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SPANISH RESEARCH REPORT
PART C

Biological-Fishing Cruises on Board Pair Trawler "Playa de Ondarreta" off Newfoundland and Nova Scotia

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Two cruises have been carried out, the first one during February, March and the first half of April, and the second one in September and October, in 1962.

Being alone throughout both cruises it was very difficult to do the work properly, though it was easier during the second cruise when some of the difficulties found were overcome.

Acknowledgements

I must thank the shipowners, D. Bernardo and D. Javier Andonaegui, for having kindly given me all sorts of facilities and help to embark and use their ship whenever I needed to. I also wish to thank the captain and the skipper, Sr. Mendia and Sr. Yarza, as well as the whole crew for they helped me as much as possible.

(1) Ship

The "Playa de Ondarreta" works together with the "Playa de la Concha", whose home port is Pasajes (Northern Spain). Both ships have the following features:

Overall length	43.30	metres
Beam breadth	7.57	"
Draught	4.31	"
Depth of hold	4.50	"
Total displacement	847.22	cubic metres
Net "	599.91	" "
Total tonnage	431.45	metric tons
Maximum load	376.00	" "

They are powered by a Werkspoor Diesel engine of 1230 I.H.P. and they are equipped with radio-telephone, radio-goniometer, echo-sounder, Atlas-Echolot type "Monograph" and a "Monoscop" loop. The "Playa de Ondarreta" also has an "Elac" electro-acustic loop, radar and Loran navigator.

1.1. Crew: There are 23 crewmen per ship, who rank as follows: master, fishing skipper, engineer, four oilers, boatswain, salter, 12 seamen or fishermen, cook and cook's assistant.

(2) Description of the Gear

The pair trawl looks rather like an otter trawl. However, it possesses some significant differences from the latter.

First, the fact that it is towed by two ships which keep well apart while towing make otter boards unnecessary and therefore they do not exist in this type of gear.

There is no top chafing gear, either. The way the net is shot and hauled back, which will be described later, avoids damage to the "roof" of the net by the hull, since only the "floor" of the net rubs on the hull, and so the chafing gear is useless.

Pair trawlers generally work on sandy and smooth grounds; nevertheless, those parts of the trawl which touch the bottom during the tows are naturally more or less worn out. In order to slow down this wear, a piece of small-meshed, thick-twined hemp net is sewed under the codend, by its forward edge only. This allows the remainder of this piece of net to flap loosely.

The way this net is fixed to the trawl has not the slightest influence on its selectivity. The meshes it might block are those which otherwise would drag on the bottom, and therefore no fish can escape through them at all.

The trawl consists of the following parts: wings, "cazarete", "goleron" and codend. There are two other parts named "fisca" and "fisqueta" which reinforce the trawl.

All these parts are illustrated in Figures 1 and 2, as well as the position and number of floats fixed on the headline and the "fisqueta". The groundrope is ballasted with chains whose number varies according to the conditions of bottom; if the latter is rought some chains are removed to make the trawl lighter and to preserve it from possible tearings.

2.1. The Trawl: The trawl used by our ships was made completely of synthetic twine (nylon). Each ship carries a net and all the equipment required (warps, wire cables, etc.).

2.1.1. Wings: They start from a sort of Dan lenos to whose ends the bridles leading from both groundrope and headline are fixed. Their narrowest part has 70 meshes across and this number increases steadily to 160 meshes at the mouth of the funnel where the wings join the "cazarete". The mesh size is 145.8 mm, and the piece of net is 24 m wide where it joins the "cazarete" and 54 m long.

2.1.2. "Cazarete": The net becomes more or less cone-shaped, narrowing from the front to the rear. The meshes are smaller (117 mm) and there are 280 along and 220 across at the widest end. The net dimensions are 33.6 x 26.4 m.

2.1.3. "Goleron": The net becomes narrower and the mesh size smaller (115.65 mm). The "goleron" is 12 m long by 15 m wide, and there are 80 meshes along and 100 meshes across.

