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Selection of saithe by bottom trawl codends in Icelandic
waters

by

Hansjürgen Bohl
Institut für Fangtechnik, Hamburg



Introduction

As far as known to the author, till now little or nothing has been reported on the selection of saithe by trawls. The bibliography includes only one publication (Hysten, 1968) which is - in part - concerned with coalfish selection. However, no great importance could be attached to Hysten's data (selection factor 3.79; selection range 8.8 cm), because these were based on a single haul (carried out with a small Granton trawl in September 1967 of the Finnmark coast) and on a small number of fish within the selection range (233 specimens). The 136-mm-codend used by Hysten was made of double braided polypropylene splitfibre.

In order to fill the gap in the knowledge of saithe selection by trawls, two cruises were carried out with FRV "Anton Dohrn" in Icelandic waters. The first cruise (September/October 1976) failed owing to the absence of small saithe in the area of investigations: Only fish of more than 60 cm in length could be caught off South and West Iceland, i.e. all fish were retained by the codend used at that time (polyamide, double braided, plaited, mesh opening 152 mm). On the homeward voyage, however, one haul each could be made off Faroe Islands and on Viking Bank (northern North Sea) which indicated selection factors of 3.85 and 3.93 respectively (Bohl, unpublished).

The second cruise (May 1977) was more successful. Its results will be described in greater detail in the following.

Material and methods

The experiments were carried out in the second decade of May 1977 with FRV "Anton Dohrn" - a diesel-electric stern trawler of 83.2 m total length, 1987 gross tons, capable of developing 200 h.p.e. at 190 r.p.m. For the first time the 140 ft. standard roundfish bottom trawl used for all previous German selectivity trials in the North Atlantic, was replaced by a modern 180 ft. bottom trawl with a vertical net opening of about 7.5 m.

The codend and cover used as well as the physical properties of their netting yarns are described in Table 1. The cover attached to the topside of the codend was in accordance with ICES specifications. The inner underside of the codend was lined with small-meshed netting similar to that of the cover.

The codend mesh opening was determined immediately after each haul by measuring a marked row of 41 consecutive meshes running the full length of the codend parallel to its long axis in the middle of the upper panel. The mesh measurements were taken by means of an ICES mesh gauge adjusted to an operating pressure of 4 kg.

The length composition of the saithe catches was ascertained by measuring the total length to the centimeter below. To study the girth/length relationship of saithe, the unconstricted maximum body girth was measured to the nearest millimeter.

Results

Most of the time available in Icelandic waters was spent in searching for saithe, but dense aggregations of this species could be found neither west nor south of Iceland. Especially along the west coast coalfish were almost completely missing: Fifteen differently located hauls with a total towing time of 25 hours yielded about 100 specimens in the codend and exactly 13 specimen in the cover. Off the south coast the experimental conditions were somewhat better in so far as, occasionally, saithe of all length-classes could be caught. The

trials were finally concentrated on the fishing ground Beru-Deep where apparently the best chance was given to gain some knowledge of the selection of saithe. However, also there rather long tows were necessary to scratch up fairly satisfactory catches.

Suitable results were obtained from 23 hauls carried out in the Beru-Deep from 13 to 21 May 1977 by day and night. In general, the hauls conducted in the night proved more efficient than those conducted in the day-time. The total catches (saithe plus by-catch) of 22 hauls ranged from 0.4 to 2.4 metric tons per $2 \frac{3}{4}$ - 6 hours fishing, whilst the total catch of one haul amounted to 5.5 metric tons per $4 \frac{1}{4}$ hours fishing. Saithe were not always predominant; they represented in 4 hauls 30 - 50 %, in 14 hauls 50 - 75 % and in 5 hauls more than 75 % of the catch weights. The by-catches are listed by species in footnote 2 of Table 2.

