INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA

C. M. 1963
Comparative Fishing Committee
Nº 88

Hake Mesh Selection Experiments in the Portuguese Coast

by

Rui Monteiro

(Instituto de Biologia Marítima, Lisboa, Portugal)

During July, August and September 1962 and 1963, some mesh selection experiments on the hake (Merluccius merluccius L.), using the covered codend method, have been carried out between Cape Raso and Cape Espichel.

Since we have operated aboard commercial side-trawlers, where it is rather difficult to handle the fish without disturbing very much the fishing operations, we could not get all the data we wanted.

Some Portuguese trawlers still fish with manila nets, but, nowadays, more and more synthetic fibres, principally nylon, are being introduced. So we have used, in our experiments, the following codends, each measuring 70 × 70 meshes:

IBM I: double twine manila, 4 twisted yarns, preserved (coaltar)
IBM II: single " nylon, 16 braided " , not preserved
IBM III: double " " , 16 " " , " "

All the experiments were made with the same cover (150 × 230 meshes), which enveloped the whole codend and extended some centimetres beyond the codline; consequently, the selectivity values calculated deal only with the codend and not with any other part of the net.

The trawlers were of the 120/140 class (gross tons), and the towing speed varied between 3 and 4 knots; the mean haul duration was between 3 and 4 hours.

The fish lenghts have been taken in fresh condition, and reported by 1 - centimetre groups, in such a way that the middle of each class corresponds to the centimetre figure.

Normally the catches were so good that it was impossible to have measurements of all the individuals without delaying very much the next haul; under these conditions, we measured some codend and cover samples, and weighted the results.

Each day, after a complete series of hauls, some longitudinal rows of 25-30 meshes beginning in the codline, were measured aboard using a Westhoff type gauge with a pressure of 4,95 Kg. Only the upper side of the codend was taken into consideration; as a dispersion index, we have calculated the standard error of the mean:

$$\left(s.e. = \sqrt{\frac{\Sigma (a-m)^2}{n\,(n-1)}};\ a = \text{mesh sizes};\ m = \text{mean};\ n = \text{nº of measured meshes}\right).$$

The individual hauls concerning every codend under study, have been pooled according to the stock composition. Nevertheless, we found some discrepancies between hauls, but this is quite expectable since there are so many factors controlling the experiments, as for example the towing speed or the physiological condition of the fish, that some sudden changes can really occur, even when the hauls have been made within a short period of time and in the same place approximately.

In the computation of the selection means for each length group (tab.I), we have followed the method described by R. JONES (ICES Meeting, 1958, Document nº.81) in which the reciprocals of the estimated "between hauls" and "within hauls" variances for each haul separately, are used as weighting factors.

If the resulted retention percentages correspond, to some extent, to normal curves (see χ^2 tests, Tab.II), it is easy to fit a selection curve, simply by using a reduced normal curve of the form.

$$Y = \frac{1}{\sqrt{2\pi}} e^{-\frac{X^2}{2}} \qquad \text{where } X = \frac{x - \bar{x}}{\sigma}$$

and L_{50} = 50% retention lenght = $\bar{x}$

As we can see in Figs.1,2 and 3, the experimental and theoretical points concerning the three codends are quite similar, specially in the central zones of the curves (between L_{25} and L_{75}), which are the most important under the codend selectivity point of view.

In calculating the normal curve of the codend IBM-III, we assumed that the retention percentage of the 25 class was 98.0, instead of 97.2, otherwise the single frequency woul be negative.

In the Table II are presented the χ^2 values and the respectives goodnesses of fit. Since in these tests it is not desirable to have small frequencies, and also because we are mainly interested in the $L_{75} - L_{25}$ zones of the curves, the classes at the tails of the distributions have been accordingly pooled. This is particularly important in the IBM-II codend, where the χ^2 test is not quite clear, depending the results very much of how the extreme classes (high retention percentages) have been pooled (Fig.2). However, the study of the moments about the mean of the distribution gave the same conclusions, that is, the distribution is not significantly different from the normal form.