At the union of the "goleron" and the codend, and in the inside, there is a "flapper" of very

small mesh net. It works like a mousetrap and that is why Spanish fishermen call it "trampa" (the Spanish for "trap"). It is meant to stop fish escaping through the funnel when they have gone into the codend, and to keep them in during the hauling. Thus, only undersize fish can escape through the codend meshes.

2.1.4. Codend: It is the retaining part of the trawl and is made of two pieces of net, 14 x 14 m each, tied together along their edges. Attention must be drawn to the fact that those two pieces of net are not sewed, but tied together. A very strong string is used for this, and it can be easily untied when the codend must be emptied.

There are 120 meshes across and along. The mesh size is 113 mm when the net is new and dry. This size increases noticeably to about 116 mm (115.98 mm) when the net is wet and used. Nylon twines stretch noticeably as they get older, although not very much. Our net stretched only 2.98 mm as an average, i.e. 2.64% its original size.

The rear corners of the codend are provided with two rings of thick rope, to which other ropes are tied. These two ropes are used to fasten the codend alongside the ship whilst it is being emptied (see 3.3. The Hauling of the Trawl).

2.1.5. "Fisca": It runs along the floor of the trawl from the groundrope to the forward edge of the codend. It has 60 meshes in its maximum width (10.6 m) at the groundrope and 170 meshes in its length (30.6 m). The mesh size is 168 mm. The "fisca" is meant to strengthen the net where it is most liable to be torn.

2.1.6. "Fisqueta": It is also meant to reinforce the trawl and runs from the headline to the "golerón". Maximum length, 25 m; maximum width, 8.4 m. It is 140 meshes in length and 60 meshes in width at the headline. The mesh size is 130 mm.

The "fisca", the "fisqueta" and the codend are made with double twine, and all the other parts with single twine.

All measurements were made when the net was wet and used, except those of the codend, as stated above, using a wedge-shaped ICNAF gauge.

(3) Fishing Operations

The trawl is towed by the two ships, which maintain a constant distance apart. The ships take alternate hauls on board, unless one of them has already stored more fish than the other, in which case the ship with the lesser load takes in all hauls until both loads become about the same.

3.1. The Shooting of the Trawl: The trawl is shot from the larboard side of one of the ships. The codend is thrown first and then the rest of the gear. Shooting the trawl is done very slowly so that the net does not twist and can stretch properly.

When all the trawl is in the water a line loaded with a lead ball is thrown from the ship which has shot

the trawl. This line is tied to the towing warp which leads directly from the Dan lenos; then this warp is fastened to the one wound on the drum of the winch of the sister ship.

Having done this, both ships begin to steam ahead releasing the warps which run from the winch along the foredeck to the peak, then over a roller (Fig. 3) and backward along the larboard side and over pulleys which drive them to the poop (Fig. 4).

When all the warp necessary (from three to five times the depth of the water) has been released the ships come to a standstill. Then the staple of the last piece of warp is fastened to a very strong and thick towing chain which leads from the towing hook (Fig. 3). The towing hook is on the afterdeck and supports the full towing traction. The tow then starts at the speed the skipper thinks best, and increases slowly until the full towing speed is reached.

3.2. The Tow: The abundance of fish and the conditions of weather and bottom determine the duration of the tow. It generally lasts between one and five hours, usually between two and a half to four hours, and at a speed of 2 - 2½ knots.

3.3. The Hauling of the Trawl: When the skipper thinks he must stop towing he tells the crew and the sister ship to get ready for the hauling. When both crews are ready, the skipper orders "Turn round!" At that moment the towing chain is unfastened from the hook and the ships turn larboard until the trawl is no longer at their poops, but at their peaks (Fig. 5), and then the winches begin to wind the warps back on the drums.

All work described above is under the skipper's direct control and, as both ships must work at the same time, he has to keep in permanent contact with the sister ship on the radio-telephone.

