers | Altern. hauls | 130.0 | 3.70 | 7.0 | 11/10 | 676 | /1736 | 415 | / 740 | 1½ | 2.91/3.08 |
| " | " | Control hauls M 14 C | Nymplex | 131.6 | 3.50 | 7.0 | 4 | 162 | 210 | 270 | 100 | 1½ | 3.03 |
| " | Cod Loc. C | M 14+chafers+cover | " | 130.3 | 3.75 | 7.0 | 6 | 440 | 470 | 410 | 200 | 1½ | 2.51 |
| " | " | Control hauls M 14 C | " | 131.6 | 3.75 | - | 4 | 165 | 34 | 590 | 250 | 1½ | 2.80 |
| " | Haddock Loc. C | M 14+chafers+cover | " | 130.3 | 3.25 | 8.0 | 10 | 1047 | 763 | 340 | 160 | 1½ | 2.51 |
| " | " | Control hauls M 14 C | " | 131.6 | 3.35 | 9.0 | 5 | 971 | 778 | 460 | 220 | 1½ | 2.76 |
| " | Cod Loc. D | M 14+chafers+cover | " | 130.3 | 4.05 | 11.0 | 5 | 303 | 224 | 688 | 112 | 1½ | 2.30 |
| " | Haddock Loc. D | M 14+chafers+cover | " | 130.3 | 3.30 | 8.0 | 5 | 467 | 234 | 688 | 112 | 1½ | 2.30 |
| D. Redfish | Loc. D | M 14 C | Nymplex | 131.6 | 3.05 | 4.0 | 1 | 878 | 730 | 1100 | 720 | 1½ | 2.50 |
| " | " | " | " | 132.0 | 2.90 | 7.0 | 1 | 1583 | 1054 | 1730 | 840 | 1½ | 2.50 |

(1) With splitting strap round cod end and cover.

(2) No splitting strap.

(3) Total range = 2 x Range 25 % - 75 %.

(4) Towing speed from log.

