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Selectivity of 130 mm Mesh Size in Deep Sea Bottom Trawl Fishery in NAFO Regulatory Area

by

E. de Cárdenas[1], A. Avila de Melo[2], S. Iglesias[3] and F. Saborido[4]

1 Instituto Español de Oceanografía P.O. 240, Santander, Spain.
2 Instituto Português de Investigaçao Marítima, Av. Brasilia 1400, Lisboa, Portugal.
3 Instituto Español de Oceanografía. P.O. Box 1552 Vigo Spain.
4 Instituto de Investigaciones Marinas, Eduardo Cabello 8, Vigo Spain.

In February 1995 the European Community carried out a selectivity campaign on board of a Spanish commercial trawler, using the codend cover method. The objective was to study the selectivity of 130 mm mesh size for the deep sea trawl fisheries in the NAFO Regulatory Area. One hour and four hour hauls were used and results obtained for Greenland halibut, American plaice, roughhead grenadier and theebeard rockling. For the two flatfish species the proportion of retention increase with the duration of the haul. This increase, reflected in a decrease of the corresponding selection factor, also varies with the size of fish, being greater in smaller individuals, and induces an asymmetry in the selectivity curve. For the roundfish species data were enough only to fit the four hour selectivity curves, both appearing more symmetrical than the flatfishes ones.

Introduction.

Since the late eighties, Portugal and Spain developed a deep sea fishery in the NAFO Regulatory Area on depths between 800-1800m directed to Greenland halibut (Junquera et al. 1992). This new fishery shifted the distribution of the Greenland halibut catches in Northwest Atlantic to the slopes in the nose and tail of the Grand Bank.

Although at present the population structure, exploitation pattern and geographical distribution of Greenland halibut in sub areas 2 and 3 still remains uncertain, the declines recorded in several abundance indices over recent years might point out to a decline of this segment of the stock (Anon., 1994a).

The trawl mesh size enforce in NAFO Regulatory Area is 130mm, except for poliamide fibres where 120mm mesh is allowed and for directed fishery to squid (Anon.,1994b). As complement NAFO established minimum landing sizes for the main commercial species.

So far this minimum landing size was not available for Greenland halibut due to lack of selectivity data for this species.

With the purpose of filling this gap the European Community supported a campaign early this year whose results are now presented.

Material and methods

The campaign took place from 12 to 22 February on board of the Spanish stern trawler "Playa de Sartaxens". This vessel was constructed in 1987 and is able to trawl down to 2,000m depth, has a gross tonnage of 996 ton, a 2,000 HP power, total length of 75m, and a ... of 13m. The experiment followed the cover codend method (Pope et al., 1975) using one of the gears of the vessel. The mesh sized was determined with the net wetted, through 25 measurements with a graduate calliper CEE TS 21.06 001 made by A/S N.P. UTZON c/ Vejelevej 111, 7000 Fredericia, Denmark.

The codend, 30m long, was covered by a 35mm cover only in its last 15m since, as pointed out by Beverton (1963) and also confirmed in this experiment, the escape is mainly produced in the distal part of the codend. A 2.5m distance was kept between the codend and the cover to allow a normal escape of fish from one net to the other. To prevent the damage of either nets, that would invalidate the results the lower side of the uncovered codend and cover has been protected with a horse tail chafers.

A total of 15 hauls were made, 10 of which for length sampling and the rest for biological sampling and collection of Greenland halibut gonads.

In order to check the impact of time in selectivity two sets of hauls were made, one with 1 hour length and the other with 4 hours length (average length of a commercial haul).

Four species were analysed: Greenland halibut (Reinhardtius hippoglossoides), American plaice (Hippoglossoides platessoides), threebeard rockling (Gaidropsarus ensis) and roughhead grenadier (Macrourus berglax). All the species were measured to the lower centimetre, the first three from the tip of the nose till the end of the tail, and for roughhead grenadier from the tip of the nose till the beginning of the anal fin.

On the selectivity hauls, for each one of the studied species the respective catch from the codend and cover was weighted and measured (from sampling) separately.

