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# SOME EXPERIMENTS TO DETERMINE THE COD-END SELECTIVITY OF A SHRIMP TRAWL

by

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## Summary

A series of experiments to determine the cod-end selectivity of a 45 mm shrimp trawl was undertaken in the Farn Deeps over the period 1974-1976. Six cod-ends with stretched mesh sizes of 20-45 mm in 5 mm increments were examined. The 50% selection length [l (50%)] of each mesh size was estimated, and a selection factor for Pandalus spp calculated.

## Introduction

A resolution was made at the ICES Statutory Meeting in Helsinki in 1971, that an attempt be made to carry out an assessment of the Pandalus stocks in the ICES area. (C. Res. 1971/2:13). Following this, a working group was formed, and one of its recommendations was that while available data were sparse, it felt that selectivity had a very important bearing on yield assessment and emphasised the need for more data on this parameter (ICES 1972/1973).

A series of experiments were subsequently initiated by the Marine Laboratory, Aberdeen to investigate the effects of cod-end selectivity on the P. borealis stocks of the Farn Deeps.

## Materials and Method

A series of comparative fishing experiments was undertaken from FRV Goldseeker on the Farn Deeps grounds off the coast of Northumberland (Figure 1).

A shrimp trawl with a stretched mesh size of 45 mm throughout was used, with cod-ends of stretched mesh size ranging from 20 to 45 mm in 5 mm increments. In most hauls the cod-end was covered by a small mesh whole cover of stretched mesh size 15 mm (Table 1). The specifications of the net were:-

| | | |
|---|---|---|
| Headline length | : | 28 m |
| Footrope length | : | 32 m |
| Groundrope | : | 22 m diameter coir with 125 x 150 g leads |

The net was used with 45 m sweeps and 1.8 m V-doors (Figure 2).

The experiments were carried out at approximately six-monthly intervals over a three year period: June-July 1974, October 1974, May-June 1975 October-November 1975, May 1976 and November 1976.

A total of 119 hauls, each of half an hour duration, were made from FRV "Goldseeker", 42 hauls with a 45 mm cod-end, 34 with a 35 mm cod-end, four with a 30 mm cod-end, 26 with a 25 mm cod-end and 13 with a 20 mm cod-end. In all these hauls the cod-end was covered by a small mesh cover.

Additionally 36 hauls, 21 with a 45 mm cod-end, 9 with a 35 mm cod-end and 6 with a 25 mm cod-end were made without a small mesh cover.

All hauls were made using a trawl warp length of 275 m and a length:depth ratio of approximately 3:1. An engine speed of 800-1000 r.p.m. with the propeller set at pitch 2.5 gave a uniform towing speed in varying sea conditions.

In November 1976 a further 18 hauls, again of half hour duration, were made from a chartered fishing vessel MFV "Sunbeam". Nine hauls were made with a 40 mm cod-end and nine with a 30 mm cod-end. In all hauls the small mesh cod-end cover was used.

The experiments were carried out at the southern end of the Farn Deeps, between 15 and 20 miles east of Blyth, on a bottom consisting of very fine sand and silt (Warren and Sheldon, 1968). Hauls were made at each of six stations in turn, and each cod-end was used for six consecutive hauls. In order to facilitate the cod-end changes, the net, cod-end, and cover were all fitted with 32 mm diameter plastic rings through which attachment twine could easily be threaded.

On hauling, the catches in the cod-end and the small mesh cover were kept separate. The catch, which consisted mainly of large and small mixed gadoids, Nephrops and shrimps, was sorted, and the shrimp catch weighed. When only small quantities of shrimp were caught, up to 4.0 kg, the whole catch was preserved. When larger quantities were obtained, a sub-sample selected at random of 4.0 kg was kept. Theshrimps were immediately preserved in a solution of 4% formalin in sea water.

Later, in the Laboratory, the preserved samples were sexed and length frequency distributions obtained. The measurement used, taken to the nearest millimetre, was the carapace length from the posterior end of the eye socket to the mid dorsal posterior end of the carapace.

## Results

Of 137 hauls made with the 45 mm shrimp trawl and small mesh cod-end cover, shrimps were present in the catches of 117, they were absent in 16, and four hauls were foul. The shrimp catches ranged from 0.5 kg to 14.5 kg per half hour tow; the total weight caught was 445 kg.