When the Dan lenos reach the peak rollers both winches stop winding back and the ship which is not taking the haul unfastens her warp from the lenos and passes it over to the sister ship by the means of the line with the lead ball. The latter ship then hoists the trawl until just the codend remains in the water. A becket is then slipped round the codend and tightened in order to retain the fish.

If the catch has not been large the becket is linked to a cable leading from the winch and the codend is hauled in. But, if the catch has been good, the codend is drawn alongside, at the larboard, and then fastened on a hook "ad hoc" by means of the ropes at the rear corners of the codend. Then, the string which ties the two pieces of the codend together is untied and a thick cudgel is put in between to keep the pieces apart. The fish are then taken on board in small quantities with a huge bagnet which can hold some 250 kg and which is guided by a long handle and is lifted by a wire cable, which goes round a pulley hung from the mast, to the winch.

When the codend is almost empty it is tied up again and then hauled aboard to empty it completely.

From the bagnet or the codend fish fall into boxes set on deck. The desired specimens are selected, leaving the others on the deck where they are washed overboard by the hoses or swept overboard by the fishermen. These fish return to the water almost immediately, for fishermen work very quickly in order to clear the deck as soon as possible.

Selected specimens are beheaded, gutted and washed clean and then taken down to the hold, salted and stored.

(4) Yields

Pair trawling has proven to be a good type of fishing in the Northwest Atlantic grounds. Consequently, the number of pair trawlers has increased rapidly since the first ones arrived at those banks, though in late years it seems that some of them are withdrawing because they are not so profitable as they used to be, at least for the Spanish fleet which keeps carrying out a way of handling fish that perhaps is not the best.

Salting is still the only aim of our trawlers, and fish required for this purpose must be cod or other gadoids, not less than 40 cm in length. These fish are scarcer and scarcer due to the ever-increasing exploitation of the stocks and ships are taking much longer to fill their holds. Therefore the number of kgs caught per hour and per man is decreasing significantly while the expenses are increasing.

Tables 1 and 2 and Fig. 6, 7, 8, 9 and 10 show the yields during my first and second trips. It is readily noticed that in the first months figures are bigger. The reasons are, apparently, as follows.

The first trip was definitely a lucky one for the pair trawlers. They fished quickly. Holds were filled in five months after having missed many fishing days during the two first months due to bad weather. I think that the real time fished must be just seventeen weeks. Moreover, fish caught were unusually large; mean lengths were about or over 60 cm.

It was not the same during the second trip, in which we had to face a siutation of scarce, small fish. Table 2 shows the catches made in September and October.

Figures of kgs per hour and per man are quite meaningful, too. The total per hour and per man was 45.57 kgs at the end of February, March and April, and just 32.24 kgs after September and October. All these quantities are referred to round fresh fish.

They have been calculated as follows:

When the fish have been beheaded and gutted they are put in baskets to be taken to the hold. The weight of the fish held in one of these baskets is 100 kgs. This is the weight of fresh split fish, not round fish. Conversion factor A has been applied to calculate this; this conversion factor is drawn from the division of total weight of specimens tagged for the study of the total conversion factor (see 6. Conversion Factor) when round fresh by the weight of those same specimens when fresh

split. The result is 1.63. Thus, 1.63 x 100 - 163 is the weight of a basket-hold when round fresh. Multiplying 163 by the number of baskets from each haul we arrive at a fairly accurate estimation of the total weight round fresh.

(5) Discards

This item, so important for the fishery statistics is very difficult to deal with on board a pair trawler.

The way the discards are returned to the water was described in the Hauling of the Trawl (see Section 3.3). Discarded fish are gotten rid of almost as soon as they are hauled in and, of course, all species are mixed together. Therefore, it is almost impossible to give an estimation of discards and much more difficult to estimate the weight of each species.

The estimation of round fresh fish is rather accurate, but the error of the discards data must be necessarily very large.