The asymmetry showed in the plot of the retention against length was better adjusted by a generalized logistic curve given by the following retention length relationship (Nelder, 1961):

$$P_i = \left(\frac{1}{1+e^{(a+b\times L_i)}}\right)^m$$

Being

L_i = mean length of fish within the ith length group
P_i = retention of fish of the ith length group
a, b y m = parameters to be estimated

The calculi of these parameters is made by an iterative process that minimizes the function:

$$\Phi = \Sigma\, W_i * (P_i - \hat{P}_i)^2$$

Being

$$W_i = N_i * P_i * (1 - P_i)$$

Where

N_i = number of individuals in ith length group

The weighting factor W_i (Paloheimo & Cadima, 1964) is proportional to the number of observations used to estimate P_i, increasing as P_i aproaches 0.5 and being 0 when P_i equals 0 or 1.

Results

The mesh size of the codend was founded to be of 129.24mm, with a standard deviation of 4.24mm.

In table 1 are presented the number of fish measured within the overlapping range of the length distribution of the codend and cover.

For both threebeard rockling and roughhead grenadier, the number of individuals within the range of overlapping were not sufficient to made the adjustment for 1 hour trawl.

In table 2 are presented, for each time interval and species considered, the curve parameters as well as the sizes for 25%, 50% and 75% of retention and the selection factor.

Discussion

The selection of 2.4 for American plaice calculated by Walsh et al (1992) for 130mm mesh size lies between the values obtained in this study for 1hr and 4 hrs trawl. As regards the minimum landing size for this species of 28cm is similar to the size of 25% retention for 1hr trawl (this parameter is usually used to set the minimum landing size).

Both American plaice and Greenland halibut increase its retention with fishing time and this is reflected in a decrease of the respective selection factors. The main cause for this decrease is probably the accumulated catch at the end of the codend, stuffing it progressively. This pattern is more evident in the smaller sizes, as showed by the greater differences observed at L_{25} when compared with the ones recorded at L_{75} and should related to a greater difficulty that small fish face when trying to break through a codend increasingly filled up. This phenomena induces a greater asymmetry of the logistic curves for 4hr trawl, as already pointed out in selectivity studies of other flatfishes for instance megrim (Lepidorhombus sp.) in Astudillo and Sanchez (1989).

In the roundfishes studied roughhead grenadier, but mainly t. rocking present more symmetrical curves for 4hrs trawl.

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	1 hour		4 hours	
species	cover	codend	cover	codend
G. halibut	1463	838	287	866
A. plaice	1154	301	651	467
rockling	68	40	309	222
grenadier	64	187	369	467

Table 1.- number of fish measured within the overlapping range of the length distribution of the codend and cover.

1 hour

	a	b	m	L25	L50	L75	S.F.
G. halibut	19.631	-0.466	0.389	34.53	38.69	41.93	2.99
A. plaice	57.943	-1.582	0.102	28.05	32.34	34.89	2.50

4 hours

	a	b	m	L25	L50	L75	S.F.
G. halibut	24.226	-0.540	0.178	30.46	37.68	42.26	2.91
A. plaice	47.779	-1.375	0.101	24.75	29.75	32.72	2.30
grenadier	9.636	-0.599	0.310	8.65	12.55	15.39	0.97
rockling	13.538	-0.294	0.447	35.67	41.59	46.40	3.21

Table 2.- Parameters of the generalized logistic curves, L25, L50, L75 and S.F. for each species and time interval.

In figures 1 to 4 the logistic curves of each species are presented together with the observed values of retention.