The total catch in each cod-end type was:-

| Cod-end | No of ½ hour hauls | Catch (kg) in cod-end | Catch (kg) in small mesh cover | Catch (kg) per ½ hour |
|---|---|---|---|---|
| 45 mm | 42 | 73 | 37 | 1.74 |
| 40 mm | 9 | 5 | 4 | 0.56 |
| 35 mm | 34 | 128 | 20 | 3.76 |
| 30 mm | 13 | 26 | 15 | 2.00 |
| 25 mm | 26 | 98 | 7 | 3.77 |
| 20 mm | 13 | 23 | 4 | 1.77 |

The shrimp catches consisted of a mixture of Pandalus borealis and P. montagui the latter tended to be scarcer and was sometimes completely absent. P. montagui accounted for some 20% of the total catch.

In all, 39 505 P. borealis and 9 599 P. montagui were examined. The data were plotted as length frequency distribution of those animals retained in the cod-end of a given mesh size and those escaping through into the cover. Since numbers caught per haul were low, the length frequency distributions for replicate hauls were combined, giving an average total number of animals in both cod-end and small mesh cover of 6 500 for P. borealis and 1 600 for P. montagui.

The length frequency distribution of those animals retained in the cod-end and those escaping into the small mesh cover were combined to give a total length frequency distribution, and the percentage retained in the cod-end at each millimetre size group was calculated.

These percentages should increase smoothly from 0% for small individuals to 100% for large individuals. The point of interest is the length at which 50% of the individuals are retained, l (50%) which is a useful summary of the selectivity characteristics of the cod-end, and presumably a simple function of the cod-end mesh size.

The percentages were calculated separately for P. borealis and P. montagui. The estimated l (50%)'s for P. borealis and P. montagui by mesh size and date of experiment are shown in Table 2. The estimated l (50%)'s were then plotted against mesh size (Figures 3 and 4). For P. borealis l (50%) increased linearly with mesh size. A straight line was fitted to these data, and the intercept with the ordinate axis proved to be not significantly different from zero. A line passing through the origin was therefore fitted giving

$$l\ (50\%) = 0.43 \times \text{mesh size}.$$

The standard error for the slope of this line was $\pm$ 0.02.

For P. montagui there were too few data points to infer anything about the relationship between l (50%) and mesh size. However, if the line l (50%) = 0.43 x mesh size is plotted on this graph, it passes through the data points, and it seems reasonable to accept this relationship at present.

The 36 additional hauls made without a small mesh cover were carried out to determine whether or not the presence of a cover had any effect on the size of shrimp retained.

Calculations of the mean carapace length showed there was no significant difference between the mean carapace lengths ofshrimps retained in a cod-end with cover and those in an uncovered cod-end.

Acknowledgement

I am grateful to my colleague Mr M.D. Nicholson for his help with the statistical analysis of the results.

Reference

Warren, P.J. and Sheldon, R.W. 1968 Association between Pandalus borealis and fine-grained sediments off Northumberland. Nature Lond. 217 (5 128), 579-580.

Sommaire

Une série d'expériences visant à déterminer la sélectivité de queue-de-morue d'un chalut à crevettes de 45 mm a été entreprise dans les Farn Deeps au cours de la période de 1974 à 1976. On a examiné six queues-de-morue avec des tailles de mailles étirées de 20 à 45 mm par paliers de 5 mm. On a estimé la longueur de sélection à 50% (l (50%)) de chaque taille de maille et l'on a calculé un facteur de sélection pour le Pandalus spp.

Table 1

Mean stretched mesh sizes of cod-end, net and cover before and after use

| Mesh Size (Nominal value) | Mean Stretched Mesh Size (new) | Mean Stretched Mesh Size (used) |
|---|---|---|
| Cod-end | | |
| 45 mm | 48.19 mm | 47.42 mm |
| 40 mm | 42.45 mm | 38.46 mm |
| 35 mm | 36.20 mm | 34.33 mm |
| 30 mm | 30.60 mm | 29.15 mm |
| 25 mm | 28.65 mm | 26.32 mm |
| 20 mm | 23.38 mm | 20.97 mm |
| Wings | | |
| 45 mm | 48.30 mm | 45.70 mm |
| Belly | | |
| 45 mm | 49.20 mm | 47.20 mm |
| Small mesh cover | | |
| 15 mm | 15.14 mm | 15.13 mm |

