INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

Serial No. 447 Document No. 9

ANNUAL MEETING - MAY 1957

SPANISH RESEARCH REPORT - 1956

The Researches carried out during the Campaign on board the Trawlers "Santa Ines" and "Santa Celia" in Subdivision 3N, the Grand Bank of Newfoundland, in September 1956.

by Dr. Alfonso Rojo

Introduction

As in previous years the studies carried out on board the Spanish commercial fishing vessels in 1956 have been mainly concerned with cod, Gadus callarias L., and haddock, Melanogrammus aeglefinus (L), the two species principally caught by the Spanish vessels.

The vessels used during the investigation were the "Santa Ines" and "Santa Celia", both of the fishing company PESSA which has its headquarters in Madrid. The two trawlers are of 1,360 gross tons with a length of 68.5 metres; both vessels are provided with 6-cylinder diesel motors which give a speed of 13 knots; both are provided with echo-sounders; the "Sanata Celia" also with a fishloupe. The trawls used by both vessels are identical in material and fabrication, although the captains may make some small modifications in the use of the trawls based on their own experience. The trawls are manufactured from No. 4 manila. When measured by means of a calibrator (Scottish Spring gauge) the meshes measure 120.6 mm. internal diagonal measurement when the net is new and dry, and around 110 mm. after use. In order to calculate the mean mesh size 40 meshes were measured.

Place of Fishery - The area investigated was Subdivision 3N, on the Grand Bank of Newfoundland, between 44°17' and 45°54' N. Lat. and 50°03' and 51°15' W. Long. This region is northwest of the so-called Plateau of the Grand Bank. The same region was studied in 1954 on board the trawler "Mistral" during June and July.

The 1955 cruise also took place in much the same area. The results of these three years are therefore comparable.

Season of the Cruise - The duration of the cruise was three weeks during the month of September, 1956.

Particulars about the Fishery - During August, Sept. and part of Oct., twelve Spanish vessels were fishing in the area, however, under changing conditions.

At the end of August, when the campaign started cod and haddock were caught. The cod were small and much mixed with haddock; but during September and the first half of October the cod increased in quantity and in quality. About the middle of October the cod disappeared from that region.

The haddock, on the contrary, was decreasing in quantity during September and it was very scarce towards the end of the month. The size of the haddock increased during the month.

A. COD

1. Size

The samples were taken on board the two trawlers by the author when the fish came on deck. From the catch of each haul a representative part was taken for length measurements and age determination (otoliths).

...../2.

The length was measured from the snout to the fork of the tail fin; the measurements were later grouped in 3 cm. groups. Attached are curves of percentage length distribution for the samples of the separate days, and for all samples together. A total of 3,400 specimens were measured. The mean size in September was 52.31 cm.

TABLE 1

COD. Number and Frequency Percentages by 3 cm. groups. Subdivision 3N. September 1956.

Cms.	N.	%	Cms.	N.	%
26	4	0.11	80	27	0.77
29	15	0.42	83	15	0.42
32	34	0.97	86	14	0.42
35	79	2.25	89	7	0.20
38	175	5.05	92	8	0.22
41	345	9.85	95	8	0.22
44	388	11.08	98	11	0.31
47	454	12.97	101	7	0.20
50	513	14.66	104	7	0.20
53	422	12.60	107	8	0.22
56	284	8.16	110	9	0.25
59	147	4.20	113	4	0.11
62	105	3.00	116	7	0.20
65	91	2.60	119	3	0.08
68	83	2.37	122	3	0.08
71	104	2.97	125	-	-
74	68	1.94	128	2	0.05
77	48	1.37	-	-	-

The mean size of the samples varied from day to day with a tendency to increase during the campaign (see Fig. 1). The equation of this tendency has been found to be as follows:

$$Y = 46.743 + 0.81.x$$

The values of the means in the successive days of sampling were:

TABLE 2.

COD. Mean size on the Various Days in September 1956.

Day	Mean
1	42.38
2	51.32
3	53.07
4	46.31
5	50.03
7	50.93
8	48.50
10	43.43
12	56.39
13	53.66
14	50.54
15	49.55
16	55.40
17	60.50
18	62.24

...../3.

The total mean of the samples is 52.31. The mean size varies from day to day between 42.38 and 62.24 cm., these sizes being found on the first and the last day of the sampling. This seems to indicate that the stock of cod is migrating through the region during the cruise.

A summary of the study of the size of the cod in Subdivision 3N in 1954, 1955 & 1956 are given in Fig. 2. The mean size of the cod increased over this period. Between 1954 and 1955 the mean size increased from 53 to 58.5 cm., and between 1955 (July-August) and 1956 the two peaks of 41 and 62 cm. are displaced to 50 and 71 cm. respectively. These changes in mean size correspond to changes in age composition over the same years.

In 1955 three cruises were made in April-May. The results were not then reported to the Commission because the main attention of the Spanish researches that year was centred on the haddock. Therefore the curves of the size of cod from that year are given now (Fig. 3).

1. Subdivision 3O. The samples from this subdivision were taken in February and April. The mean size in February was 59 cm. and in April as much as 71 cm. An increase in size during the campaign was also found in September of 1956.

2. Subdivision 3L. The samples were taken in April and May. The same phenomenon is found, namely the increase in size during the period of investigations, but the stocks are more uniform. The absence of small sized fish is apparent. The mean size for this subdivision and season is 59 cm.

3. Subdivision 4V. The fishery in this subdivision was carried out in April. Only one sample of 708 specimens was taken; their mean size was 50 cm. which corresponds to the small commercial culling.