	IBM-I	IBM-II	IBM-III
χ^2	9.57	5.38	10.24
D F	5	6	5
Differences (5% level)	Not significant		

Table II

TABLE I

L cm	retention (%) IBM-I	IBM-II	IBM-III
11	-	0.0	-
12	0.0	0.1	-
13	1.7	0.2	-
14	2.4	0.8	0.0
15	8.3	1.9	3.6
16	15.4	3.5	4.9
17	28.0	5.8	10.6
18	45.9	10.3	23.6
19	54.9	14.9	32.7
20	78.0	20.0	52.5
21	89.6	26.9	67.2
22	92.2	41.4	87.3
23	94.2	50.8	91.0
24	98.9	62.7	98.0
25	100.0	73.0	97.2
26	-	78.5	100.0
27	-	94.1	-
28	-	94.7	-
29	-	96.5	-
30	-	97.7	-
31	-	100.0	-
Nº of hauls	4	7	2
Mesh size	43.83 $\pm$ 0.51	63.43 $\pm$ 0.59	55.32 $\pm$ 0.54
$L_{50} = \bar{x}$	18.4	22.8	19.8
$L_{75} - L_{25}$	20.1 - 16.8	25.2 - 20.4	21.4 - 18.2
x	2.43 X $\pm$ $\bar{x}$	3.49 X $\pm$ $\bar{x}$	2.40 X $\pm$ $\bar{x}$
F S	4.2	3.6	3.6

Returning to the Figs.1,2 and 3, and Table I, we can see that the curves of the codends IBM-I and IBM-III are nearly identical, and very much sharper than that of the codend II. The same can also be deduced from the standard deviations of the frequencies used for calculating the normal curves (3.49 for IBM-II and 2.43 and 2.40 for IBM-I and III respectively).

Concerning the selection factors, we have found that the manila codends seem to have a higher selectivity than the nylon ones. In a general way, this is in marked contrasts with previous results of others authors and, in fact, the nylon being a smoother material one could perfectly expect that, for the same mesh size, these codends would allow bigger fish to escape.

The experiments made in 1962 with nylon codends were repeated a year latter with similar results; as an explanation, we can only advance, at the moment, that the braided yarns of the nylon codends decrease so much the flexibility and the smoothness of the fibres, that the selection factors became very small relatively to the twisted yarns of the double manila codend.

The selection factors obtained correspond to a restricted zone and to a relatively short period of time. We intend to do more observations in order to get mean values covering a wider range of conditions in the portuguese coast.