Table 2

Estimated l (50%)'s of *P. borealis* and *P. montagui* by mesh size

| Date | Cod-end Mesh Size | | | | | |
|---|---|---|---|---|---|---|
| | 20 | 25 | 30 | 35 | 40 | 45 |
| July 1974 | | | | 12.8 | | 17.0 |
| Oct 1974 | | 11.4 | | | | 16.5 |
| June 1975 | | 12.5 | | 14.7 | | + |
| Oct 1975 | | 11.5 | | 14.5 | | |
| May 1976 | 8.7 | | 11.8 | | | |
| Nov 1976 | | | 15.6 | | 22.0 | |

*P. borealis*: estimated l (50%) by cod-end mesh size

| Date | Cod-end Mesh Size | | | | | |
|---|---|---|---|---|---|---|
| | 20 | 25 | 30 | 35 | 40 | 45 |
| July 1974 | | | | 10.7 | | |
| Oct 1974 | | 11.2 | | | | 15.8 |
| June 1975 | | – | | – | | – |
| Oct 1975 | | 11.2 | | + | | + |
| May 1976 | + | | – | | | |
| Nov 1976 | | | 16.2 | | + | |

*P. montagui*: estimated l (50%) by cod-end mesh size

Experiments where too few individuals were present for l (50%) to be estimated are denoted by +