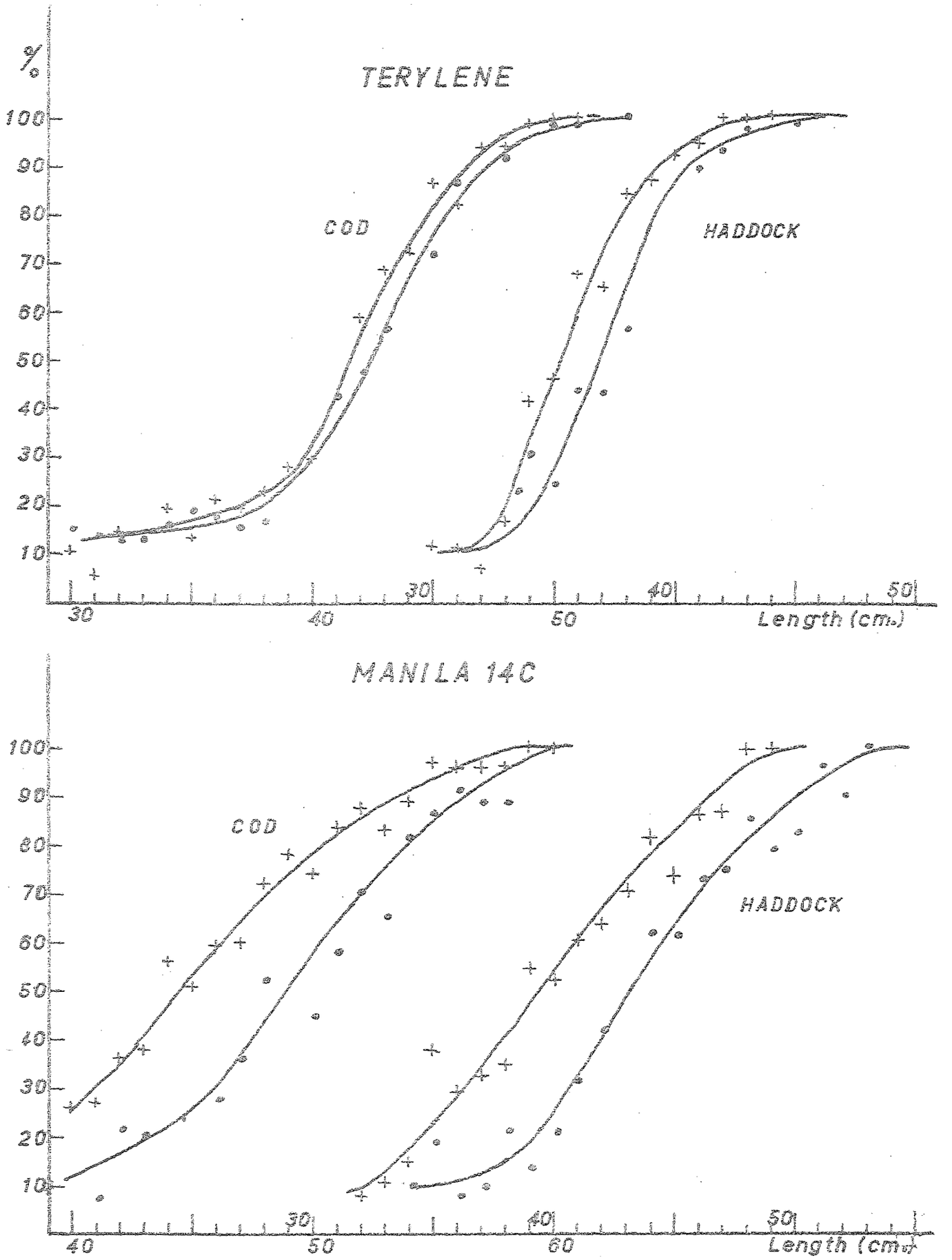


Fig. 1. Selection curves for cod and haddock for groups of hauls with Terylene cod end and Manila cod end with- and without splitting straps. Left hand curve of each pair: with splitting strap, right hand curve without strap.

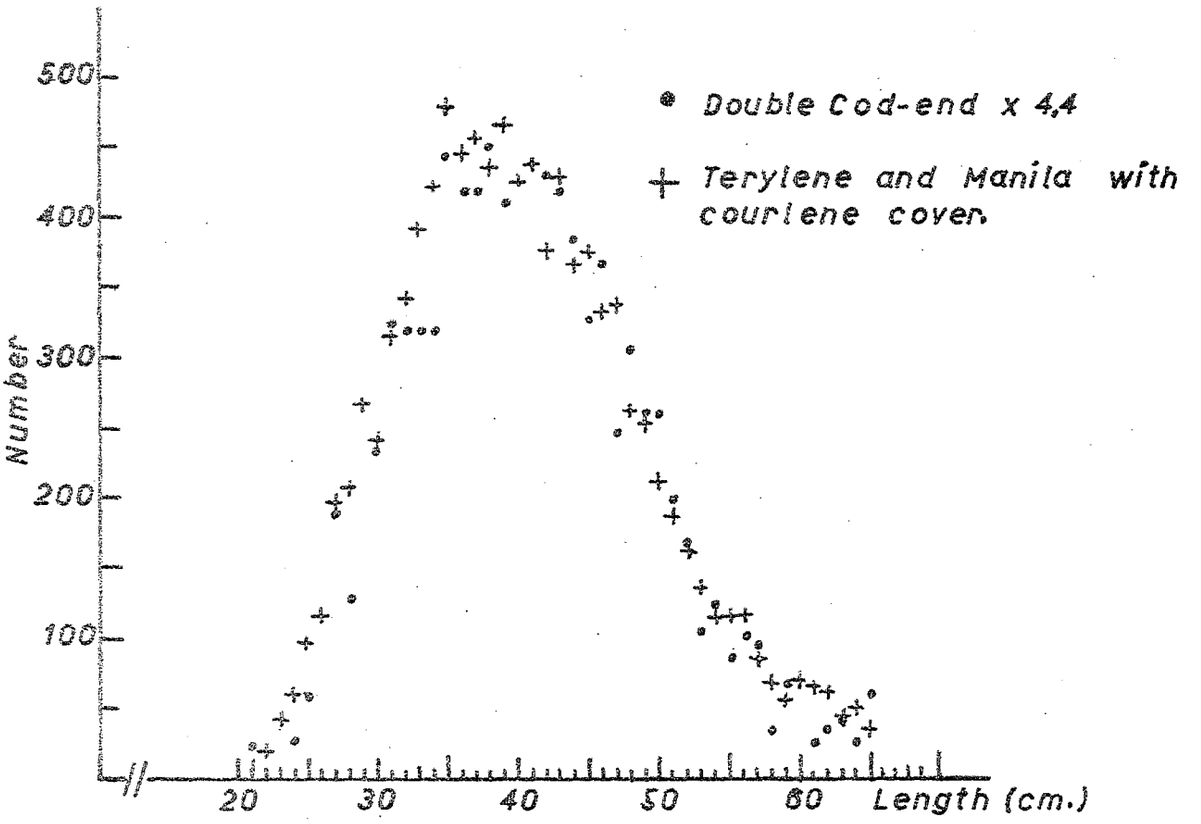


Fig. 2. Size composition of cod in alternate hauls with double cod end (points) and with two other cod ends with Nymplex covers (crosses).