The relative length composition of the total saithe catch which consisted of 4903 specimens caught in the codend plus 5611 specimens caught in the cover, is illustrated in Fig. 1. The distribution was clearly bimodal with a very prominent mode at 47.5 cm and a less prominent mode at 83.5 cm. The smallest and biggest fishes caught measured 34.5 cm and 117.5 cm respectively. Figure 2, showing the absolute length composition of the codend catch on the one hand and that of the cover catch on the other, demonstrates strikingly the protective effect of the 150.8 mm codend mesh used.

For the calculation of the selection data (Table 2), all hauls with saithe catches of less than 2 metric tons were combined (22 hauls, 6602 specimens). For one haul with a much bigger saithe catch (5.3 tons, 3912 specimens) the corresponding data were determined separately.

The two selection curves obtained are shown in Fig. 3. They are smoothed by using three-point moving averages and fitted by eye. The curve for the single haul exhibits some strong irregularities in the shape of its upper and lower limbs (see the points in parentheses); these are thought due to very small numbers of fish in the length-classes concerned (below 40 cm and above 65 cm). However, there is no question that the central part of the curve is reliable.

As shown in Table 2 and Fig. 3, the saithe selection factors were found to be 3.88 for the group of smaller catches and 3.51 for the single bigger catch. These results indicate that the selectivity of bottom trawls decreases with increasing catch-sizes. This phenomenon is already well-known from mesh selection experiments with some other species, especially redfish and flatfish.

The result of 342 saithe girth measurements taken during the course of the trials is shown graphically in Fig. 4. The relationship between maximum body girth (G) and total length (L) is described by the regression equation $G = 0.418 L + 5.544$ cm.

Final remark

There are still many gaps in the knowledge of the selection of saithe by trawls. Further experiments are urgently needed to confirm the selection factors reported so far, to investigate the possible influence of the towing time on the selectivity, and to study in greater detail the relationship between catch-size and selectivity.

References

- Brandt, A.v. and P.J.G. Carrothers (1964):
Test methods for fishing gear materials (twines
and netting).
In: Modern Fishing Gear of the World 2, Fishing
News (Books) Ltd., London
- Hysten, A. (1969): Selectivity experiments with a cod-end made
of polypropylene splitfiber.
ICES Coop. Res. Rep., Series B, 1968, p. 51 - 55.

Table 1: Description of the codend and cover used

<u>Codend</u>	
Code - Number	63
Material and type of fibre	Polyamid continuous
Construction of netting yarn of netting	Plaited Double braided
Method of manufacture	Machine-made
Treatment of netting yarn of netting	Untreated Thermo-fixed
Rtex (g/1000 m)	13057
Runnage (m/kg)	76.6
Diameter, nominal (mm)	6
Flexibility ¹⁾ , wet (g)	41.4
Weaver-knot breaking load, wet (kp)	579
Breaking load, without knot, dry (kp)	708
wet (kp)	611
Breaking length, dry (km)	54.2
wet (km)	46.8
Knot breaking length, wet, 1/2 (km)	22.2
Elongation (% at a load of	
5 kp	0.2
10 kp	1.2
30 kp	4.5
50 kp	7.0
1/2 weaver-knot breaking load, wet (kp)	16.9
Number of hours of previous use	80.3
<u>Cover</u>	
Type	Topside cover of ICES specification
Material and type of fibre	Polyamide continuous
Construction of netting yarn of netting	Twisted Single braided
Rtex (g/1000 m)	5000
Runnage (m/kg)	200
Mesh opening (mm)	70

1) The flexibility has been determined by means of the "Lötzener Methode" described by v. Brandt and Carrothers (1964).