4. Subdivision 3N. This subdivision accounts for the greatest proportion of small cod. The mean size was only 41 cm. It is worth noting that many specimens of one year's age were found in the stomachs of the adult cod.

The curves for the above-mentioned subdivisions are attached.

Table 3 shows size and age distribution of 600 cod fished in Subdivision 3N in September 1956.

2. Quantity of Cod Discarded

It is difficult to estimate the quantity of cod discarded by the Spanish fishing fleet which is composed of 30 trawlers and an additional number of pair trawlers, because the captains only estimate the quantities of each size of fish which are placed in the holds.

Therefore the values calculated are given in percent of the total number of specimens measured in the different cruises (see Fig. 3). This number varies considerably according to the area subdivision and the season of the year.

However, one can see two well-defined groups (Table 4). The quantities discarded in summer an autumn until October are much larger than those discarded in winter and spring. The reason for this is that in the spring the concentrations of cod on the banks for spawning are composed of adult specimens, while in summer and autumn the population is more heterogeneous.

In fact the number of specimens discarded is much smaller because practically all the cod caught are used. Only for comparison we are giving the following numbers (Table 4).

...../4.

TABLE 3.

Age and Size of 600 Cod caught in Subdivision 3N in September, 1956

Cms.	2	3	4	5	6	7	8	9	10	11	12	13	15	16	17	18	19	20	21	23	Total
26	2																				2
29	3																				3
32	1																				1
35		2	1	1																	4
38		9	8	1																	18
41		5	15	9	2																31
44		10	15	15	1																41
47		2	20	28	8	1															59
50			26	50	16	1															93
53			20	45	17	2															84
56			7	25	12	6	1														51
59			2	6	17	9	3	1													38
62					3	10	3	3													19
65				2	4	4	3														13
68				1	-	11	8	2	2												24
71					1	6	6	7	2												22
74					3	3	9	6	1	1											23
77							7	2	3												12
80						1	3	2	3	-	1										10
83						1	1	2	3	1					1						9
86								1	1	1											3
89									1					1							2
92								1	2	1											4
95								1	2												3
98									2	1		2									5
101										1	1	1		1							4
104													1				1				2
107														1	1			1			3
110													1	1		1	1				4
113															1						1
116														2				1			3
119													1	1			1		1		4
122																			2	1	3
125																			2		2
Total	6	28	114	183	84	55	44	28	22	6	2	3	3	7	3	1	3	2	5	1	(600)

The smallest cod "theoretically" used by the vessels are those of 40 cm. All smaller cod are discarded into the sea.

The data in the following Table 4 are calculated for the various cruises which lasted more or less one month each.

TABLE 4.

COD.	Percentage Number of Specimens Discarded (smaller than 40 cms.) 1954	1955	1956
Spring 3L		1.89%	
Spring 3O		0.48%	
Spring 4V		0.56%	
Summer 3N	2%	16%	8.7%
Mean Sizes for the Same Cruises			
Spring 3L		59 cms.	
Spring 3O		59-65 cms.	
Spring 4V		50 cms.	
Summer 3N	51-55 cms.	39-41 cms.	49-52 cms.

...../5.

3. Age Distribution of Cod

Otoliths of 600 specimens were used for the study of age. In the majority it was easy to count the age. The largest percentage was found for age-group 5, followed by age-groups 4 and 6. All the specimens aged are from Subdivision 3N in September 1956. In the attached Fig. 4 the age distribution for the years 1953, 1954, 1955 and 1956 are given. The 1949 year-class predominated only for two years (1954 and June 1955), although it is still rather well represented in the catches. In 1953 it occupied the second place. The 1951 year-class has been very good in 1955 and 1956. This year-class also appears to be good for haddock, judging from the growth of the scale rings of that year.

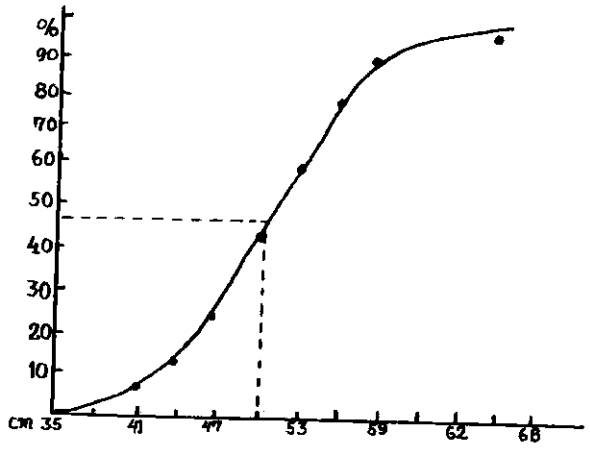
TABLE 5.

COD. Age Distribution, Numbers & Percentages, Subdivision 3L, September 1956.

Age	Yr. Cl.	Freq.	Percentage
2	1954	6	1.00
3	1953	28	4.66
4	1952	114	19.00
5	1951	183	30.50
6	1950	84	14.00
7	1949	55	9.16
8	1948	44	7.33
9	1947	28	4.66
10	1946	22	3.66
11	1945	6	1.00
12	1944	2	0.33
13	1943	3	0.50
14	1942	-	-
15	1941	3	0.50
16	1940	7	1.16
17	1939	3	0.50
18	1938	1	0.16
19	1937	3	0.50
20	1936	2	0.33
21	1935	5	0.83
23	1933	1	0.16

FIGURE 5.

COD. Subdivision 3N, September 1956. Maturity by size categories.



