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Preliminary results of a trawl fitted with a selective grid for the fishery of benthic species from Celtic Sea and Bay of Biscay.

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Résumé

La pêcherie d'espèces benthiques (Baudroies, Cardines, Raies, etc..) représente pour les pays riverains de la Mer Celtique et du Golfe de Gascogne une des principales activités de pêche. L'estimation des rejets occasionnés par le tri à bord des chalutiers français a été conduite en 1985 et 1991. il en ressort que des quantités importantes de juvéniles de raies, cardines et baudroies sont rejetées chaque année en pure perte.

L'objectif du présent travail est de concevoir un dispositif à grille métallique fixée dans la partie arrière du chalut pour limiter en grande partie les rejets. Plusieurs types de configuration de grilles ont été successivement conçus et essayés au cours de trois campagnes océanographiques. La difficulté principale réside dans le comportement différent de l'espèce cible (Baudroie) et des espèces accessoires (Raies, Cardines). Les résultats préliminaires de ce travail sont exposés. Le meilleur compromis réside dans le choix d'une grille à barreaux verticaux et horizontaux d'espacement respectif de 110 mm et de 50 à 60 mm.

Mots clefs : Chalut sélectif, grille, Mer Celtique, Golfe de Gascogne, Baudroies, Cardines, Raies.

Abstract

The fishery for benthic species (Monkfish, Megrim, Rays, etc...) represents for the surrounder countries of the Celtic Sea and the Bay of Biscaye one of the most important activities . An estimate of the discards of the main species resulting from the sorting practice onboard of the trawlers participating in this fishery was made in 1985 and 1991. it was concluded that an important quantity of juveniles of Rays, Megrim and Monkfish are discarded each year causing an important mortality.

The aim of the present paper is to present the preliminary results of a selectivity grid fixed on a bottom trawl to limit as possible the discards. Three different grids were tested at sea during surveys with different results. The major problem is due to difference in the behaviour of the main species in front of the grid. Finally a good compromise was realised with a grid made of vertical bars and horizontal ones respectively of 110 mm and 50 to 60 mm spacing.

Key words : Selectivity, grid, trawl, Celtic Sea, Bay of Biscaye, Monkfish, Megrim, Rays.

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PRELIMINARY RESULTS OF A TRAWL FITTED WITH A SELECTIVE GRID FOR THE FISHERY OF BENTHIC SPECIES FROM THE CELTIC SEA AND THE BAY OF BISCAY

I - INTRODUCTION.

The ICES working group of subareas VII and VIII has classified according different fishery units, the fishing fleets of the surrounding countries of the Celtic sea and the bay of Biscay (Anon 1986). On a total of about 20 fishery units, 7 are targetting benthic species (monkfish, ray, megrim, etc...) Of this total 6 use bottom trawls for this purpose. About 50000 tons of benthic species are caught in the Celtic sea and the bay of biscay, by 500 boats.

French studies from the laboratory of IFREMER in Lorient (Charuau and Biseau, 1989 ; Peronnet and al, 1991) have pointed out the problem of discarding practices, for underzised fish, of the main species of the Celtic sea. For example, the French boats only, discard each year about half a million monkfish, four million megrim and one million rays. Most of these individuals don't survive.

Different simulations using the ANALEN model (Chevaillier and Laurec, 1990) or the hybrid model (Mesnil and Shepherd, 1990) have shown that a gain of 20 to 30 % in the catch could be atained if the discard of benthic species could be saved. These results have lead Dupouy and al (1993) to propose the achievement of a selective trawl for benthic species. This trawl would be devoted to fishery units 4 and 14 of subareas VII and VIII in which most of the monkfish, ray and megrim are caught.

II - MATERIAL AND METHOD.

Three surveys of about 15 days each were undertaken on the R.V. GWEN DREZ (25 m long 600 H.P.) from June 1993 to March 1994. The trawl used was a four panelled one (Figure 1) of 27,90 m headline and 33,60 m footrope. A tickler chain was put before the footrope to oblige the benthic fish to swim and to enter in the trawl. A scanmar transmitter was fitted on the wing tips to know the horizontal opening of the trawl and another are was fitted over the grid to know the angle of the grid (usually between 50° and 60°) and the speed of the water at this point.

Two codends overlapped with stretched mesh of 70 mm were fitted after the grid to collect the catch in two parts. The grid was made of aluminium bars fixed on a frame of 80 cm high and 120 cm wide (Figure 2). A netting panel fitted diagonnally inside the lengthener worked to concentrate the fish in front of the bottom of the grid (figure 3). A part of the fish (usually the smallest) crossed through the grid and entered the inferior codend ; the other part entered the upper codend by an opening made inside the lightener before the top of the grid.

The towing area was provided by fishermen and was known to produce benthic species. It ranged at the boundary of subarea VII and VIII, by a depth stretching between 100 and 150 m. The towing speed was close to 3 knots and the tow duration was comprise between 2 hours and 2 hours 30 minutes. The marketable species were sorted and weighted according the codend and the main species were measured separatly. Five different grids were fitted during the three surveys.

III - RESULTS.

III.1 -Presentation of the results.