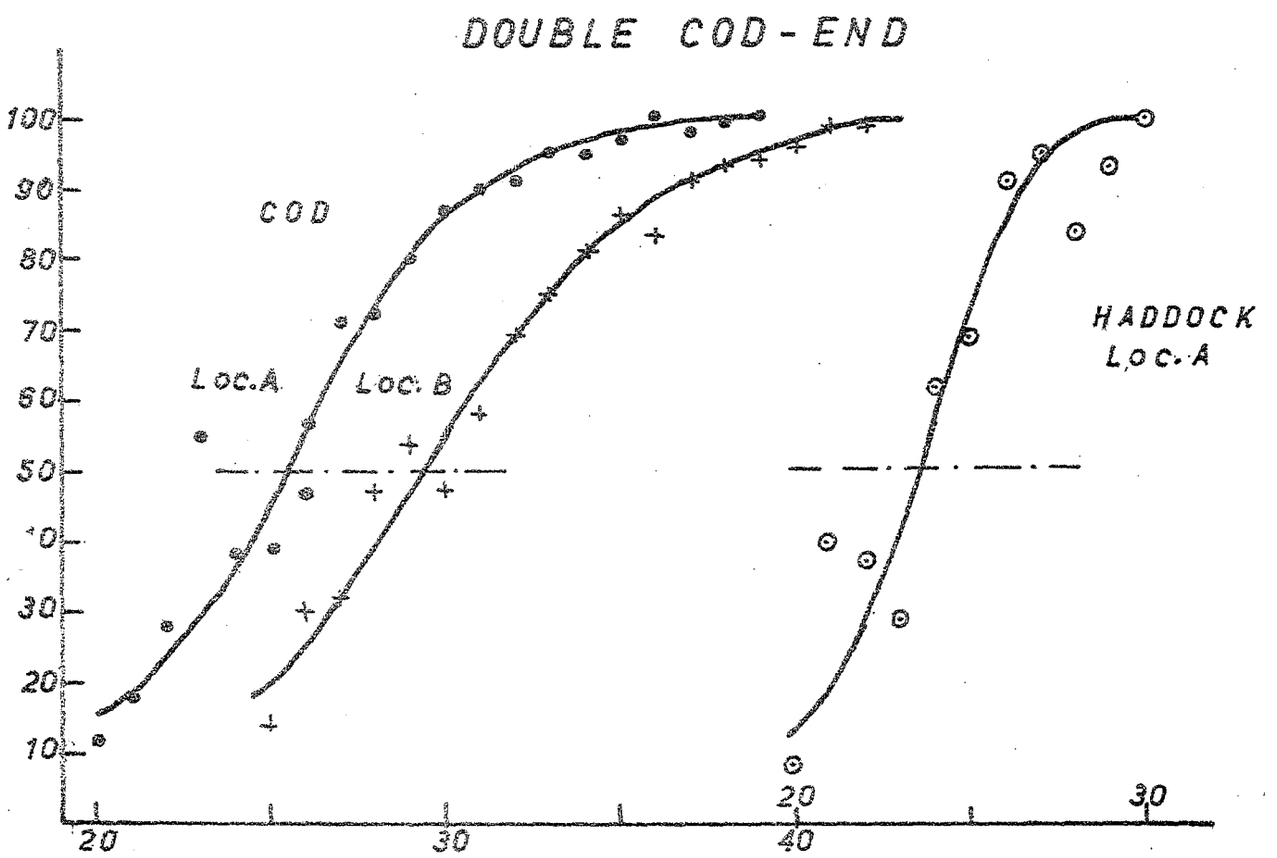


Fig. 3. Selection curves for double cod end with shrimp net cover.