Experiments in which no animals were caught are denoted by –

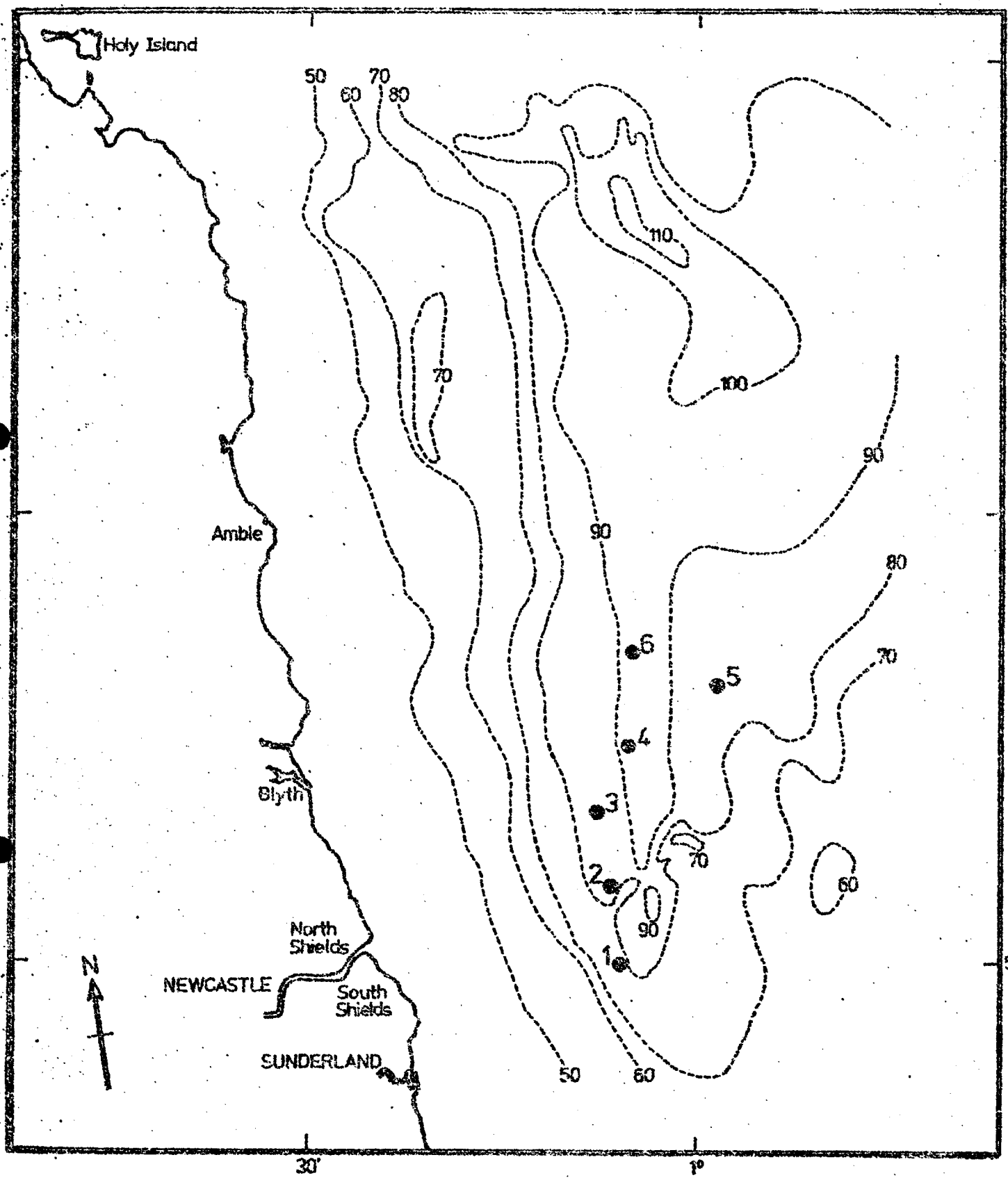
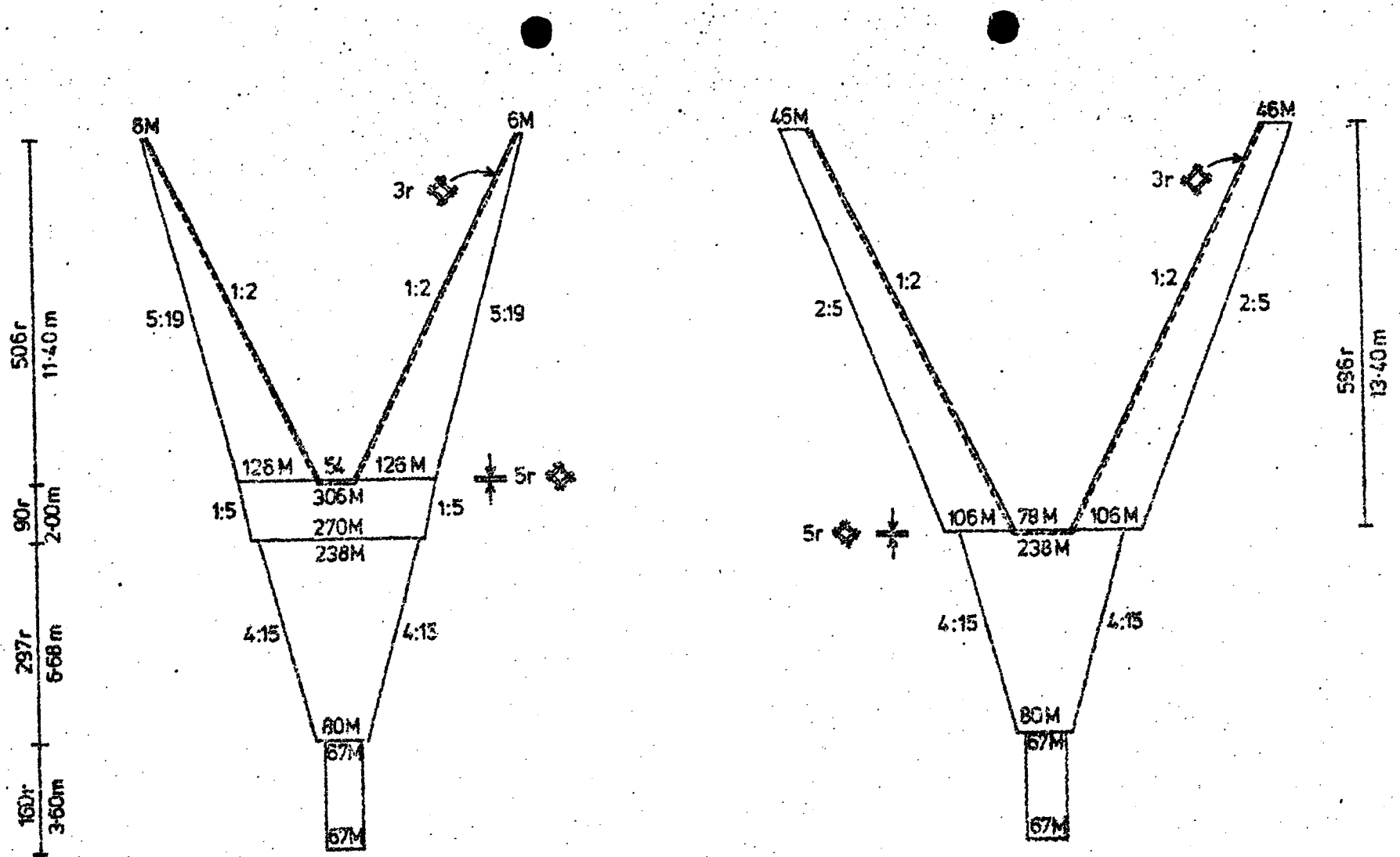