The ships stored only cod during the first trip, and many times just those over 42-44 cm. Some haddock and pollock were also salted now and then, but only when they were extraordinarily large, for those species are not as valuable as cod; thence, fishermen avoid storing them as much as possible. Nevertheless, the scarcity of cod led the seamen to store not only cod under 40 cm, but also fairly big quantities of pollock and haddock.

All the other species caught (flounders, redfish, hake, etc.) are discarded.

(6) Conversion Factor

Since the fish is not weighed when it is caught and since the only data available is that for green split fish, a factor is required to convert this data to round fresh weight.

Conversion factor for landings of both pair trawlers and otter trawlers of Spanish fleet is 3, but I think this figure must not be applied to pair trawler catches. In fact, the largest pair trawlers cannot load more than 700 or 750 metric tons (both ships together), and otter trawlers generally hold some 1000 tons. Therefore, they are on the grounds longer and hence the fish loses more weight from being stored in the hold longer.

The conversion factor has been calculated as follows:

From time to time a sample of cod was taken and each specimen was tagged with a numbered tag, weighed and measured. For the sake of easier calculations, weights were recorded to the nearest quarter of a kg; thus, if it was 2,300 kg, the figure taken down was 2,250, and 2,500 if the actual weight was 2,400 kg; the same was done with split and salted specimens.

Each specimen was weighed and measured again after having been beheaded and gutted, and maximum longitudinal and transversal dimensions of split fish were recorded. The tagged specimens were measured similarly when the fish was landed. Some of the tags were lost either in the hold or during offloading; and those specimens have not been included in the calculations.

Total weight of tagged specimens was divided by the weight of the same specimens when landed, giving 2, 7, as a result.

Partial results are given in Table 3.

(7) State of Fish Populations

7.1. Length Frequencies: The following specimens of cod were measured during the two trips:

Division	3L	864
"	3Ps	86
"	4Vs	398
"	4W	2310

Figure 11 shows the length distributions for division and month. It is noticeable that during the first months modes are rather high and therefore mean lengths are also high, about 60 cm. In September and October mean lengths are under 50 cm, except in Division 3L.

Division 3L - September: The length distribution shows a peak at 42-44 cm and another one at 59-61. Mean length is fairly high, 53.2 cm, despite the abundance of small sizes. Number discarded is 39 per 1000.

Division 3Ps - February: Only a few specimens were measured after the fish were sorted. However, it can be seen that no fish under 42 cm were stored. The mode is at 57-59 cm, and there is another one at 63-65 cm. Mean length of stored fish is about 59 cm (58.8).

Division 4Vs - March: There is also a two-peaked curve (length groups 54-56 cm and 66-68 cm.) Discarded cod are few, only 20 per 1000, and mean length is high, 54.8 cm.

October: Lengths decreased significantly. The mode is at length group 42-44, but the length group 39-41 is almost as abundant. Though many fishes of this group were stored during this month, the number discarded is 64 per 1000. Mean length is small: 47.2 cm.

Division 4W - February: The only sample obtained was of no value because it was small and was taken after sorting the fish.

March: The mode is at 60-62 cm and the number discarded just 5 per 1000. Mean length, 66.5 cm.

April: The mode is again very high, 54-56 cm; large number discarded, 90 per 1000. Mean length, 66.5 cm.

October: Mean length and mode decreased significantly. The former is 47.5 cm and the latter is at 42-44 cm. The number discarded is the largest despite having stored fish under 40 cm, 133 per 1000.

7.2 Age Frequencies

Division 3L: The otoliths of 49 specimens have been studied. Twenty-four (48.97%) of the specimens were males and the others females. Due to the small size of this sample results for males and females are combined. The same applies for Divisions 3PS and 4VS.

As illustrated in Fig. 13, the most abundant year class is that of 1957 (306.12 per 1000), with the 1958 year class almost as abundant (285.73 per 1000). The 1956 year class is also very important (204.08 per 1000). The other year classes (1959, 1955, 1954 and 1952) together make up less than a fourth of the total.