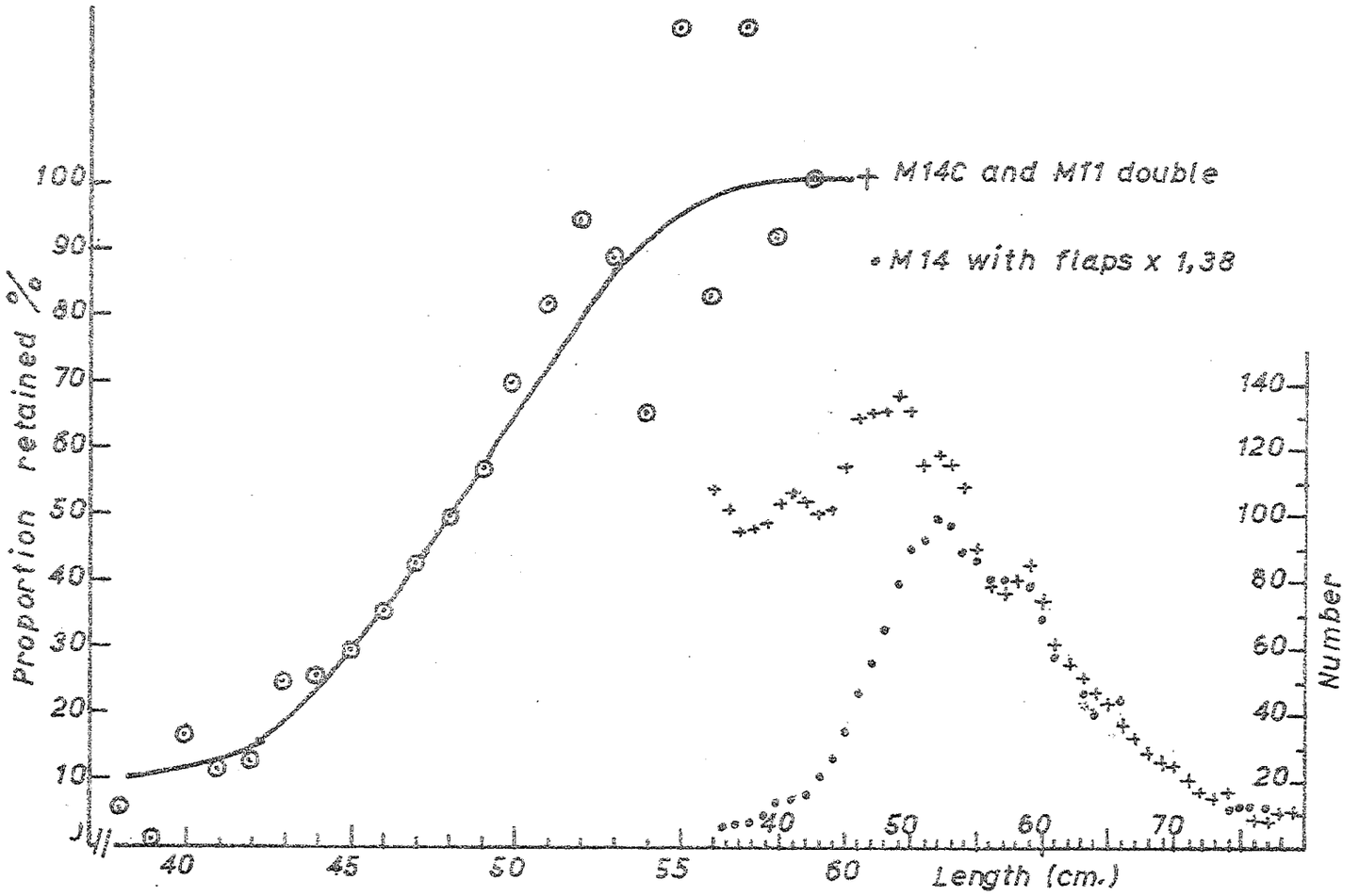


Fig. 4. Right: Size compositions of cod in alternate hauls with Manila cod end M 14 with multi-flap top chafer and with two other cod ends with covers. Adjusted to equal numbers of fish above 55 cm., smoothed. Left: Selection curve derived from these data.