The four main species caught were monkfish, megrim, rays and hake. In each codend undersized individuals (named "discards") and fish of marketable size (named "landings ") were present. The separation among discards and landings were made following a knife-edge sorting length based on the mean sorting length of the fishermen in the fishery units 4 and 14 on the French boats, i-e : 30 cm for monkfish, megrim and hake ; 40 cm for rays. For the total number of fish of each of the four above mentionned species, entering the trawl, two cases were taken into account :

- Case of the normal trawl : it was considered that no grid was in the trawl, so the individuals of the two codends were added respectively between total landings and total discards considering that there is only one codend.

- Case of the selective trawl : only the landings and the discards of the upper codend were taken into account. All the fish entering the lower codend, through the grid were considered escapees and alive (they were named "survivors") because the aim of the selective trawl is to remove the lower codend in the future to save the escapies.

Finally, the percentages of discards, landings and survivors for these two cases are presented for each of the different grids tested.

III.2 - The grid with vertical bars of 53 mm spacing.

For this type of grid, the marketable sized fish were 60 % for megrim, 89 % for monkfish, 61 % for rays and 87 % for hake in the case of a normal trawl .

If a selective trawl were used, 27 % of the individuals of megrim, 72 % of monkfish, 46 % of rays and 45 % of hake were caught as landings. The remaining percentage were split between discards (11 % for megrim, 3 % for monkfish, 17 % for rays and 2 % for hake) and survivors (62 % for megrim, 25 % for monkfish, 37 % for rays and 53 % for hake). In conclusion, for this type of grid, discards were seriously diminishing but also landings for megrim and hake. The short term losses for these two species is too heavy to promote the adoption of this grid (see table 1).

III-3 - The grid with vertical bars of 77.5 mm spacing.

The results of discards, landings and survivors for the normal trawl and the selective trawl are presented in figure 4. Most of the individuals were survivors and the discards and the landings were at a very low level for the four species. This is the result of a larger spacing between the vertical bars, allowing more individuals to cross through the grid (table 1).

III.4 - The grid with horizontal bars of 55 mm spacing.

This type of grid allows a huge drop of discards (figure 5) particularly for megrim (65% of discards with the normal trawl, only 4 % for the selective trawl) and rays (37 % to 10 %), but one can observe also that most individuals of these species cross through the grid and this hardly diminishes the percentage of landings (table 1).

III.5 - The grid with horizontal bars of 40 mm spacing.

A slight increase of the landings is noted after the reduction of spacing to 40 mm between horizontal bars. But it is also noted an increase in the discards in the upper codend. Except for monkfish the number of individuals crossing through the grid is diminishing (figure 6).

III.6 - The grid with horizontal bars (of 110 mm spacing) and vertical bars (65 mm spacing).

This type of grid provides the best results of the different tests presented here. The short term losses are limited except for megrim (40 % in number, 35 % in weight) ; however for monkfish losses are 9 % in number and 5 % in weight. For rays no losses are observed and for hake losses are respectively 30 % in number and 15 % in weight (figure 7 and table 1). This type of grid should be improved by limiting the spacing between vertical bars to 50 mm.

IV - SHORT TERM LOSSES AND MID-TERM GAINS.

We have retained the last type of grid tested, i.-e. the grid with horizontal bars spaced at 110 mm and with vertical bars spaced at 65 mm.

IV.1 - Short term losses.

The short term losses by species were presented in paragraph III.6. But for the total species caught we have used the mean catch by species of a standard trip of fishery unit 4 in division VIIh. For this standard trip a global short term loss of 10 % to 15 % of the total catch and of the turnover will occur.

After two years, the losses will be compensated by the gains in weight.

IV.2 - Mid-term gains.

Two hypothesies were drawn for knowing the beneficiaries of the gains in weight and the amount of the mid-term gains :

- The first hypothesis states that the survivors saved by the selective trawls are migrators ; in this case all the 7 fishery units which catch benthic species benefits from the adoption of the selective trawl by the fishery units 4 and 14 ;

- the second hypothesis states that the survivors are not migrating ; in this case only the fishery units which have adopted the selective trawl benefit from the gains in weight, i.e. fishery units 4 and 14.

If we take into acccount the first hypothesis, the total gains should be in the order of 10000 tons to 13000 tons to be shared between all the fishery units catching benthic species, especially for the units 6 (beam trawlers) and 8 (nephrops trawlers). The gains for the units 4 and 14 (supposing that all the boats of these two fishery units adopt the selective trawl), are limited to the species which are targetted by them, i.e. mainly monkfish and rays (see table 2).

If the second hypothesis prevails, only fishery units 4 and 14 wich benefit from the gains. These gains must be in the range 20 % to 30 % in weight i.e. about 13 000 tons (see table 2). Moreover the individuals landed by these vessels should be larger in mean than for before the adoption of the selective trawl and usually larger fish are of more valuable interest.

V - CONCLUSIONS.

The test on the different types of grid have drawn the conclusion that an interesting selectivity could be achieved for the benthic species and for gadoids

(hake, in our example). The best results were obtained by the grid with horizontal and vertical bars (110 mm X 65 mm). Most undersized individuals cross through the grid and are considered as survivors. The short term loss of marketable species are limited to megrim (-35% in weight) and hake (-15% in weight) instead of monkfish (-5 % in weight) and for rays (0%) the losses are marginal or non existant.

The problem which arises is to know how the gains would be shared (in the order of 20% to 30%) in the mid and the longterm. In fact if the individuals saved are migrators all the fleets fishing benthic species must be beneficiaires even if only the two selected fishery units 4 and 14 have adopted the selective trawl. On the other hand if the individuals escaping the trawl are not migrators, only the fishery units 4 and 14 must benefits from the gains, i.e. about 10 000 t to 13 000 t of benthic species and hake.