Table 2: Compilation of selection data for saithe

Ship Gear	FRV "Anton Dohrn" 180 ft. roundfish bottom trawl	
Locality	Beru-Deep (SE-Iceland), ICES Div. Va	
Date	13 - 21 May 1977	
Experimental method	Covered codend technique	
Type of mesh gauge	ICES gauge; 4 kg pressure	
Saithe catch size category, codend plus cover per haul	<2 metric tons	>2 metric tons
Number of hauls	22	1
Duration of tow; mean (minutes) range (minutes)	237 165 - 360	255 -
Depth range (m)	137 - 252	148 - 202
Range of total catch/haul (baskets) ¹⁾	6 - 38 1/4	88
Range of saithe catch/haul (baskets) ¹⁾ :		
- codend	2 3/4 - 23	35 3/4
- cover	1/4 - 5 3/4	49
Range of by-catch ²⁾ /haul (baskets) ¹⁾ :		
- codend	1 1/4 - 11 3/4	2 3/4
- cover	1/4 - 10 3/4	1/2
Av. total catch/hour (baskets) ¹⁾	5.4	20.7
Av. saithe catch/hour (baskets) ¹⁾ :		
- codend	2.7	8.4
- cover	0.7	11.5
Av. by-catch ²⁾ /hour (baskets) ¹⁾ :		
- codend	1.2	0.7
- cover	0.8	0.1
25 % - 75 % selection range (mm)	170	130
No. of saithe in selection range:		
- codend	899	1034
- cover	1649	1416
Total no. of saithe:		
- codend	3528	1375
- cover	3074	2537
Codend mesh opening:		
- mean (mm)	150.6	150.8
- range (mm)	144 - 159	144 - 156
- no. of measurements	902	41
50 % retention length (mm)	585	529
Selection factor	3.88	3.51

1) One basket holds approximately 63 kg of fish

2) Mainly Gadus morhua and Melanogrammus aeglefinus; smaller quantities of Sebastes marinus, Anarhichas lupus, A. minur, Hippoglossus hippoglossus, Hippoglossoides platessoides, Microstomus kitt, skates and rays; sporadically Molva molva, Brosme brosme, Lophius piscatorius, Squalus acanthias, Pleuronectes platessa and Scophthalmus maximus.