The absence of the 1953 year class may be due to inadequate sampling, since it does not seem possible that it is missing from the population. No doubt samples from the otter trawlers will prove this guess to be right. Mean age, 4.38 years.

Division 3Ps: Only 35 specimens are available. There is a predominance of the 1957 year class, i.e. specimens aged 5 (514.2 per 1000) and the second most important is the 1956 year class (228.5 per 1000). The other year classes are poorly represented: 57.1 per 1000 of the 1958 year class; 85.7 per 1000 of the 1955 year class; 28.5 per 1000 of the 1954 year class; 57.1 per 1000 of the 1953 year class and 28.5 per 1000 of the 1952 year class. Although the sample may not be representative, the 1957 year class may be considered the most significant. Mean age, 5.22 years.

Division 4Vs: Amongst the 52 specimens studied there is a predominance of the 1959 and 1958 year classes, which make up one-half of the sample. The occurrence of a greater number of the 1954 year class than that of the 1955 year class may be due to the small number of fish specimens studied, for none of the other samples show this apparent anomaly. Mean age, 4.98 years.

Division 4W: This sample was the largest available and had 349 specimens. Only one (0.28%) was discarded because of a doubtful reading.

Males (184 or 52.87%) and females (164 or 47.13%) were studied separately and the results were combined later to see what the total population was like.

The 1957 year class is the most abundant. This is true also for Divisions 3L and 3PS. The second most important year class is 1956, and then 1958, for males, and the reverse for females. Therefore, the mean age of males is slightly higher than that of females (5.38 and 5.31 years).

Specimens of age group V are the most abundant, almost a third of the sample (293 per 1000).

7.3 Growth: Growth curves are shown in Fig. 15-16. All deviate from the theoretical growth curve, but they show an inflection at the age of 6, as if growth rate were slower between the sixth and seventh year.

(8) Length/Girth Relationship

The lines showing the relationship found between total length and girth at the level of the first ray of the anterior dorsal fin are illustrated in Fig. 17.

The equation applied was:

$$y = ax^b$$

where y = girth and x = length.

Taking decimal logarithms, the following values were calculated:

Division 3L: log y = 0,78217 log x + 0,13927
" " 4Vs: log y = 0,96512 log x - 0,09713
" " 4W: log y + 0,91155 log x - 0,10415

The small number of specimens available from Division 4VS makes the result not very reliable, and it is noticeable that the relationship found is quite different from those of Divisions 3L and 4W.

Total lengths were grouped in 3-cm groups following the ICNAF model, i.e., 30-32 cm, 33-35 cm and so forth, because in some samples many of the one cm length groups were missing.

(9) Sex and Sexual Stages

Sex and sexual stages were observed in those specimens whose otoliths were extracted, 485 in all. The largest number was from Division 4W (349), and then 4Vs (52), 3L (49) and 3Ps (35).

9.1. Sex Ratio: The following table summarizes the results of the study of this item. Males are always more abundant, except in Division 3L.

Division	3L %	3Ps %	4Vs %	4W %
Males	49.0	51.4	61.5	52.7
Females	51.0	48.6	38.5	47.3
Total number	49	35	52	349

9.2 Sexual Stages: Sexual stages were determined by macroscopic observations and according to an empirical scale in which four stages were established, namely resting (or immaturity), developing, spawning and post-spawning.

Most observations were made in Division 4W and it is easy to see that the spawning and developing stages occur very frequently in March and April. This means that the spawning season begins in late February and reaches its peak in March and April.

Many developing and spawning specimens, and even post-spawning ones, were seen in Division 4W at the middle of October. Though only a few observations were recorded the real number observed is much bigger, as many gonads were studied just picking them from the deck where they had been thrown after the fish had been gutted. These observations make me think that there is another spawning season on Sable Island Bank during late October and early November.

The majority of specimens caught in Division 3L and, in October in Divisions 4VS and 4W, were still immature.

Tables 4, 5 and 6 summarize the sexual stage frequencies.