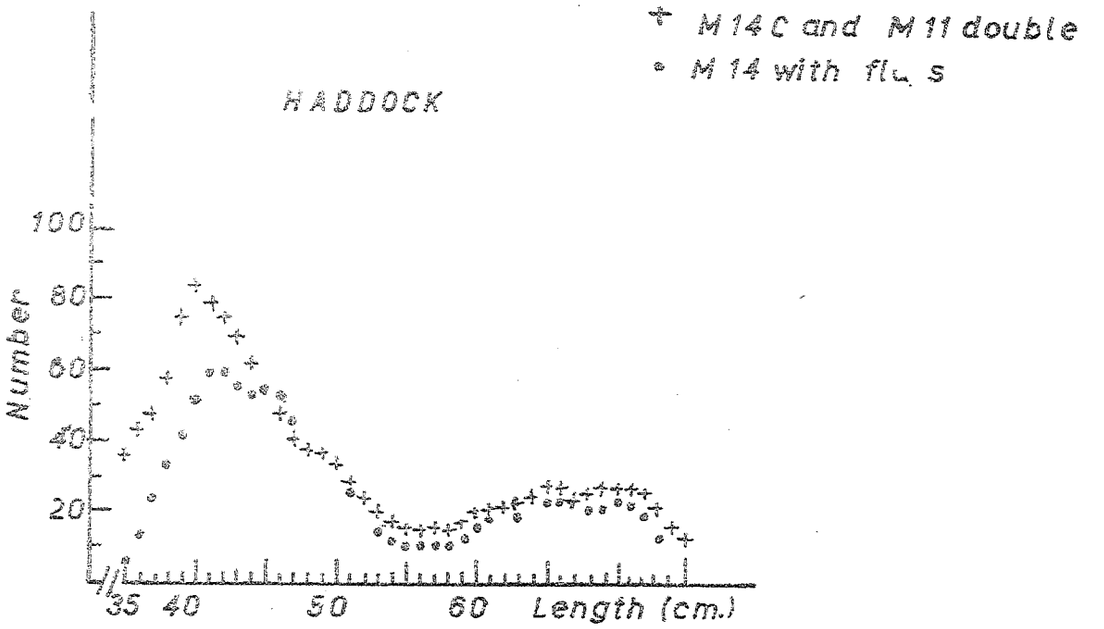


Fig. 5. Size compositions of haddock in same sets of hauls as in figure 4, smoothed.