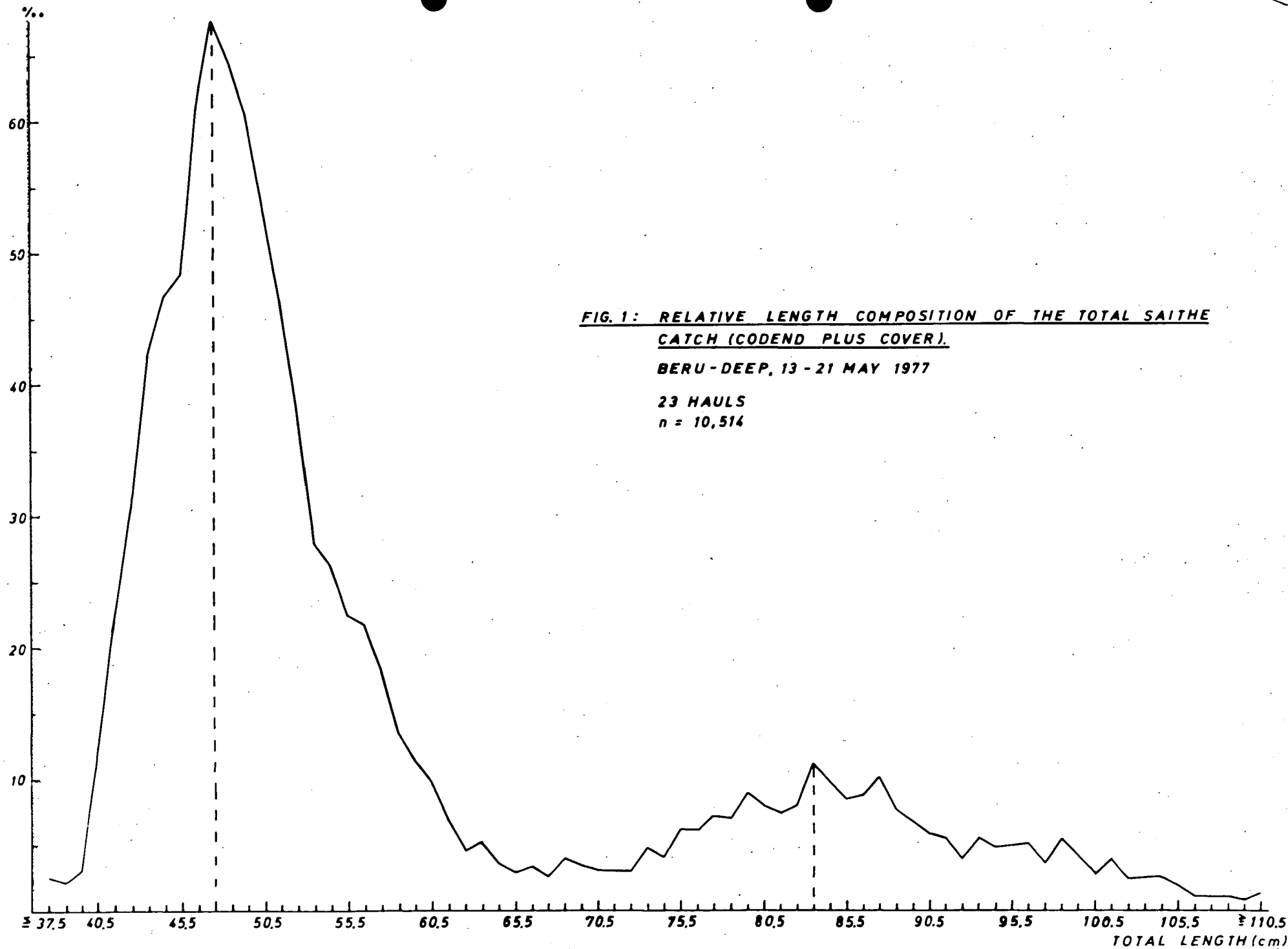


FIG. 1: RELATIVE LENGTH COMPOSITION OF THE TOTAL SAITHE CATCH (CODEND PLUS COVER).
BERU-DEEP, 13 - 21 MAY 1977
23 HAULS
n = 10,514