4. Sex and Maturity

In September only immature specimens or specimens which already had spawned in the preceding spring were found. As an exceptional case, it can be mentioned that two specimens (males) in the maturity stages IV and V were found. In order to get the largest possible amount of data, the material was only sorted in two categories: immature and mature. From a total of 622 specimens, the following distribution was found:

Immature	236	individuals	or	37.94%
Mature	384	"	"	61.73%
Stage IV	1	"	"	0.16%
Stage V	1	"	"	0.16%
Total	622			

The males and the females are found practically in the same proportion in the stock:

Males	304	representing	48.87%
Females	318	"	51.12%

...../6.

Figure 5 shows the distribution of sexual maturity. The curve indicates that at 50 cm. 50% were mature. (Exactly: 50.53% immature and 49.46% mature.)

TABLE 6.

COD. State of maturity by 3 cm. size-groups, Subdivision 3N, September 1956.

Cms.	Immature	Percentage	Mature	Percentage
26	2	100.00		
29	3	100.00		
32	1	100.00		
35	4	100.00		
38	18	100.00		
41	29	93.54	2	6.45
44	36	87.19	5	12.19
47	45	76.27	14	23.72
50	47	50.53	46	49.46
53	29	34.52	55	65.47
56	10	19.60	41	80.39
59	3	7.89	35	92.10
62	-	-	19	100.00
65	1	7.69	12	92.30
68	1	4.16	23	95.83
71	-	-	22	100.00
74	-	-	23	100.00

All larger individuals were mature.

---

5. Stomach Contents

The preferred food of the cod at this time in this area is the capelin (Mallotus villosus O.F.M.). However, other species were also found in the stomachs. On the 11th of September it was impossible to fish owing to the hurricane "Dora", and as various observations show a change in the feeding of the cod took place from this date. In the cod caught before the 11th of September 60 percent had empty stomachs:

Full stomachs	136	=	39.3%
Empty stomachs	210	=	60.7%

The amount of food found in the 136 specimens was very scarce even if the stomachs are noted as "full", and the species eaten were the common mussel, haddock, spider crabs, sea urchins, hermit crabs, prawn, Ammodytes americanus in small numbers, annelids, actinians, plaice, whelks and clams; all slow-moving animals living on the bottom.

After the 11th of September the picture of feeding changed completely, hand in hand with an increase of the stock until the first days of October. The number of cod with a full stomach were as follows:

Full stomachs	169	=	61.2%
Empty stomachs	107	=	38.8%

The only species found in the stomach from 12th September and onwards was the capelin, and in very large quantities. The effect of the hurricane on the capelin was to make it seek deeper waters, and the cod followed. During the time after the hurricane a vertical displacement of the cod towards deeper waters was observed.

...../7.

6. Parasitism

The number of specimens with parasites is small in this subdivision. Only external parasites (Clavella and Lernaeocera) were found. Of 625 specimens examined three were infected with Lernaeocera and 46 with Clavella.

B. HADDOCK

1. Size

The variation of sizes is about the same for haddock as for cod. The size increases during the month of investigation; its abundance, however, decreases during that period.

In September a total of 2,422 specimens were measured. Of these 56.72% were discarded as being too small for the fishing industry.

TABLE 7.

HADDOCK. Numbers and frequency percentages by 3 cm. groups, Subdivision 3N, September 1956.

Cms.	No.	Percentage	Cms.	No.	Percentage
20	12	0.49	47	193	7.96
23	34	1.40	50	78	3.22
26	13	0.53	53	28	1.15
29	29	1.97	56	13	0.53
32	197	8.13	59	6	0.24
35	417	17.21	62	14	0.57
38	672	27.74	65	2	0.08
41	382	15.77	68	-	-
44	331	13.66	71	1	0.04
			Total	2,422	

The length curves for the samples taken since 1954 in Subdivision 3N (Grand Banks) are shown in Fig. 6.

In 1954 there were two rich year-classes showing as peaks in the length curve, that of 1949 and that of 1946. In July-August 1955 the 1949 year-class was still rich; and the three year old 1952 year-class was entering the fishery. This is also apparent for the length distribution curves for December 1955.

In September 1956 there was only one peak on the length distribution curve, corresponding to the 1952 year-class.

In July-August 1955 there is a very small peak for the 1946 year-class. This peak is not found in December of that year.

The 1952 year-class will probably play a considerable role in the fishery of 1957.

2. Maturity

The material was divided in two categories: immature, 35 specimens; and mature, 56 specimens. The relation between males and females is as follows: males, 28 or 43.07%; females, 37 or 56.92%.

3. Stomach Contents

Of a total of 91 specimens 30 or 33% had full stomachs, and 61 or 67% empty stomachs.

...../8.

4. Age Distribution

Scales of 91 of the 2,422 haddock measured were taken for age determination. The following age distribution was found:

TABLE 8.

Age and size of 91 haddock caught in Subdivision 3N in September 1956.

Age	1	2	3	4	5	6	7	8	9	10	11	
	1955	1954	1953	1952	1951	1950	1949	1948	1947	1946	1945	Total
cms.												
20	4											4
23	5											5
26	1											1
29												-
32			2									2
35			3	6								9
38		1	3	6			1					11
41				6	2	4	4					16
44			1			3	8					12
47						3	11	1				15
50						3	7			1		11
53							1					1
56												-
59											1	1
62										1		1
65												-
68												-
71										1		1
74												-
77										1		1
	10	1	9	18	2	13	32	1	-	4	1	91
Per-cent	10.98	1.09	9.89	19.78	2.19	14.28	35.16	1.09		4.39	1.09	

Using this table as an age-size key the figures for the various year-classes corresponding to the total of specimens measured (2,422) were calculated.