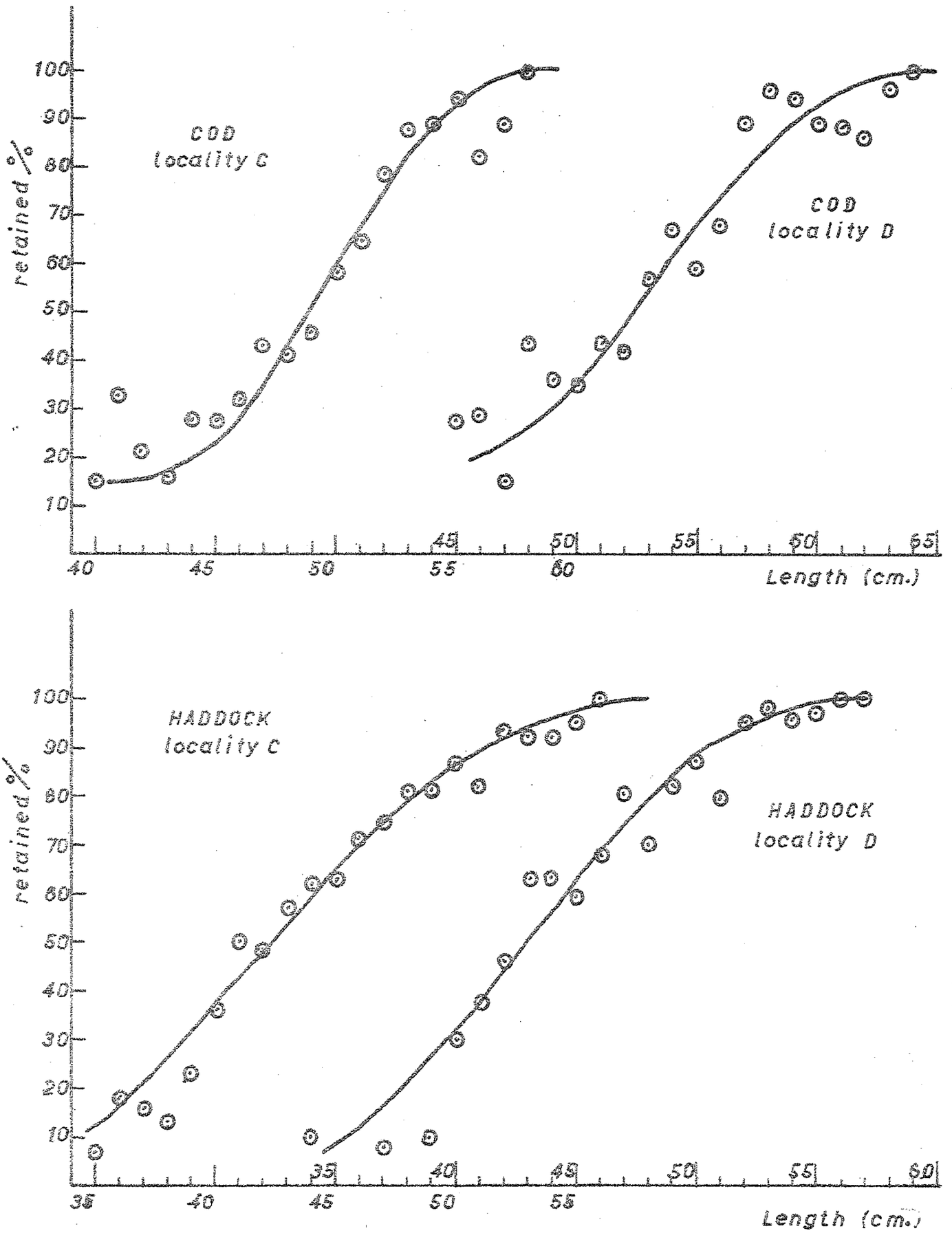


Fig. 6. Selection curves for cod end no. M 14 fitted with multi-flap chafers and Nymplex cover, localities C and D.