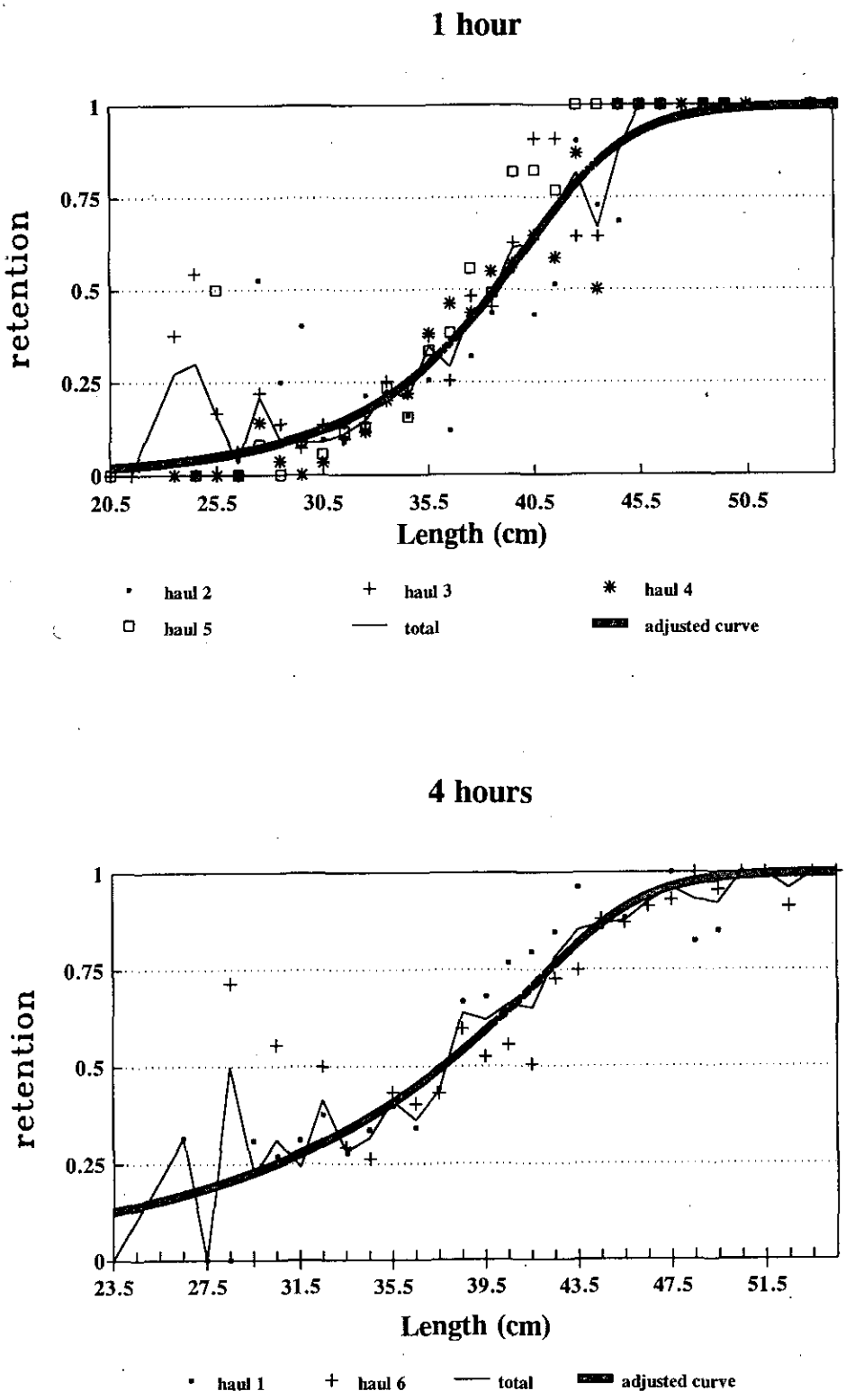
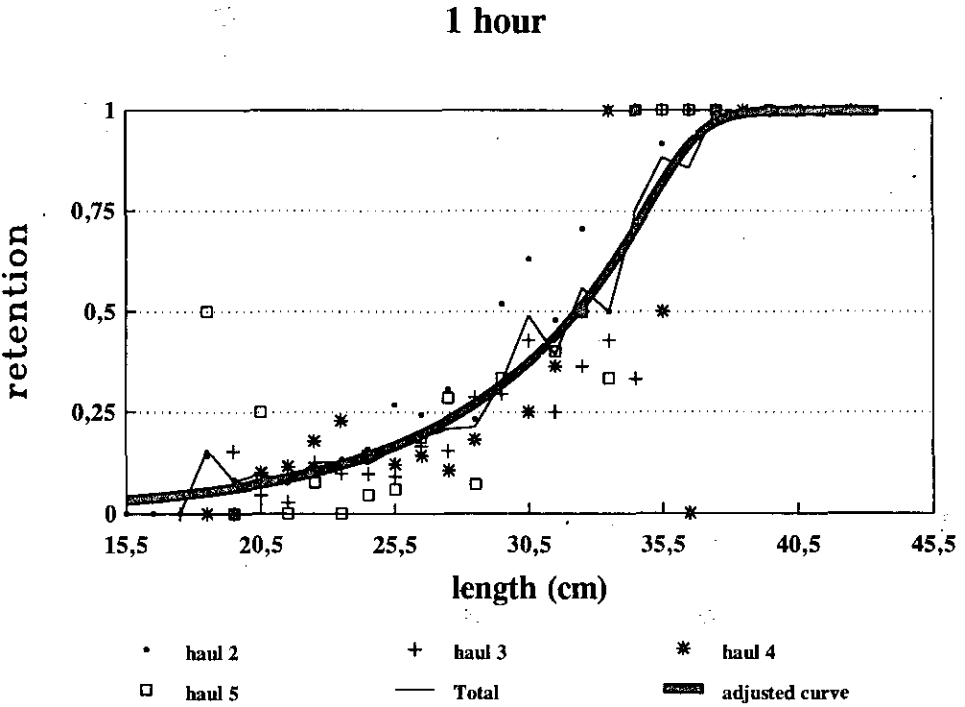