(10) Age at First Maturity

Spawning marks have been observed in 68 out of 484 otoliths studied, i.e. 14.04%. They are distributed as follows: 6 from Division 3L; 5 from Division 3PS; 3 from Division 4VS and 54 from Division 4W.

According to the spawning marks, first maturity is generally reached at the age of 6 or 7, and very rarely any sooner or later, at least for the 54 specimens from Division 4W, as is shown in the following table:

AGE AT FIRST MATURITY, DIVISION 4W

Age (Years)	Number of Specimens	%
5	5	9.25
6	17	31.48
7	24	44.44
8	4	7.40
9	1	1.84
10	1	1.84
?	3	3.70

The other 14 specimens are distributed as follows:

Age (Years)	Number of Specimens	%
5	1	7.14
6	2	14.28
7	4	28.57
8	5	35.71
9	1	7.14
?	1	7.14

(11) Temperature and Fishing

This item was studied especially during the first trip. Although the weather did not allow me to make observations every day, a possible relationship between fishing and temperature of bottom was studied throughout ten or eleven weeks.

All temperatures recorded are given in Table 1. Average temperature of the day was recorded, except for the 10th of March and the 8th of April, when the ship steamed at least 30 nautical miles from the place where the first haul was made to the location of the second haul. All other days the ships fished a much smaller area.

Temperatures recorded at the same place on the same day do not vary greatly from morning to evening, only a few tenths of a degree.

Temperatures range from 1° to 5°C, except for the 26th of

March. Probably the temperature was not so high (8°, 5C), on that day and was due to a faulty thermometer which gave an incorrect reading. But this could not be checked.

Though it may be a little premature, I do not think there is any relationship between temperature of bottom and quantity of fish caught. Temperatures at which largest and smallest catches were taken are shown in Tables 7 and 8, and it cannot be said from them that there is an optimum temperature for cod fishing.

The following happened fairly often. When the trawl was dragging no fish were detected either by the loop or by the echosounder. Nevertheless, after a normal tow (about four hours) a catch of 50 or 60 basket-holds was hauled in. Since this catch was not bad by any means, the net was shot again to drag over the same bottom, but in the opposite direction. After three or four more hours towing only 10 or 15 basket-holds were caught.

No fish was detected in either case. The time between the two hauls had not been longer than two hours, not enough for the temperature to change significantly, and in fact it had not.

Why was there not a good catch in the second haul? Why was there a good catch on one day and not on the following day, at the same place and with temperatures about the same?

In my opinion, there are many other and more significant factors to determine the occurrence of cod.

No doubt, cod have, as many other animal species, a range of temperatures outside of which they will not be at ease, but this range must be rather wide, and I do not think that cod should leave because of the affect of a wide variation of temperature within and even out of the range if there are other reasons (occurrence of good, for instance) to make them remain.

On the other hand, a preferred temperature would not mean one should expect cod to be present if other desirable conditions are lacking.

Vertical migrations of cod confirm this theory in part. Cod approach the surface at night, and also when there is caplin about. However, temperatures at the surface are often two or three degrees above those at the bottom, and cod go near the surface without caring about this difference.

Finally, the reasons that good catches were not made at the place where a few hours earlier five or six tons were caught might be that the trawl itself scared the fish which consequently swam away to a safer place. Therefore, I agree with those authors who say that there is no "cod water" or "cod temperature", although I will continue the study of this matter in future years.

(12) Cod Feeding

Data were collected mainly in Division 4W and a little in Divisions 3L and 3Ps.

Many stomachs were opened and their contents were examined.

In Division 4W, the favourite prey of cod is sandeel (Ammodytes americanus). Stomachs of cod from Sable Island Bank were normally full of sandeel at any time, with almost total

lack of any other food. When other food items were observed in the stomachs no sandeel occurred generally. Probably cod were forced by the scarcity of sandeel to use other food items.