The same procedure was used for the samples from the previous years. Fig. 7 is based on these calculations. It shows the comparative strength of the year-classes in the three years 1954, 1955 and 1956. In the table above (Table 8) it is noted that there are no specimens for the 3 cm. size-groups 29, 53, 65, 68 and 74 cm. In order to get their proportion in the total, figures from the previous years were used, estimating the age in conformity with the growth curves for the area in question.

- THE END -

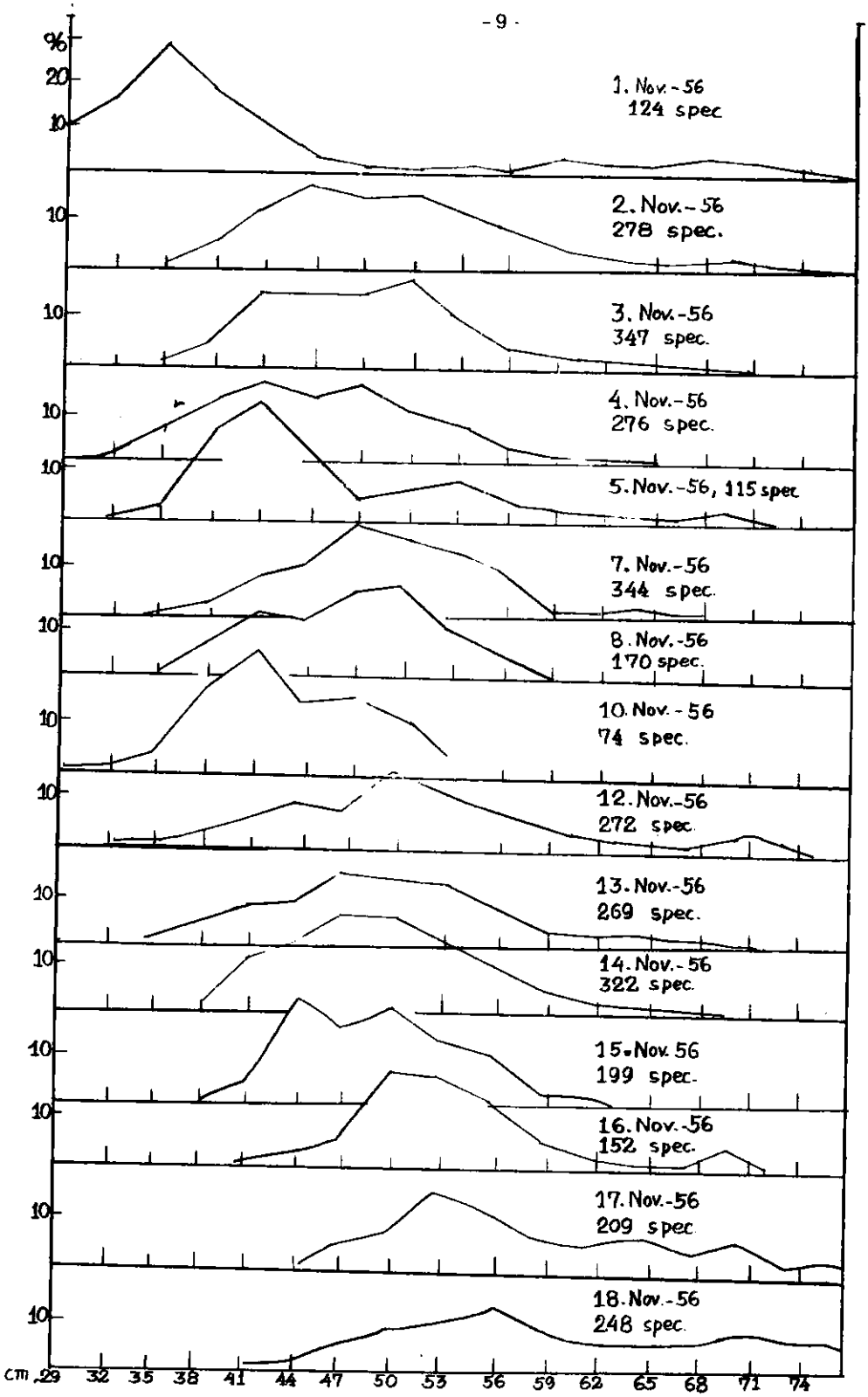


FIGURE 1. COD. Grand Bank of Newfoundland (3N), September 1956. Daily variations in size composition.