Fig. 1.- Selectivity for G. halibut



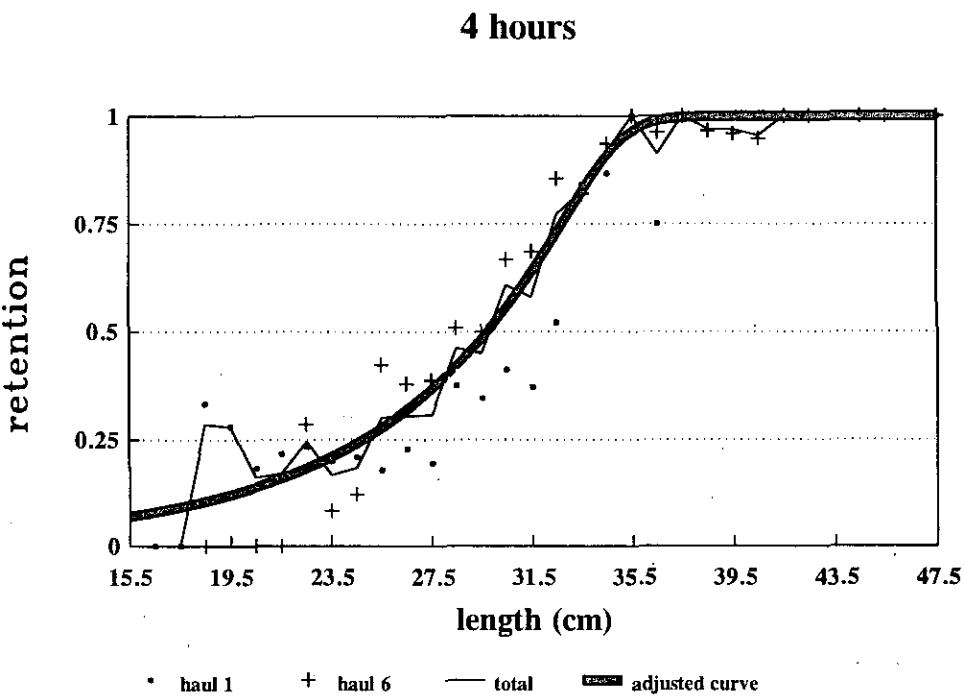


Fig. 2.- Selectivity for A. plaice.