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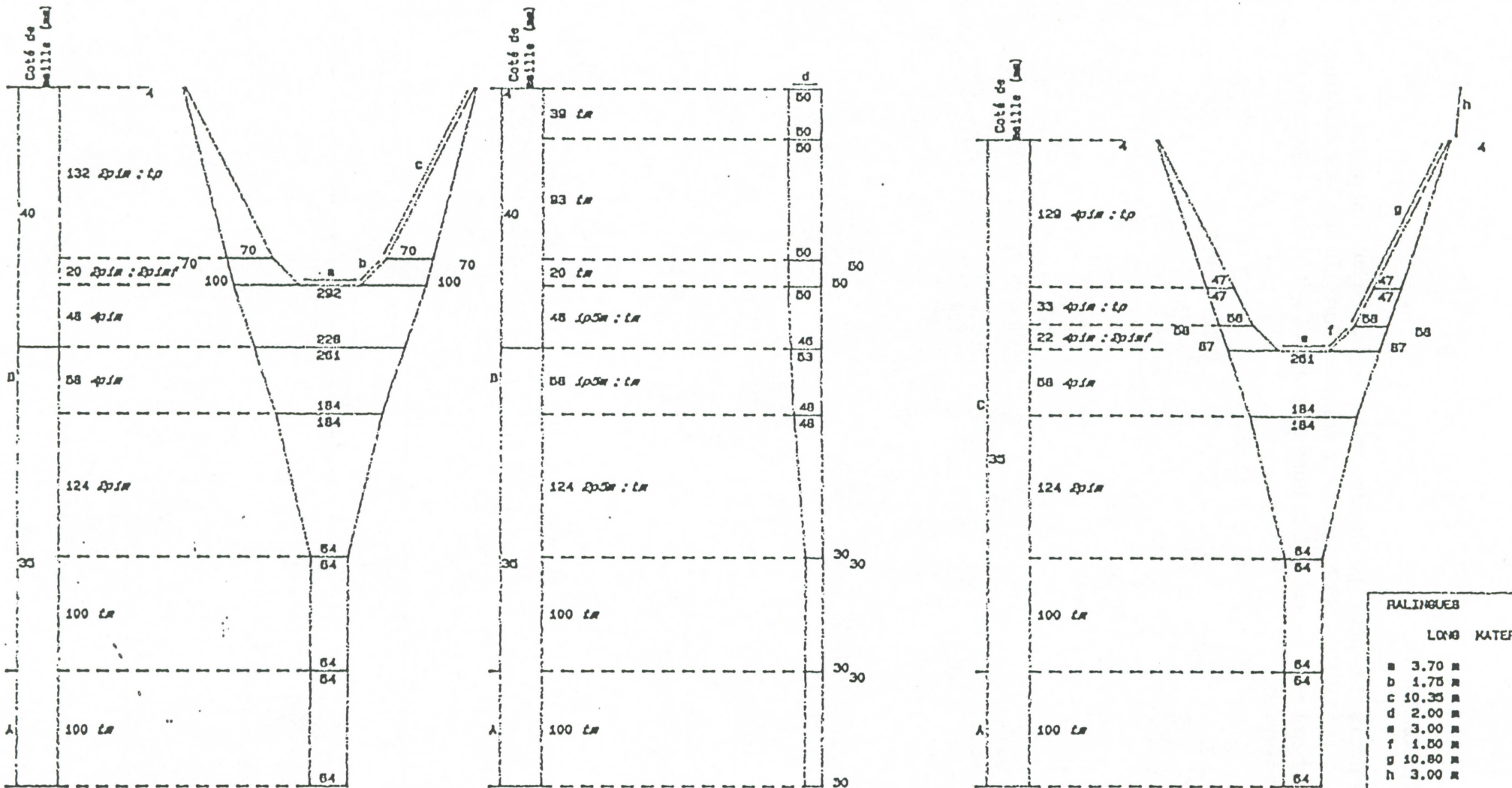

RALINGUES	LONG	MATERIAU	DI
a	3.70 m	ST	14.(
b	1.75 m	ST	14.(
c	10.35 m	ST	14.(
d	2.00 m	ST	14.(
e	3.00 m	ST	16.(
f	1.50 m	ST	16.(
g	10.80 m	ST	16.(
h	3.00 m	ST	16.(

FORCE DU FIL PAR ZONE

A	35mm.	3.0 mm.
B	35mm.	400.m/Kg
C	35mm.	280.m/Kg

CHALUT EXPERIMENTAL
POUR LOTTES
POCHE 4 FACES EN 35 mm
DESSOUS EN 280 m/kg
LARGEUR DES PIECES MONTEE
21/09/93

IFREMER LORIENT
TECHNOLOGIE PECHE
8, rue François Toullec 56100 LORIENT
Téléphone: 97.83.45.47

Ref : LOTGRIL1

DATE : 21/09/93

CHALUT 27.90m. / 33.60m.

TYPE 4 FACES LOTTES
Espece : LOTTES DIVERS
Origine : IFREMER

1 BATEAU
400 ch.
Surface fil : 45.59 m2

Figure 1: Selective trawl design.