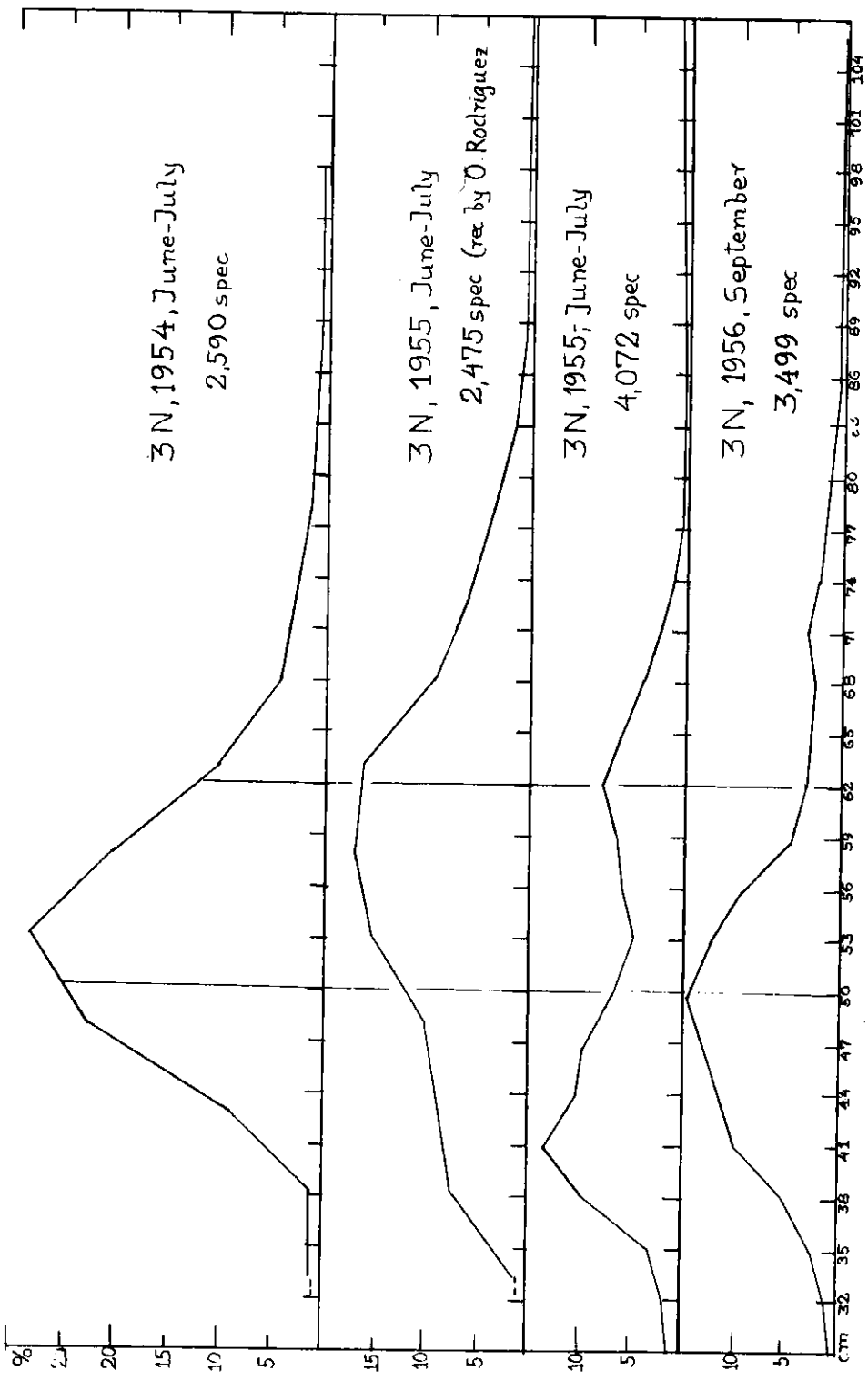


FIGURE 2. COD. Length frequency curves. Subdivision 3N, 1954, 1955, and 1956.