Fig.1

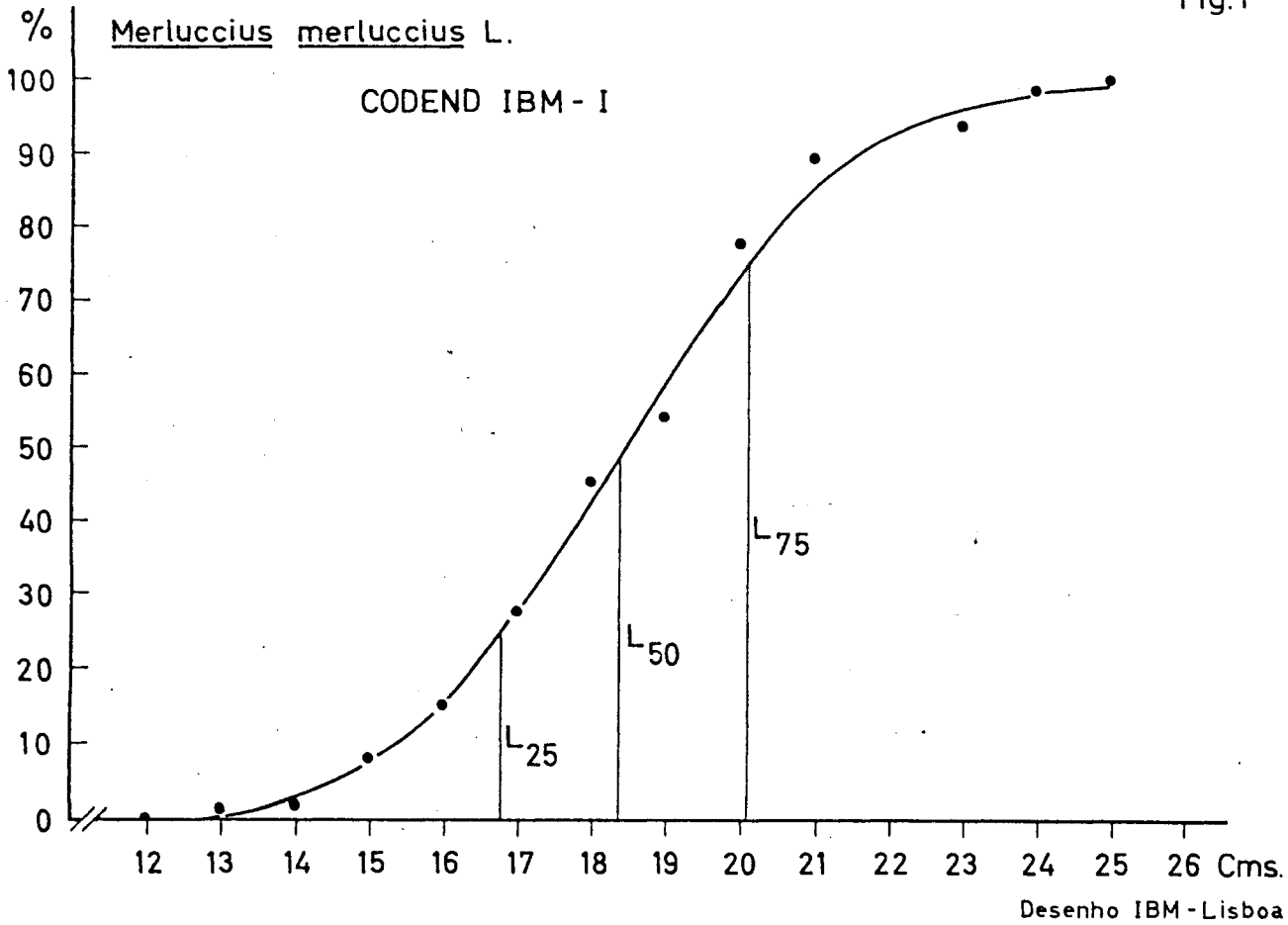

%
Merluccius merluccius L.
CODEND IBM - I
100
90
80
70
60
50
40
30
20
10
0
L25
L50
L75
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26 Cms.
Desenho IBM - Lisboa

Fig. 2

Merluccius merluccius L.