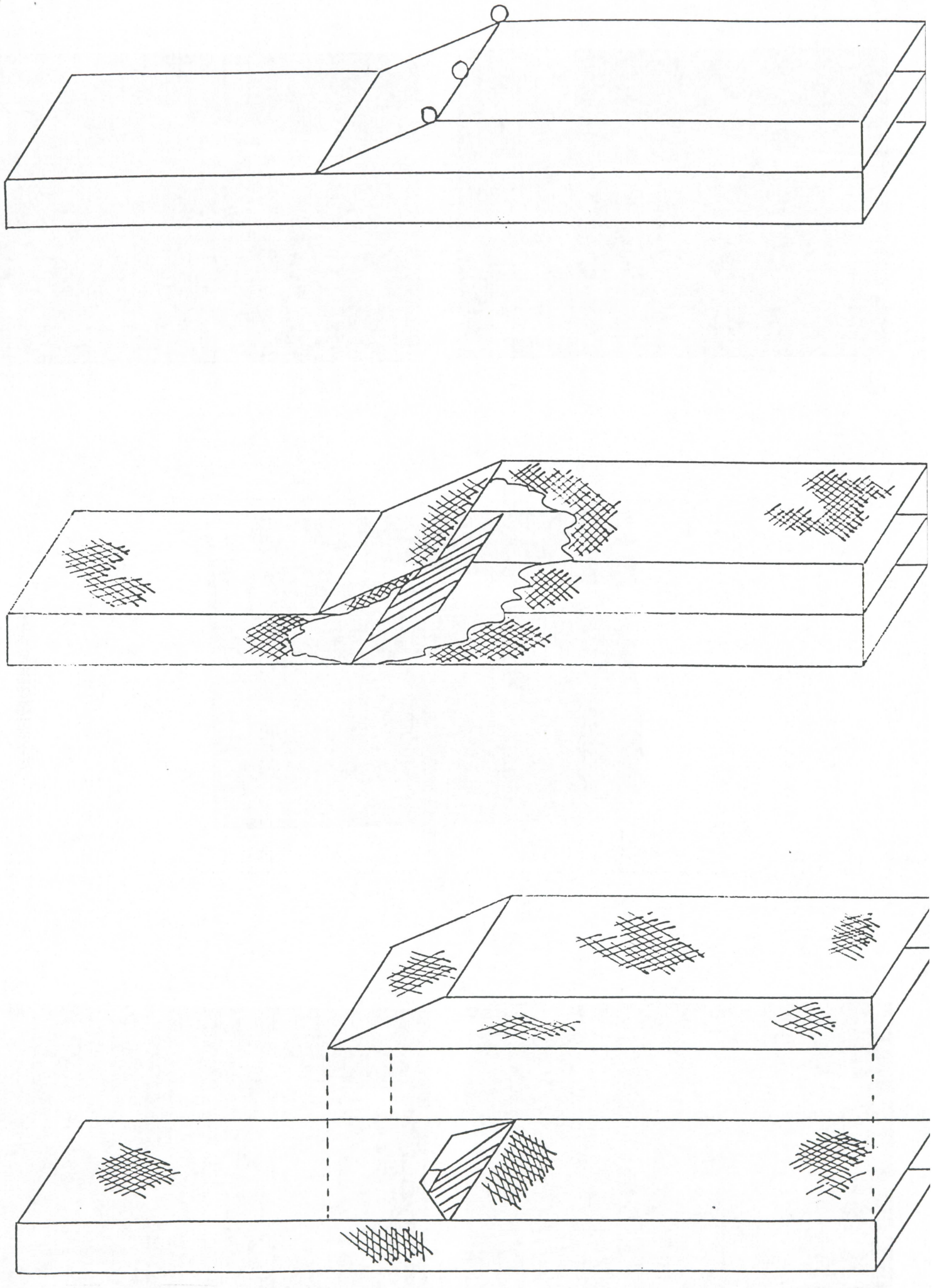

Figure 2: Diagrams showing the two-codend selective trawl with the grid (vertical bars) and the trap for the larger fish.