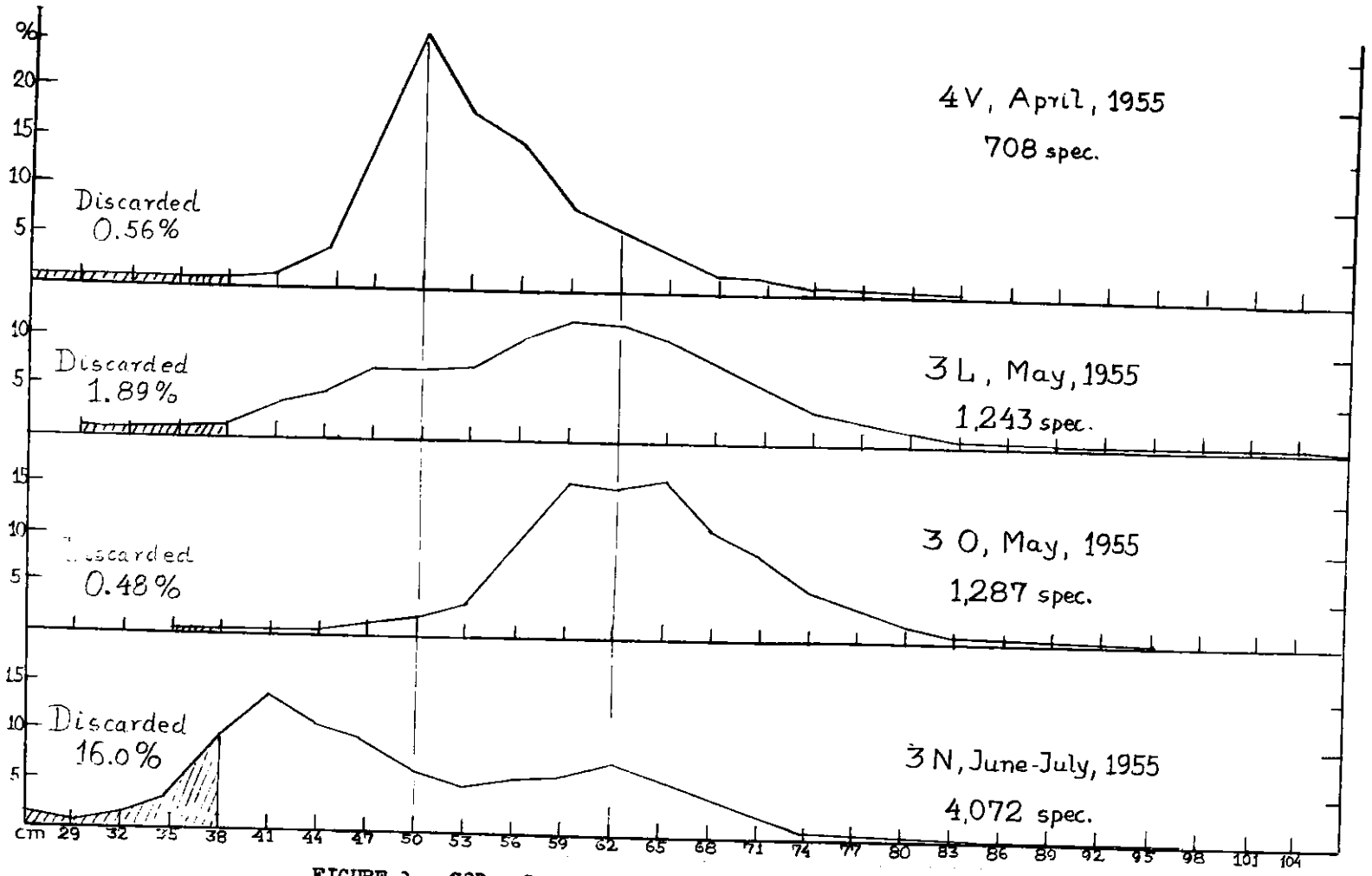


FIGURE 3. COD. Length frequency curves, Subdivisions 4V, 3L, 3O, and 3N, 1955.

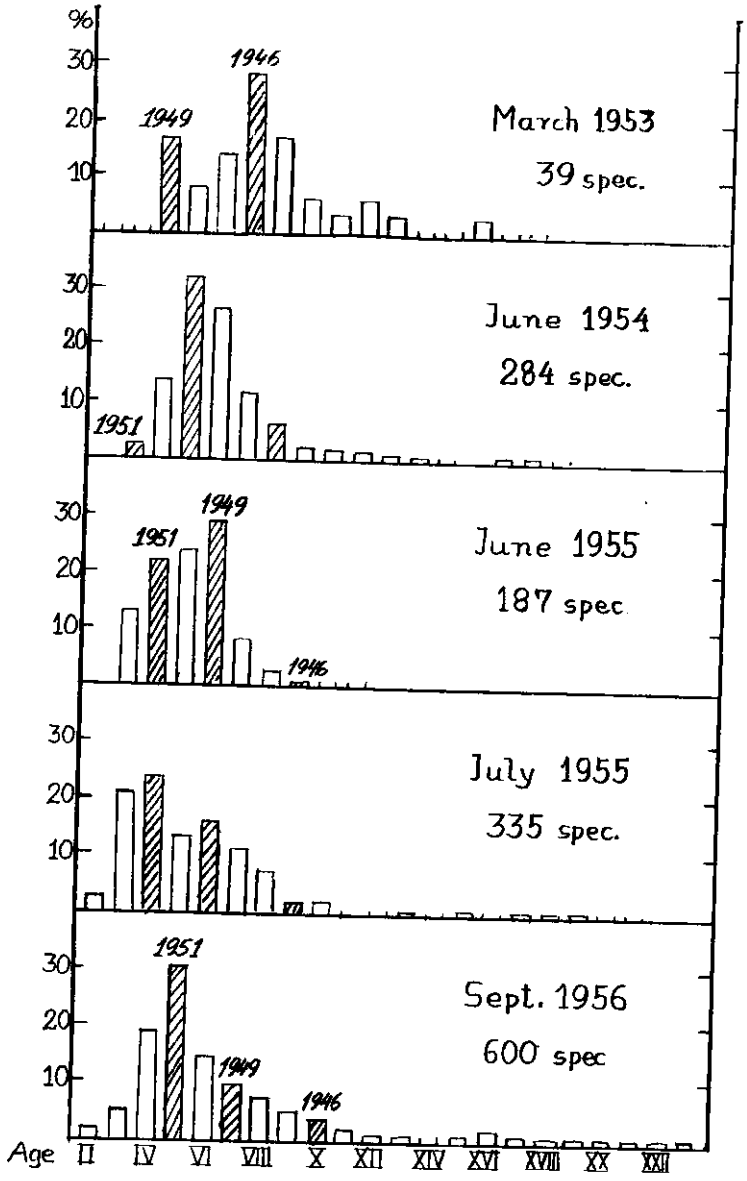


FIGURE 4. COD. Age distribution. Subdivision 3N. 1953, 1954, 1955 and 1956.