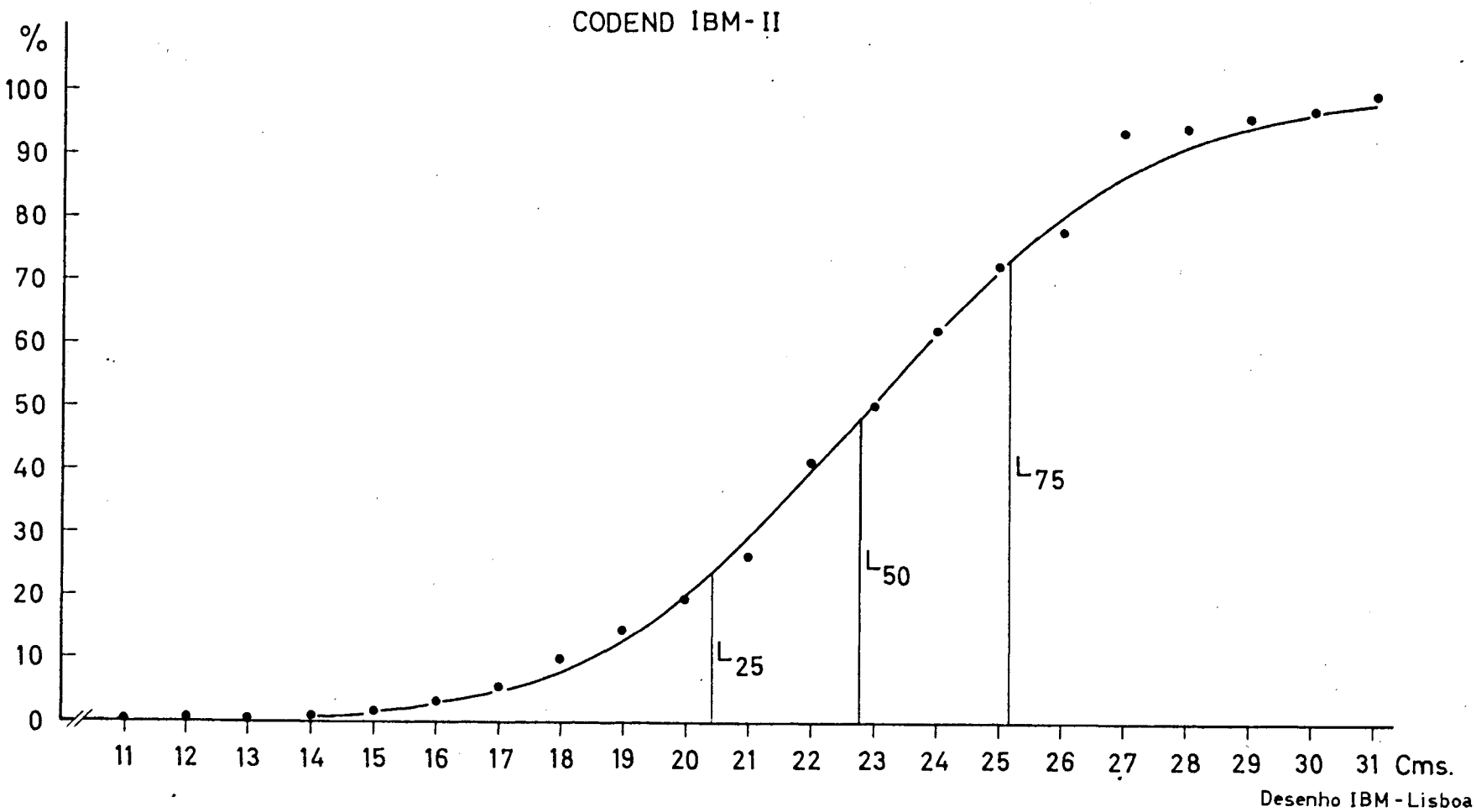
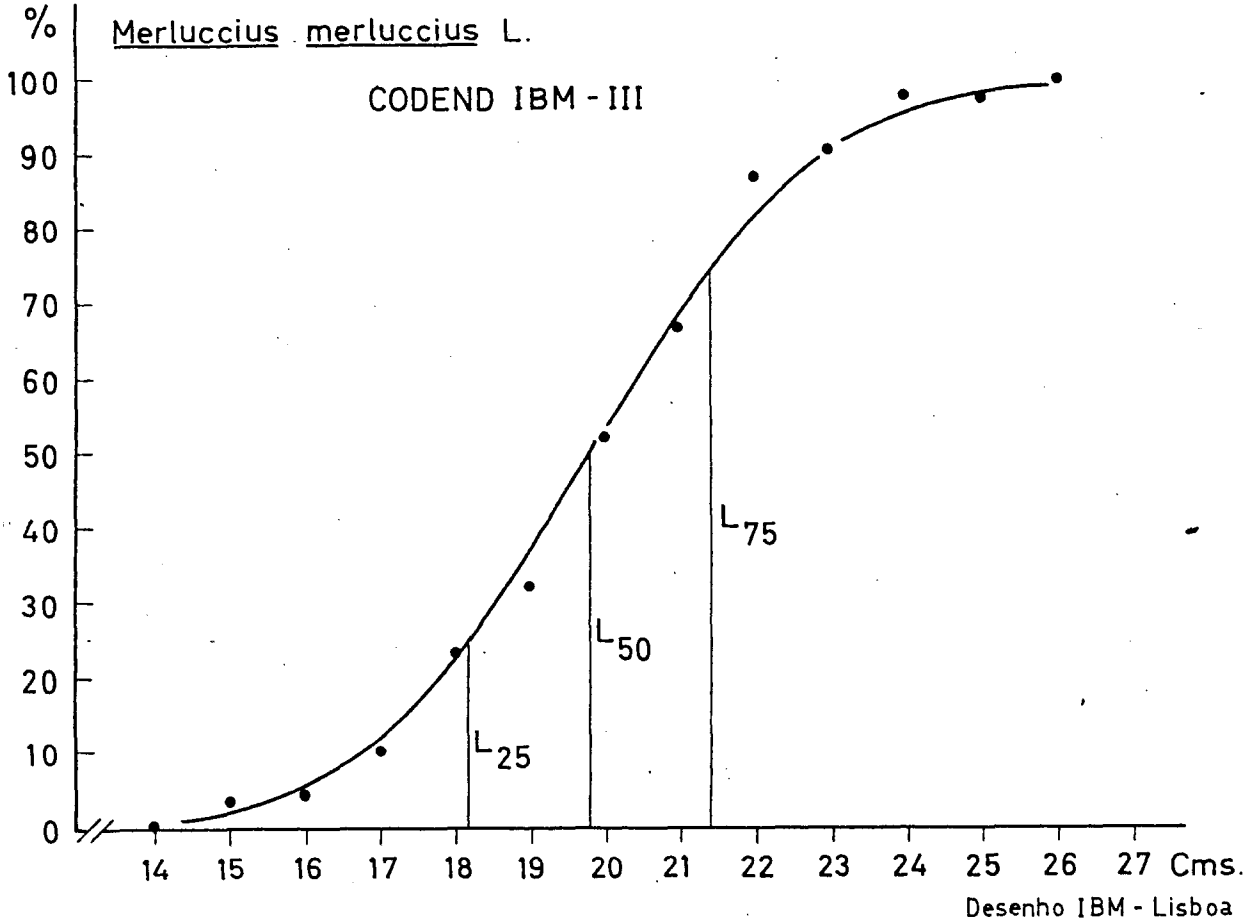


Fig. 3


%
Merluccius merluccius L.
CODEND IBM - III
100
90
80
70
60
50
40
30
20
10
0
L25
L50
L75
14 15 16 17 18 19 20 21 22 23 24 25 26 27 Cms.
Desenho IBM - Lisboa