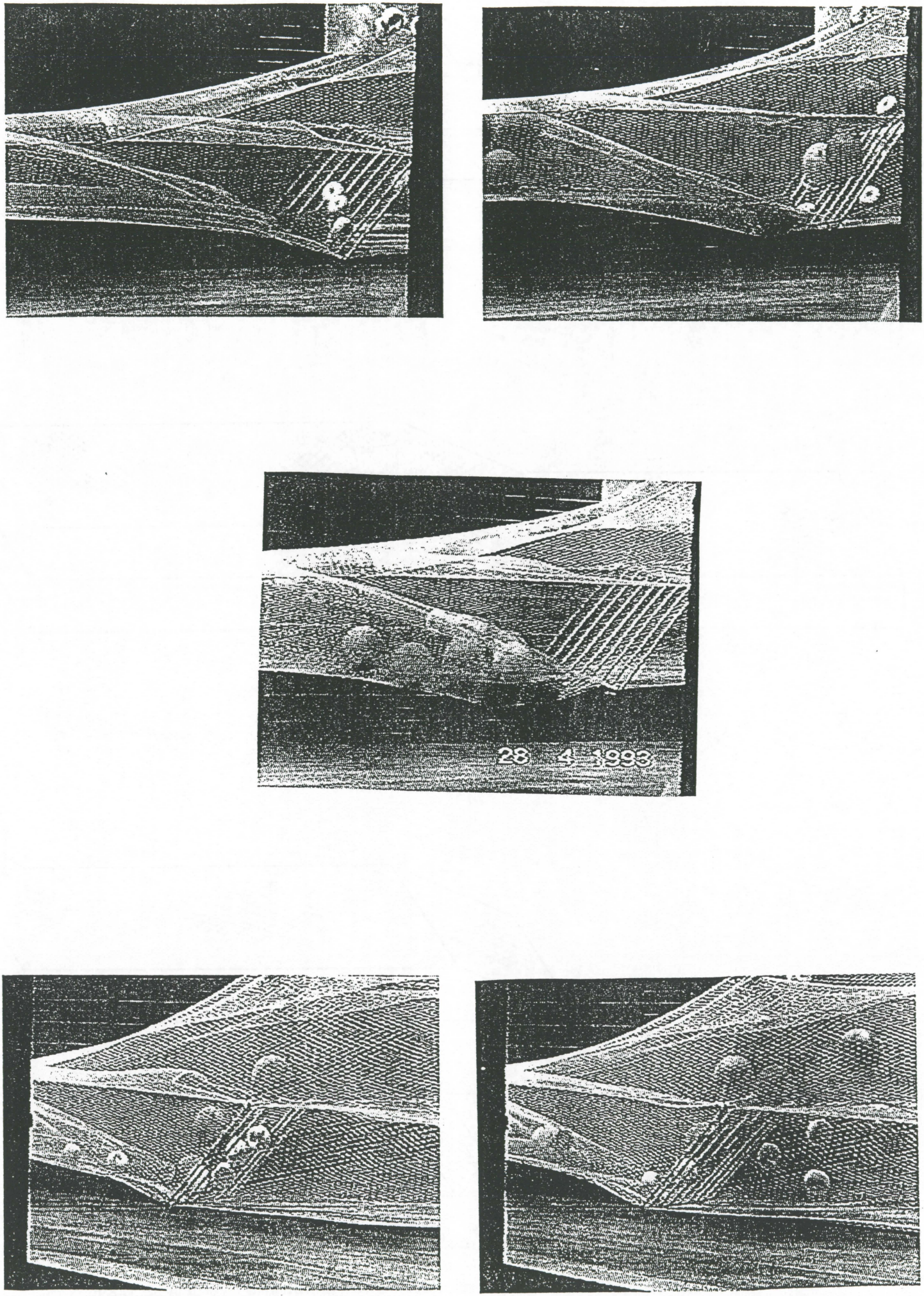

Figure 3: Views of the model of the selective trawl showing the grid and the lengthener before it. The smaller balls simulate the escapees.