No. of fish caught

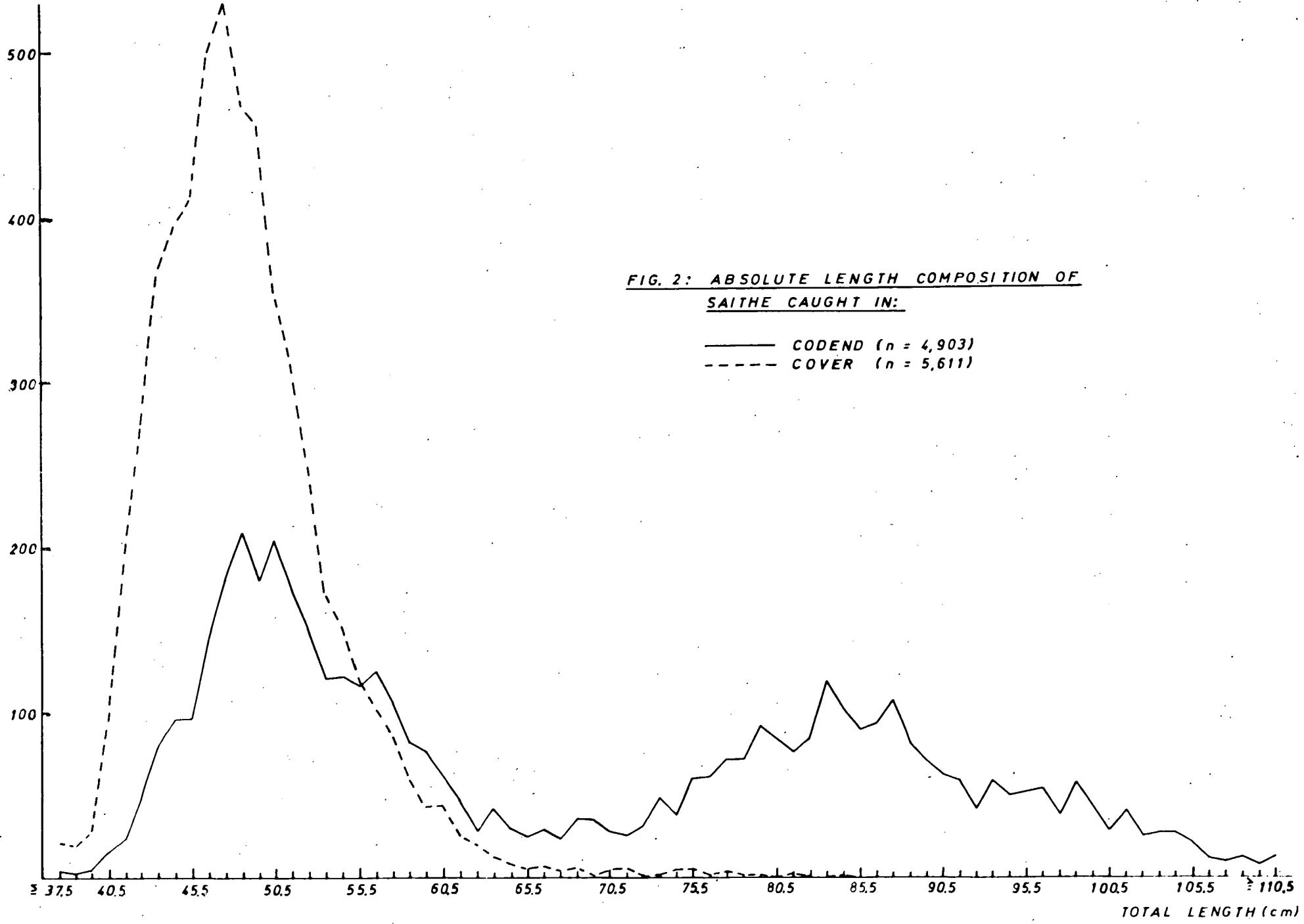


FIG. 2: ABSOLUTE LENGTH COMPOSITION OF SAI THE CAUGHT IN:

— CODEND (n = 4,903)
- - - COVER (n = 5,611)

TOTAL LENGTH (cm)

% RETAINED

(o) (o)(o) (o)(o)(o)(o)(o)(o)(o)(o)
(o)(o)