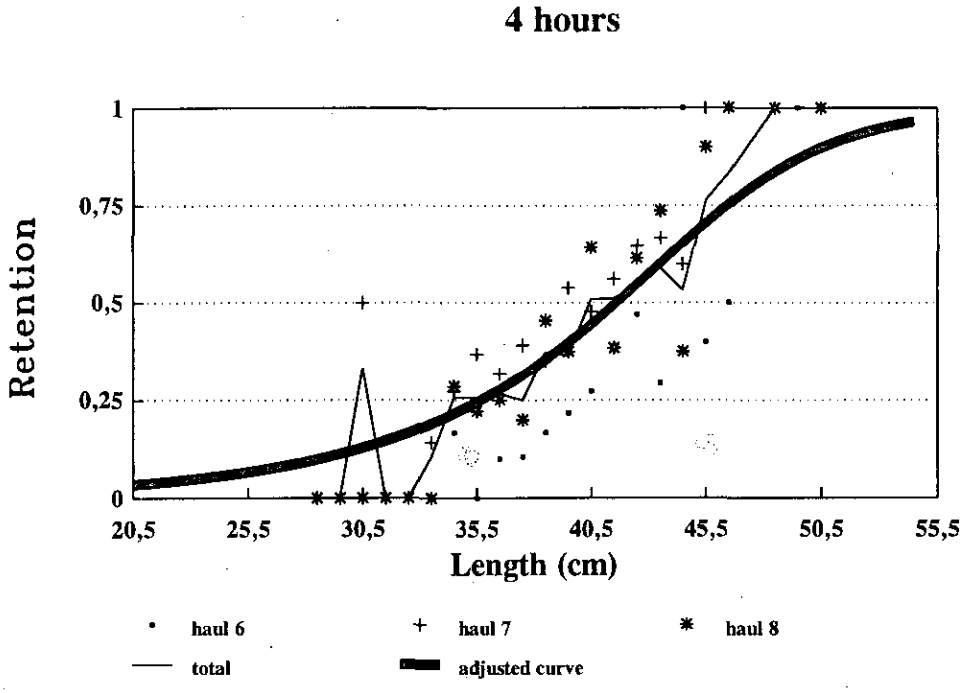


Fig. 3.- Selectivity for t. rockling

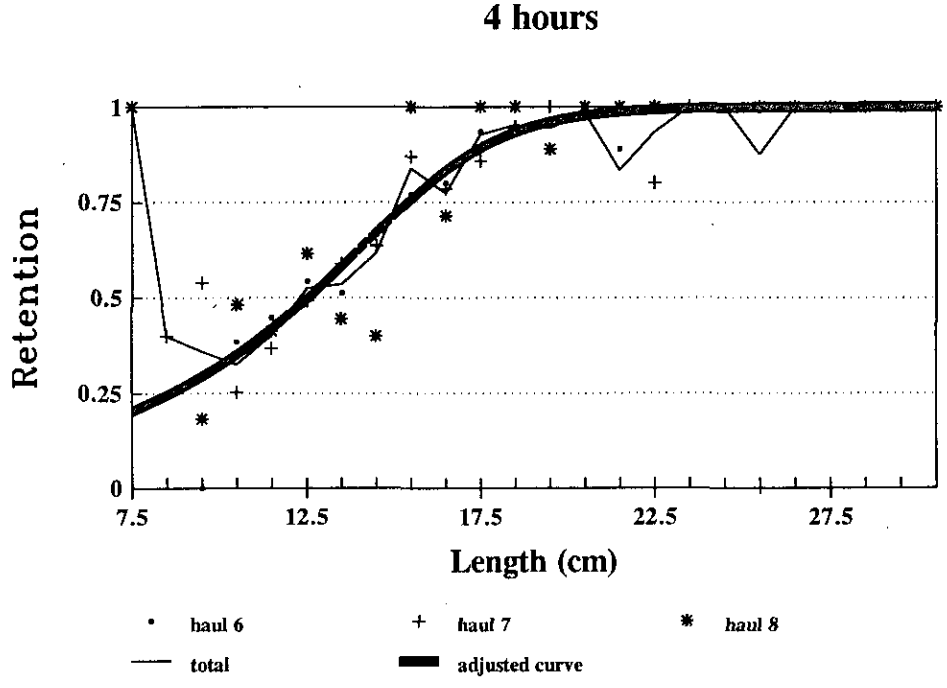


Fig. 4.- Selectivity for r. grenadier