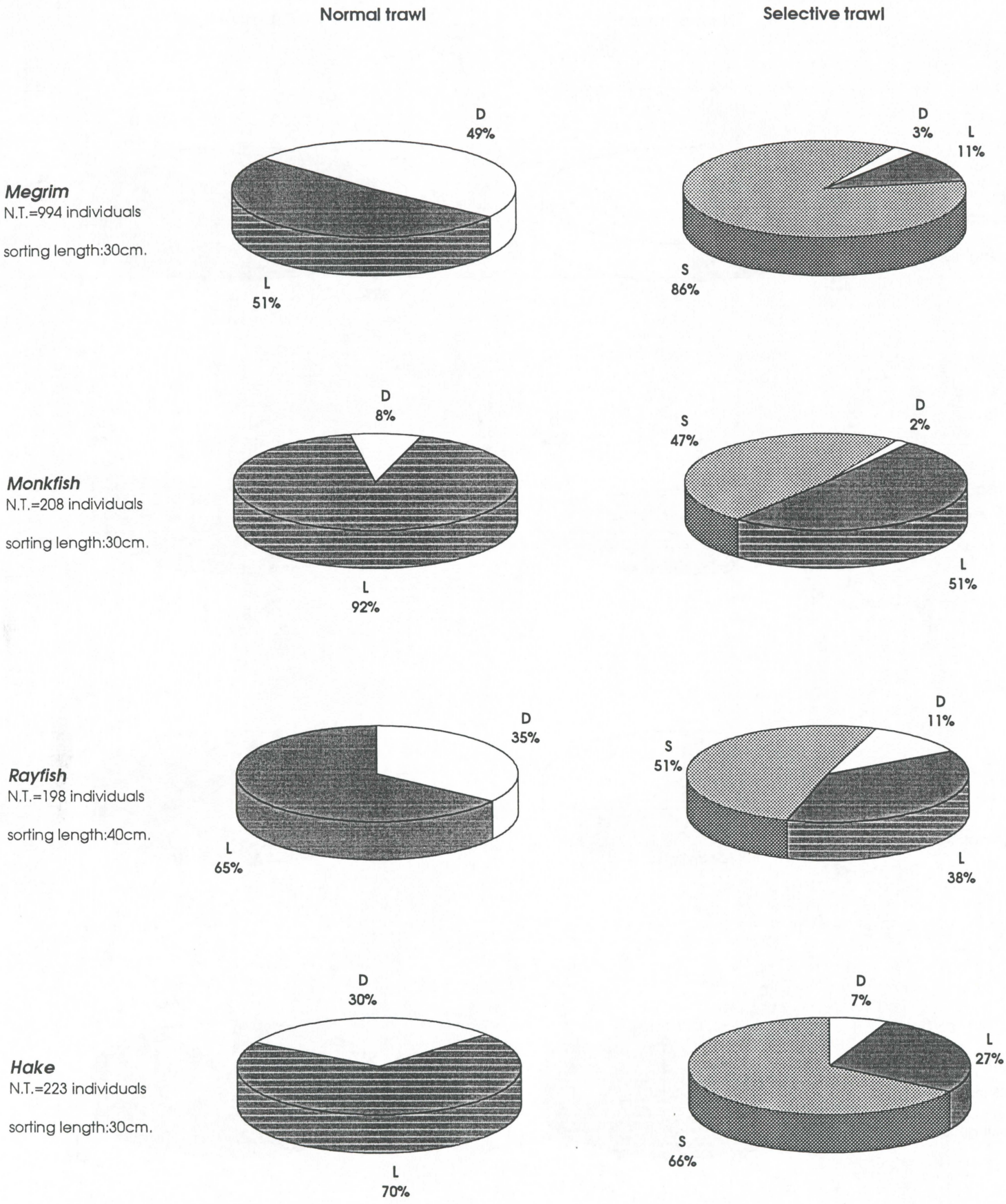

Figure: 4 Result of the comparison between the percentages of discards, landings, and survivors (escaping the 77.5 mm vertical bars grid) of the same trawl fitted without or with a selective grid (N.T. = total number of individuals entering in the trawl) .

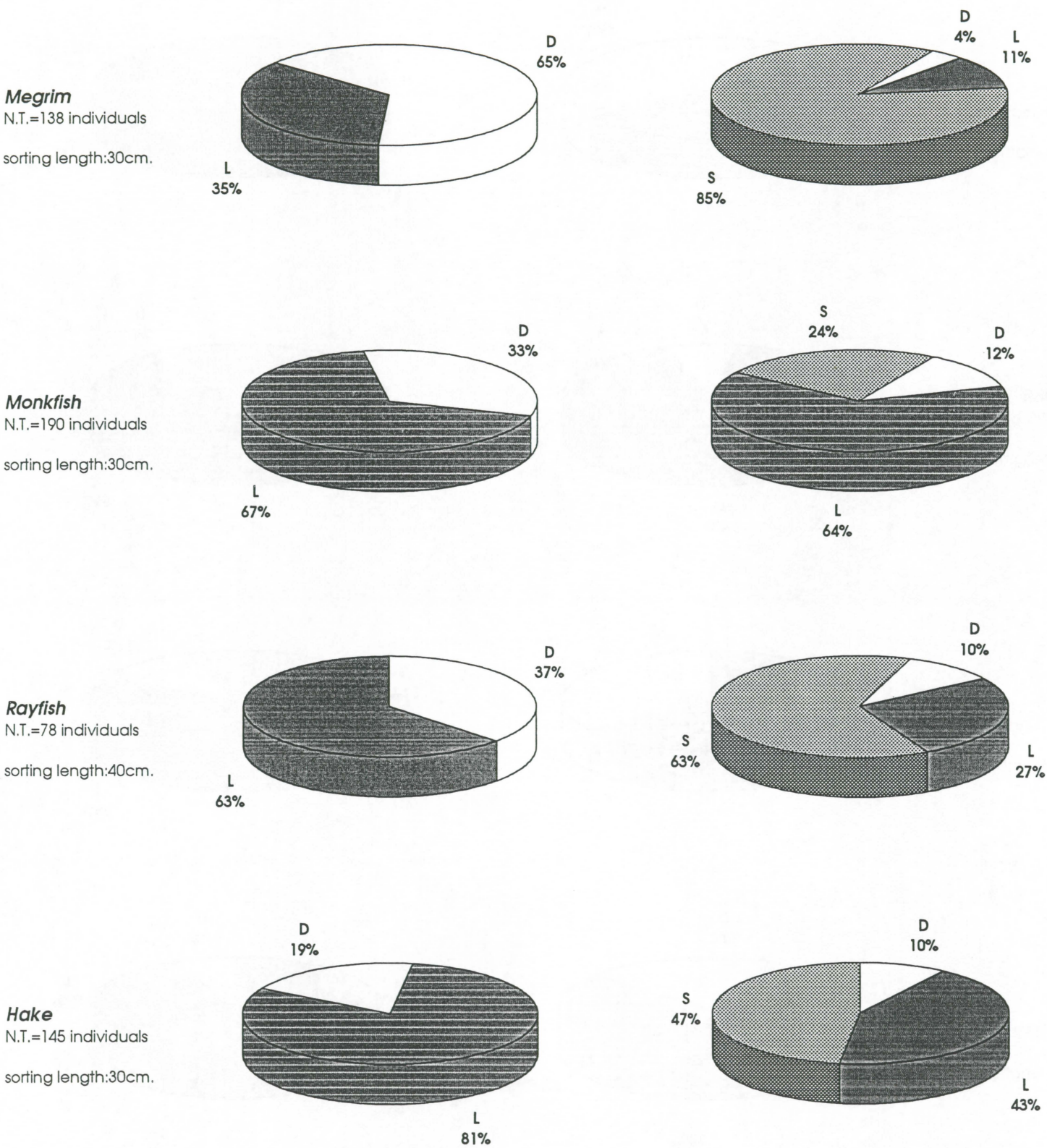

Figure: 5 Result of the comparison between the percentages of discards, landings, and survivors (escaping the 55 mm horizontal bars grid) of the same trawl fitted without or with a selective grid (N.T. = total number of individuals entering in the trawl) .