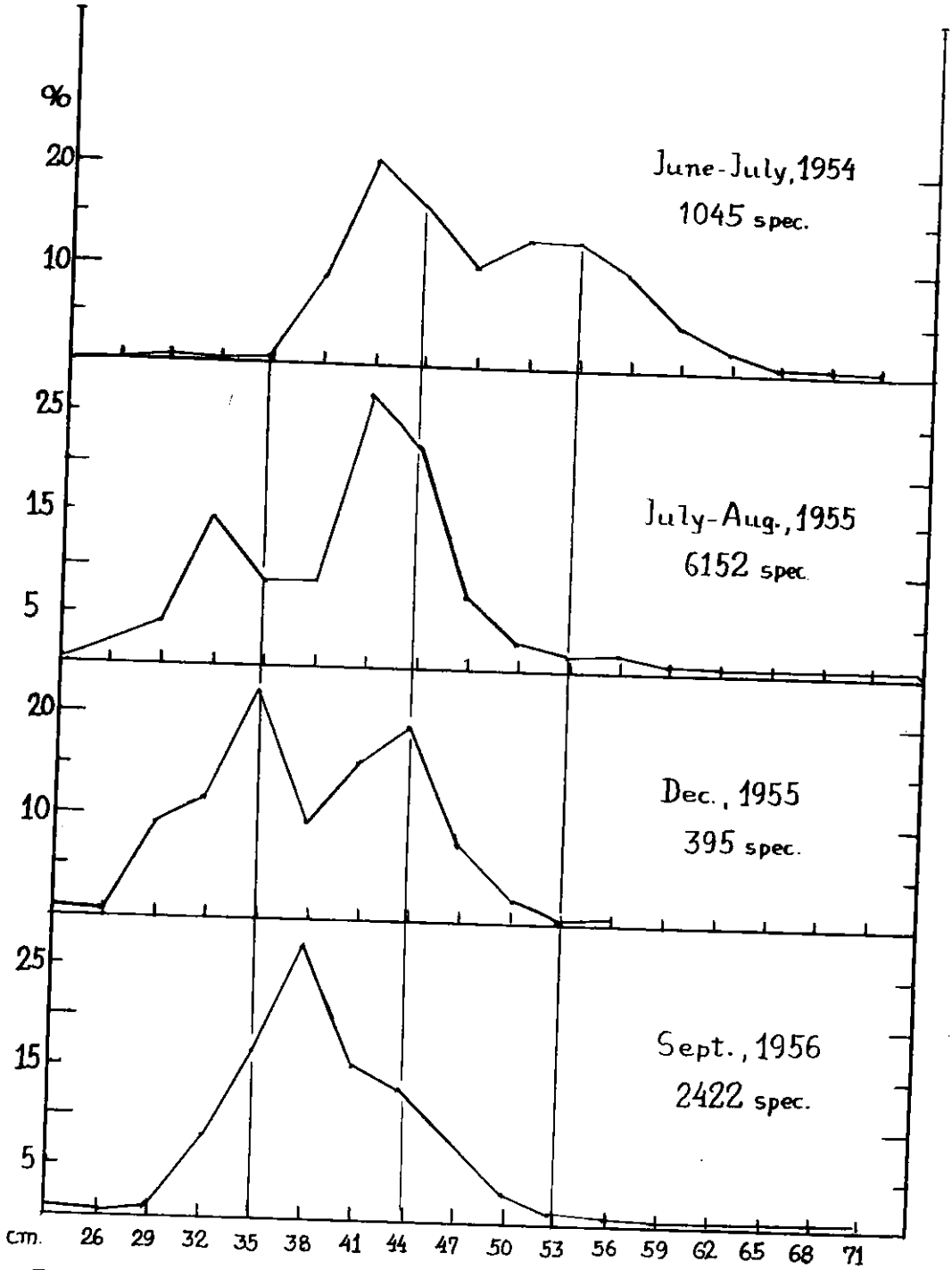


FIGURE 6. HADDOCK. Subdivision 3N. Length distribution curves, 1954, 55 and 56.