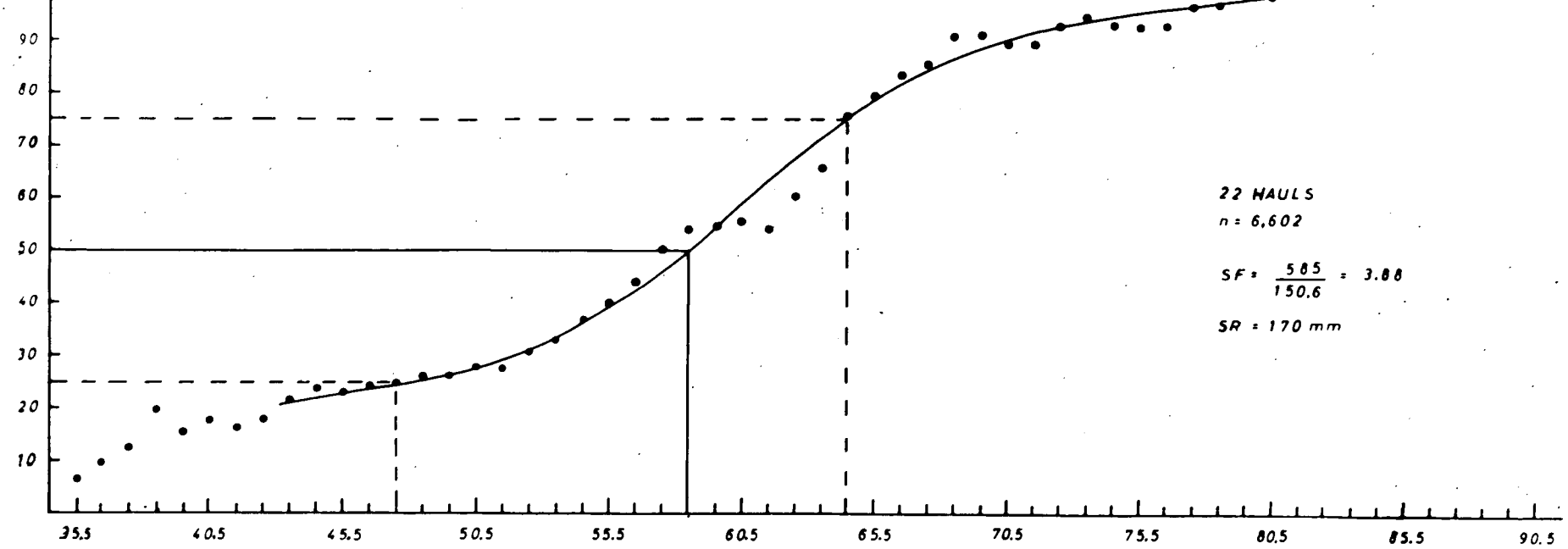
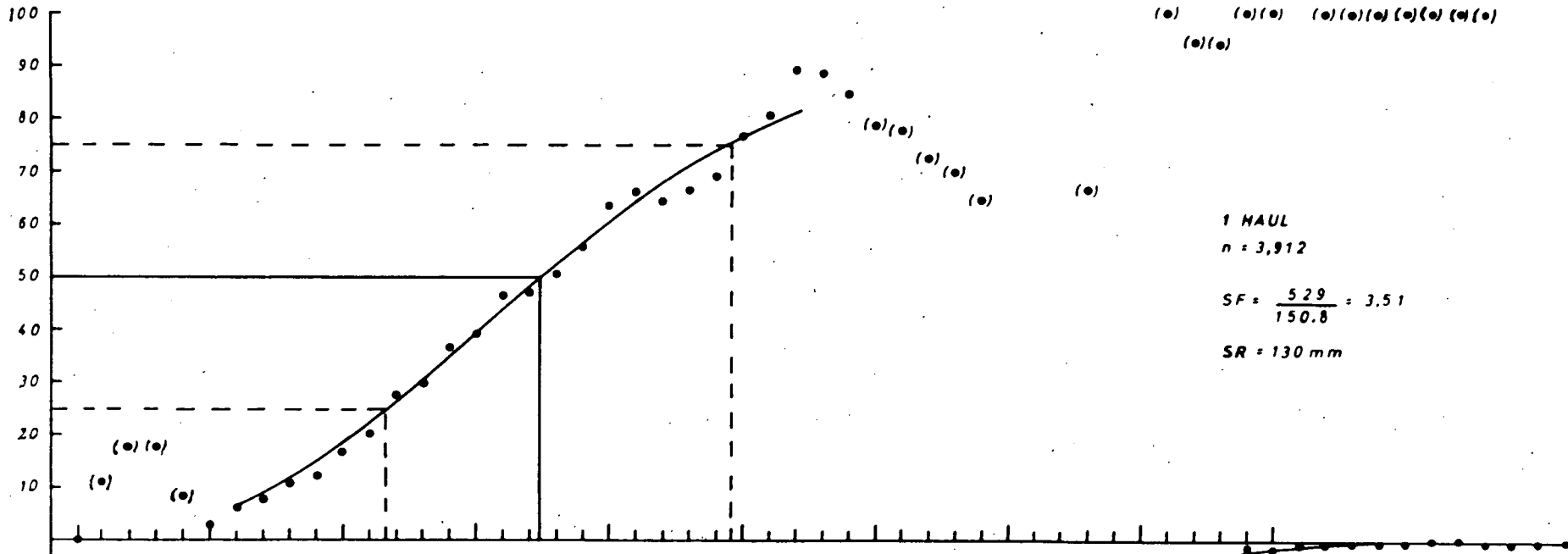
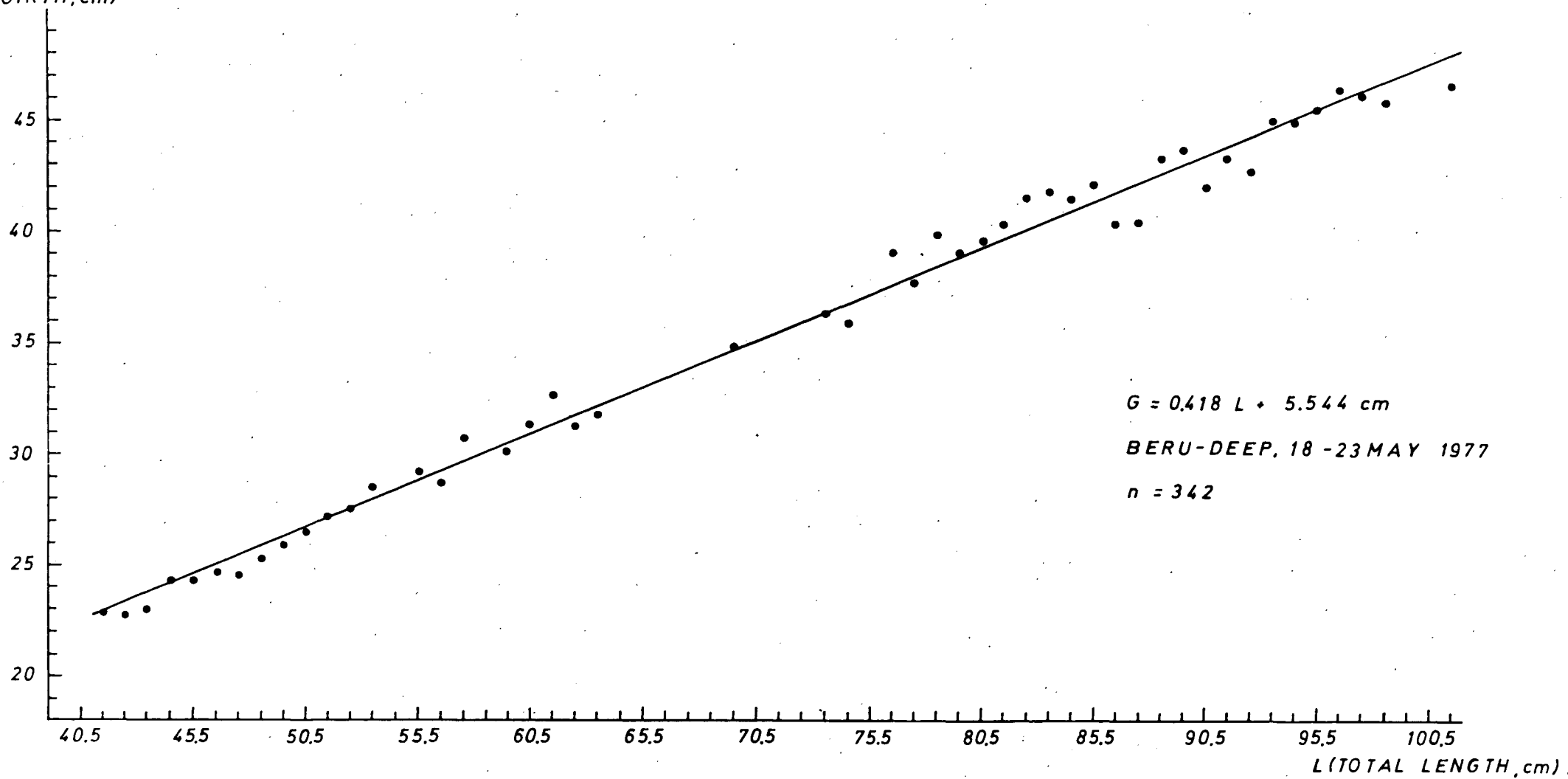


FIG. 3: SELECTION CURVES FOR SAITHE

TOTAL LENGTH (cm)

G
(AV. MAX.
GIRTH, cm)



$G = 0.418 L + 5.544$ cm

BERU-DEEP, 18 -23 MAY 1977

$n = 342$

FIG. 4: SAITHE GIRTH/LENGTH RELATIONSHIP