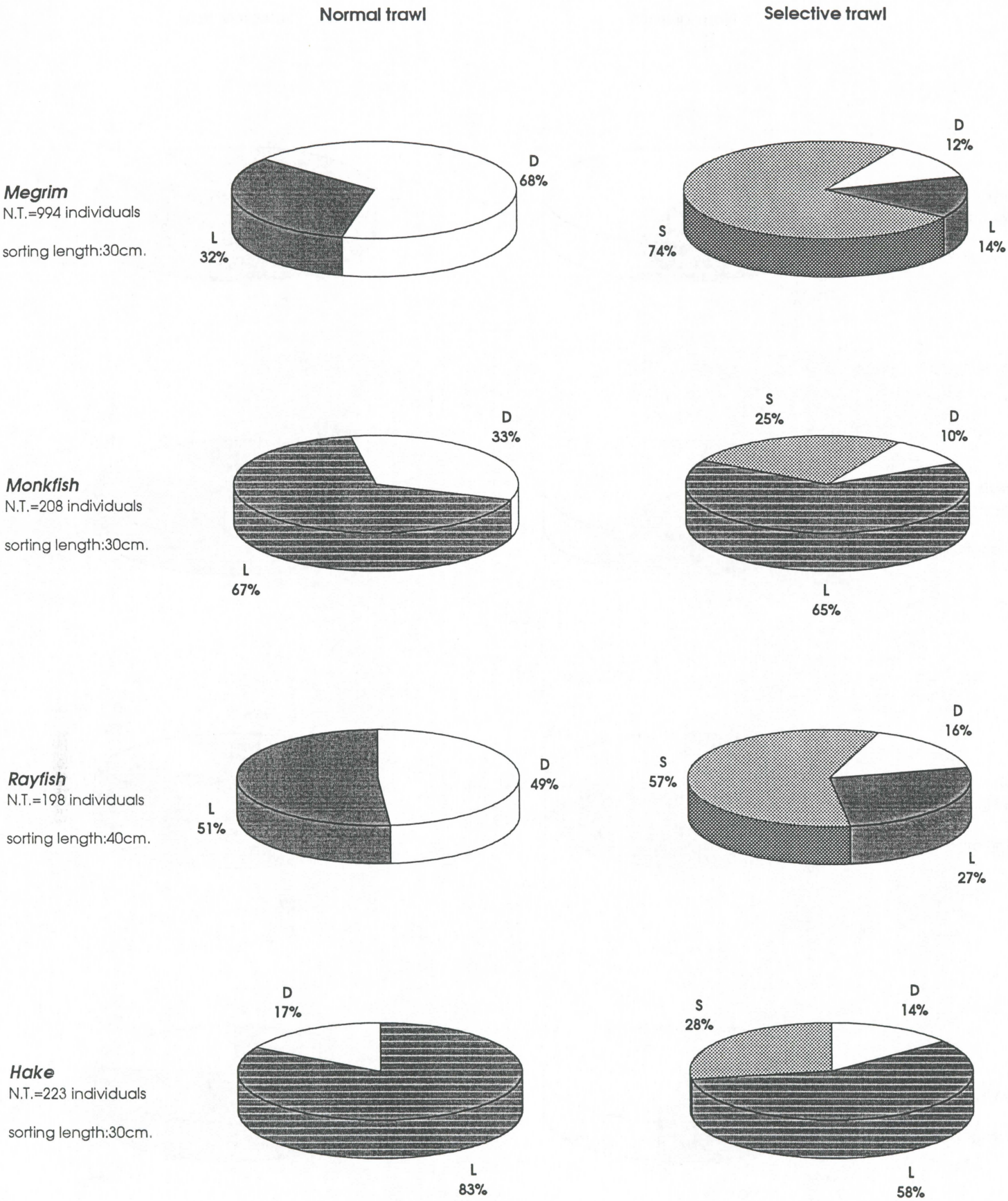

Figure: 6 Result of the comparison between the percentages of discards, landings, and survivors (escaping the 40 mm horizontal bars grid) of the same trawl fitted without or with a selective grid (N.T. = total number of individuals entering in the trawl) .