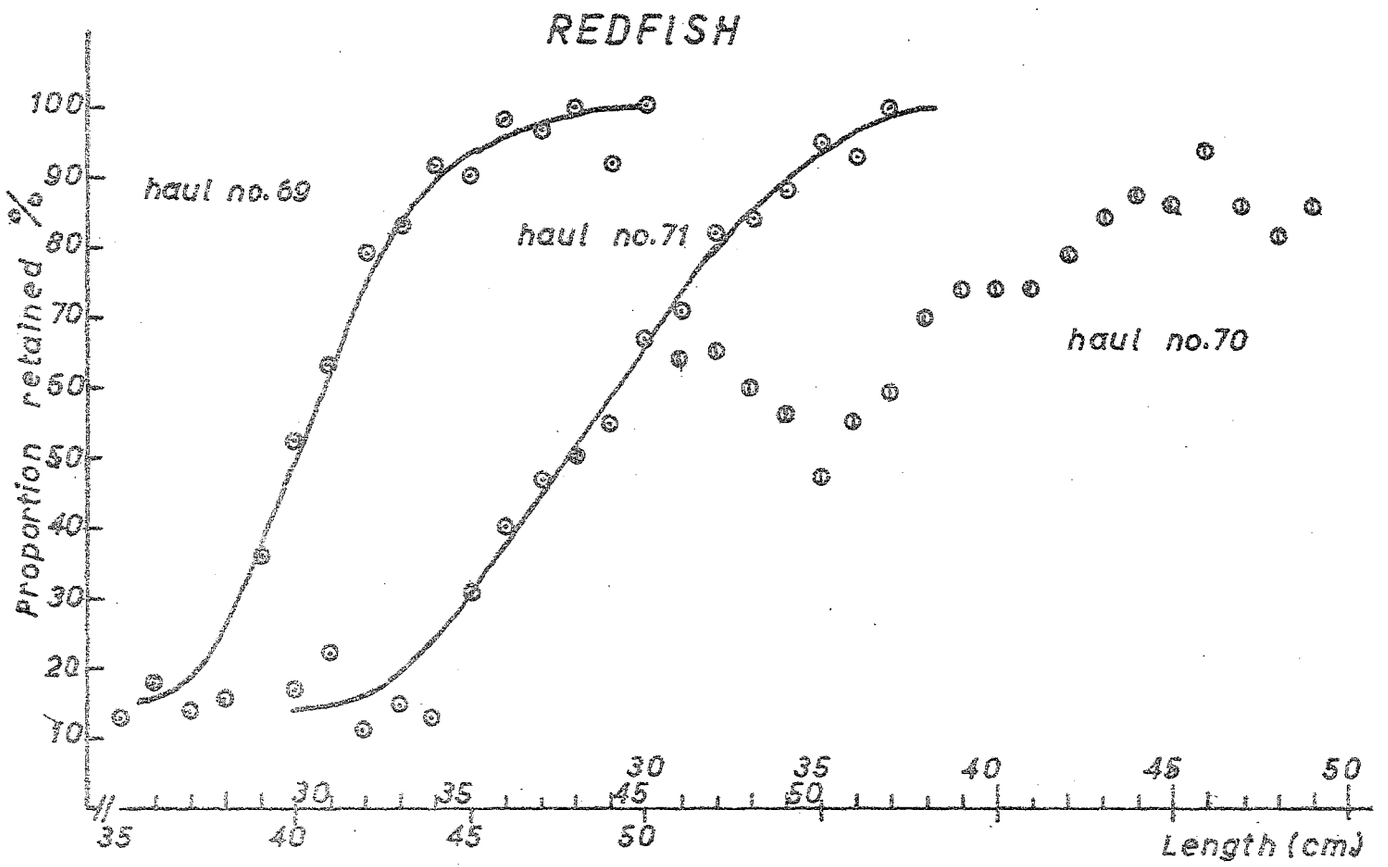


Fig. 7. Selection curves for redfish, cod end M 14 C.

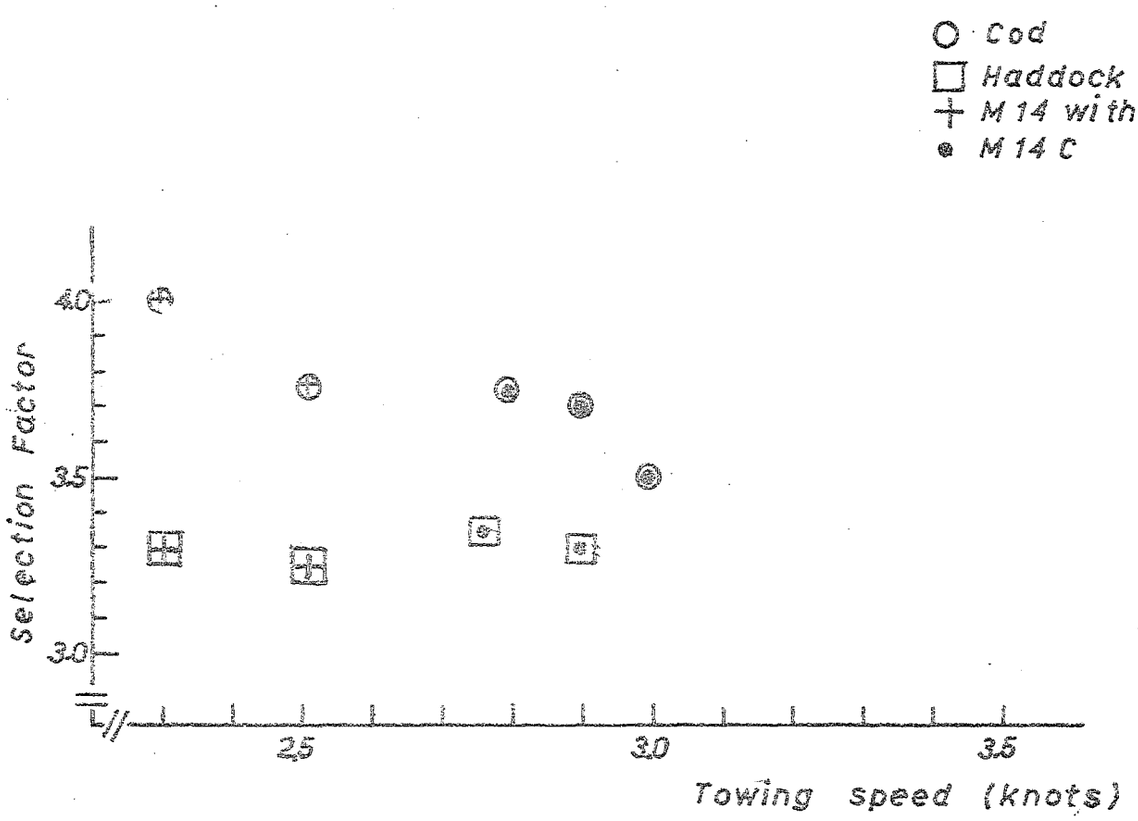


Fig. 8. Relation between selection factors and towing speed as recorded by electric log for grouped hauls with Manila cod ends.