Figure 1. Map of Farn Deeps showing trawling stations




HEADLINE ·28m × 12mm POLYETHYLENE
FOOTROPE ·32·60m × 12mm NYLON
WINGLINES ·0·5 m
GRASSROPE ·22 mm COIR ◦ 125 × 150g LEADS

Figure 2. Drawing to show the net specifications of a 45 mm shrimp trawl

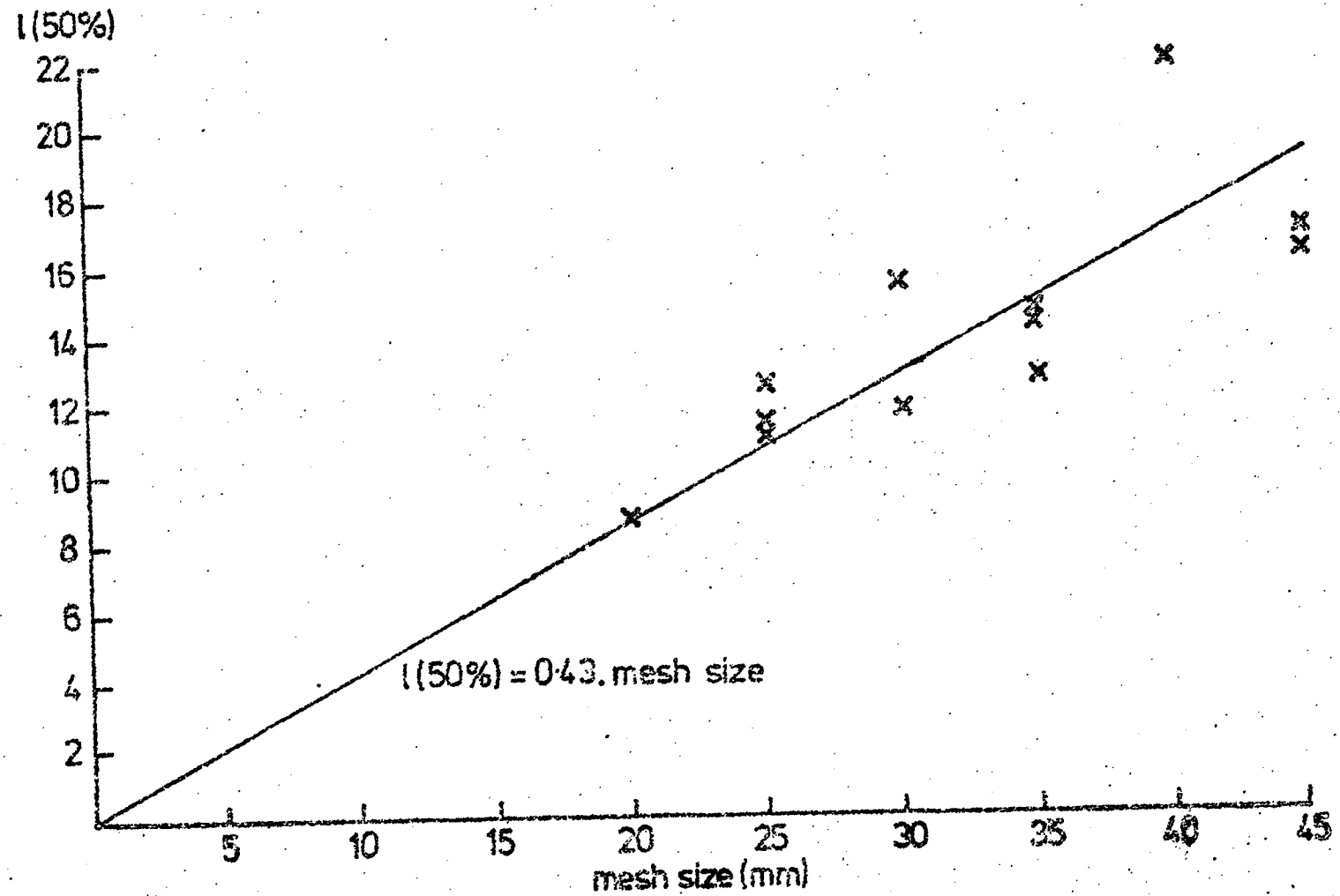



Figure 3. Graph to show estimated l (50%) of *P. borealis* and cod-end mesh size

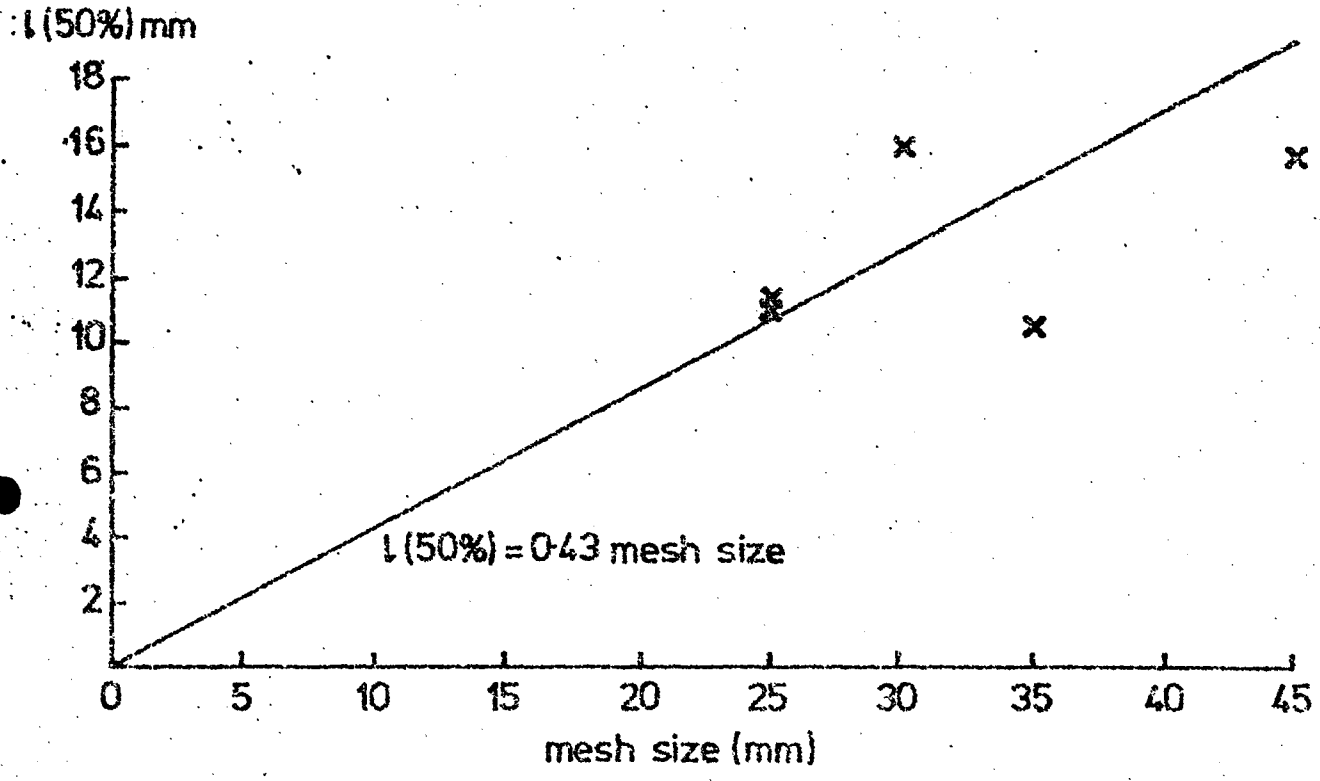



Figure 4. Graph to show estimated l (50%) of P. montanui and cod-end mesh size