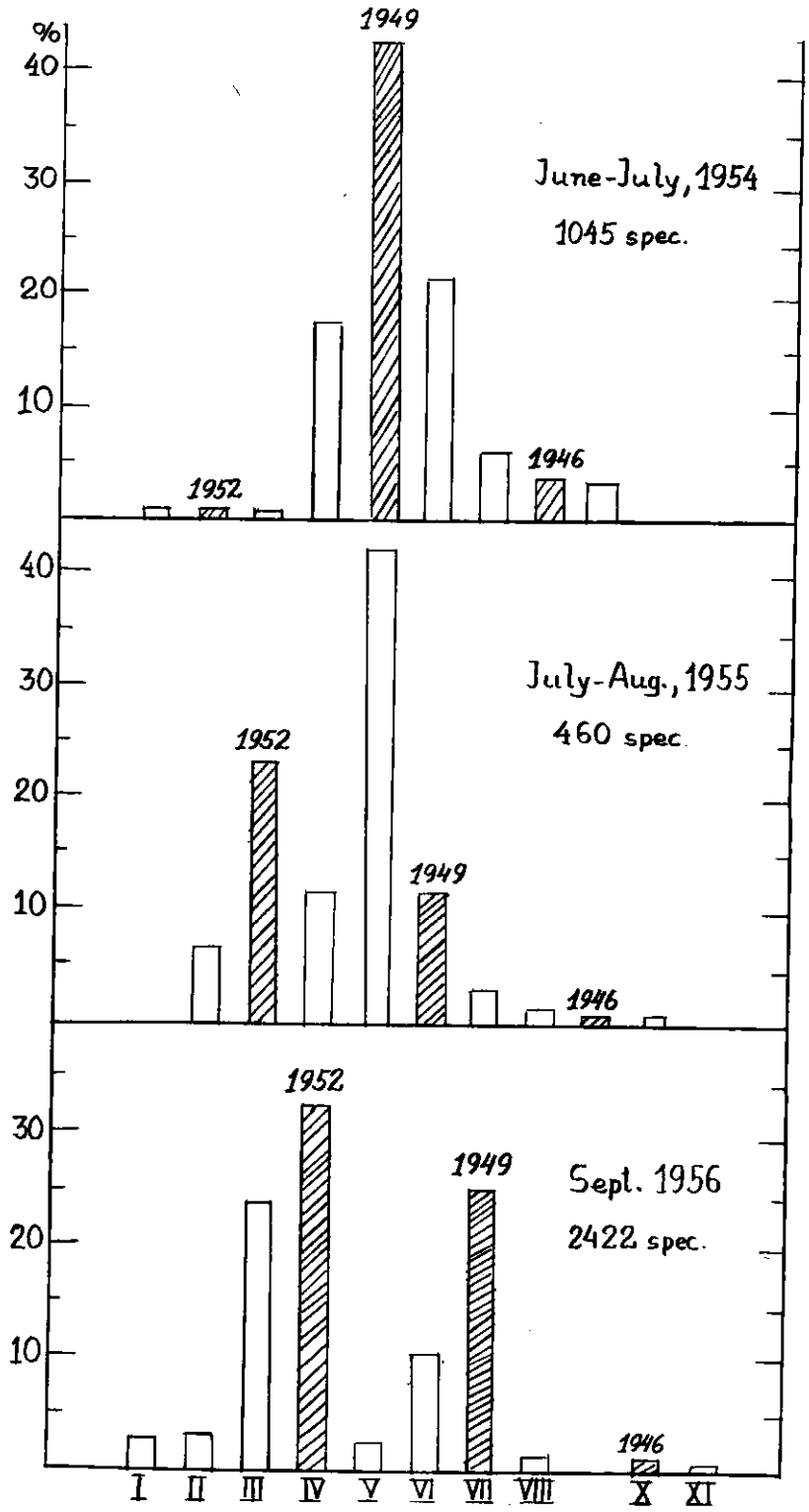


FIGURE 7. Estimated age composition for all haddock measured in 1954, 1955, and 1956.

Appendix to the Spanish Research Report for 1956

by Alfonso Rojo

Curves of growth for cod in the Subdivision 3N were calculated from datas collected in the campaigns July-August, 1955 and September 1956. All the datas come from an area within half a degree of 44°N. and 50°W. The material is shown in Table 1 and illustrated in Fig. 1 (attached).

Although the samples were collected with one month of difference in time; both curves coincide up to the eleventh year. Thereafter the values diverge much and there are discrepancies due to the scarce number of specimens.

The differences between the mean length of the year-classes XII and VI almost coincide with those found by A. Fleming in 1947 and 1948, although with a small increase for the last years.

Years	Difference (XII-VI)
1947-48	34.2 cms.
1955	35.77
1956	35.50

The figure for the twelfth year-class was taken from the curve as we did not have any specimens of that age.

Table 1. Mean length of cod of various age-groups, Subdivision 3N.

Age Years	July-Aug. 1955 no.of spec.	mean, cm.	Sept. 1956 no.of spec.	mean cm.
1	12	13.8	2	10.5
2	8	28.87	5	29.40
3	80	37.97	28	41.14
4	75	44.40	115	47.43
5	45	52.10	183	50.63
6	52	59.23	84	55.00
7	37	62.16	55	63.70
8	23	71.86	44	70.47
9	5	76.60	28	74.03
10	4	86.00	22	82.95
11	-	-	6	88.66
12	-		2	90.50
13	3	117.00	3	99.00
15	2	109.00	3	111.00
16	-	-	7	107.71
17	1	128.00	3	101.66
18	1	149.00	1	110.00
19	1	111.00	3	111.66
	349			
20			2	111.50
21			5	122.80
23			1	121.00
			602	

Difference between age-groups XII and VI = 35.77cms

The length of the age-group XII taken from the curve

Difference between age-groups XII and VI = 35.50 cms

- - THE END - -

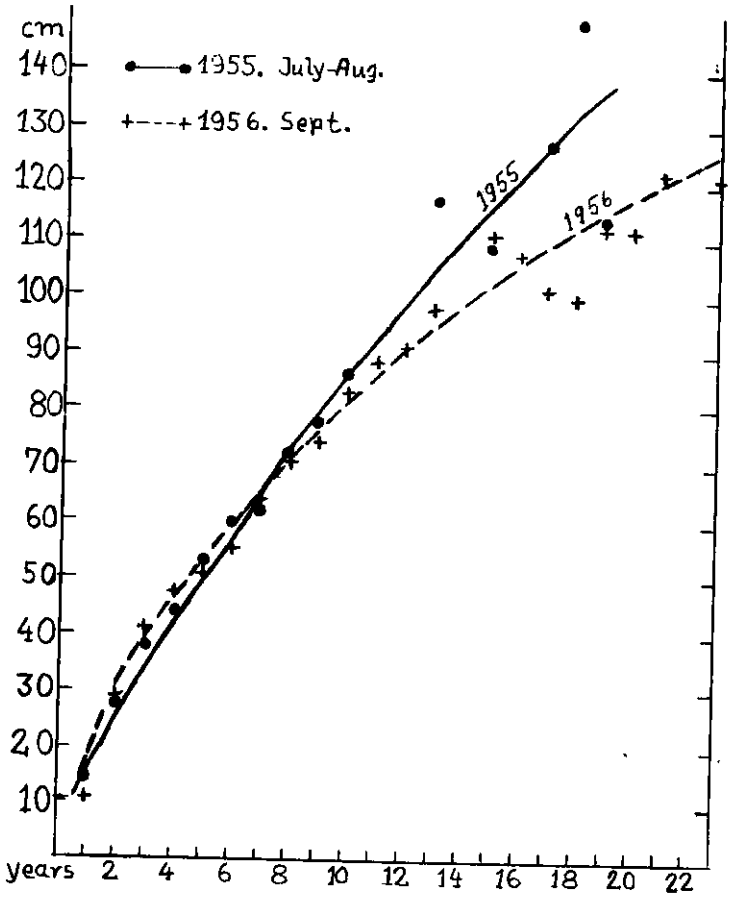


Fig.1. Cod. Subdivision 3N. Growth curves for samples taken in 1955 and 1956.