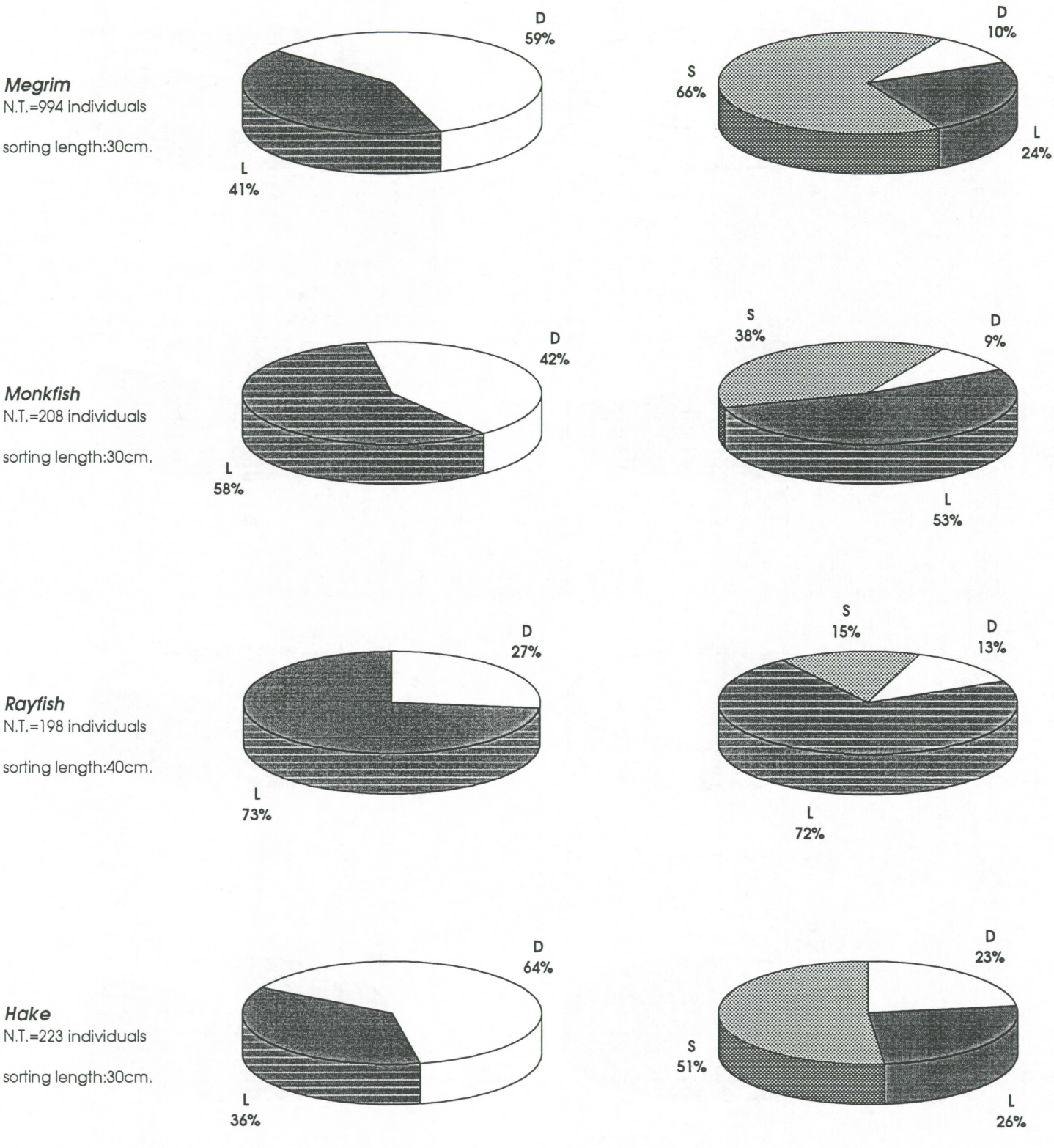

Figure: 7 Result of the comparison between the percentages of discards, landings, and survivors (escaping the 110 mm x 65 mm grid) of the same trawl fitted without or with a selective grid (N.T. = total number of individuals entering in the trawl) .

	MONKFISH		MEGRIM		RAYS		HAKE	
CODEND.	UPPER	LOWER	UPPER	LOWER	UPPER	LOWER	UPPER	LOWER
GRID WITH VERTICAL BARS SPACED 77.5mm	74 % 1650 g	26% 658 g	29% 580 g	71% 236 g	48% '800 g	52% 590 g	48% 656 g	52% 379 g
GRID WITH HORIZONTAL BARS SPACED 40 mm	96% 1365 g	4% 188 g	36% 338 g	64% 198 g	61% 930 g	39% 480 g	82% 527 g	18% 308 g
GRID WITH HORIZONTAL BARS SPACED 55 mm	94% 1271 g	6% 188 g	18% 323 g	82% 220 g	37% 850 g	63% 530 g	58% 406 g	42% 326 g
COMBINED GRID SPACED 110 mm* 65 mm	95% 1565 g	5% 229 g	65% 298 g	35% 140 g	98% 1071 g	2% 118 g	85% 676 g	15% 160 g

Table 1: Percentage of weigth and mean weight by species caught in the upper and lower codend of the selective trawl

	HYPOTHESIS WITH MIGRATION				HYPOTHESIS WITHOUT MIGRATION			
	F.U. using selective trawl		F.U. without selective trawl		F.U using selective trawl		F.U. without selective trawl	
	Gain in %	Gain in Tons	Gain in %	Gain in Tons	Gain in %	Gain in Tons	Gain in %	Gain in Tons
WHITE MONK	= +10 %		= + 0 %		= + 10 %		= + 0 %	
BLACK MONK	= +40%		= +100 %		= + 70 %		= + 0 %	
TOTAL MONK	= +20 %	= + 3000 T	= + 20 %	= + 600 T	= + 30 %	= + 3600 T	= + 0 %	= + 0 T
CUCKOO RAY	= +20 %	= + 1000 T	= + 20 %	= + 400 T	= + 30 %	= + 1400 T	= + 0 %	= + 0 T
MEGRIM	= + 0 %	= + 0 T	= + 75 %	= + 4000 T	= + 40 %	= + 4000 T	= + 0 %	= + 0 T
HAKE	= + 0 %	= + 0 T	= + 10 %	= + 4000 T	= + 60 %	= + 4000 T	= + 0 %	= + 0 T
TOTAL		**= + 4000 T**		**= + 9000 T**		**= + 13000 T**		**= + 0 T**

Table 2:Principal results of the 110mm* 65 mm selective trawl. Long-term gains in percentages and in weigth (vers international landings) for the fishery units using or not the selective trawl.