Apart from this clear preference, cod do not select their good too much. When sandeel are not available they feed on other fishes, crustaceans (even Balanidae), mussels and other molluscs and large cod even feed on small cod.

Sandeel must be particularly rich for gadoids, since not only cod but pollock too feed on them, especially in October, the spawning season of sandeel.

No sandeel were observed in Division 3L, as the ships fished all the time on stony bottom and sandeel live in sand. All stomachs of fish were full of small crustaceans (Calanidae, Crangonidae, etc.).

CONCLUSIONS

(1) Despite the fact that pair trawling is a rather efficient type of fishing, catches of pair trawlers in the Convention Area are decreasing, as mean ages and lengths of cod become smaller.

(2) This type of fishing could be at least twice as profitable if all species caught were properly handled on board instead of discarded.

(3) It is very difficult, if not impossible, to estimate the weight of discards of a pair trawler unless there is an observer on board each ship, and even then quantities recorded would be only approximate.

(4) The conversion factor calculated for pair trawlers from the author's data is 2.7, smaller than that for otter trawlers, which is 3.0.

(5) Most frequent lengths are generally under 51053 cm, and the 1957 year class is the most abundant in all divisions, except in Division 4VS where the 1959 year class was apparently more abundant.

(6) Observations on sexual stages and spawning marks confirm that there is a very large number of immature cod.

(7) Although we cannot compare the growth rates in each division, all growth curves have an inflection at age group VI, as if growth was slower between the sixth and seventh year.

(8) No relationship has been found between fishing and temperature of bottom. Apparently the best catches are made between 2° and 5°C, but good catches are made at lower temperatures.

NOTE: Figures 1 to 5 after: J.M. Navaz y Sanz (1948): "La pesca de arrastre en pareja": Sociedad Oceanografica de Guipúzcoa, Publ. No. V.

TABLE 1

INFORMATION RELATING TO CATCHES OF COD BY PAIR TRAWLERS
FISHING IN ICNAF DIVISIONS DURING FEBRUARY, MARCH AND APRIL, 1962

Date	ICNAF Division	Depth fms.	Temp on Bottom	No. of Tows	Hours Towing	LANDED FISH			
						Own Ship(1)	The Other Ship	Total	K/h
Feb. 4	3 P_s	110-90	1.2°	2	8.-	2,445	9,780	12,225	1,653
Feb. 5	3 P_s	80-110	1.5°	2	7.15	1,141	3,667	4,808	667
Feb. 9	3 P_s	105	2°	1	4.30	--	2,445	2,445	543
Feb. 10	3 P_s	110-135	--	3	8.-	3,549	11,736	15,285	1,909
Feb. 13	4 W	85-90	--	2	9.20	7,824	9,780	17,604	1,886
Feb. 14	4 W	100	2.5°	2	9.10	6,031	12,388	18,419	2,009
Feb. 17	4 W	70-90	3°	2	8.25	1,141	10,259	11,400	1,321
Feb. 22	4 W	50	--	1	4.-	4,201	--	4,201	1,050
Feb. 23	4 W	50-60	3°	2	9.25	31,948	29,640	61,588	6,530
Feb. 24	4 W	45-50	--	1	5.30	4,201	--	4,201	763
Feb. 26	4 W	45-50	--	3	9.25	1,467	19,560	21,027	2,232
Feb. 27	4 W	40-50	2.8°	3	12.45	19,071	1,630	20,701	1,623
Feb. 28	4 W	40-50	3.2°	4	11.40	4,727	19,804	24,531	2,102

..... table cont'd p. 14

TABLE 1 (cont'd)

INFORMATION RELATING TO CATCHES OF COD BY PAIR TRAWLERS
FISHING IN ICNAF DIVISIONS DURING FEBRUARY, MARCH AND APRIL, 1962

Date	ICNAF Division	Depth fms.	Temp on Bottom	No. of Tows	Hours Towing	LANDED FISH			
						Own Ship(1)	The Other Ship	Total	K/h
Mar. 1	4 W	65-40	1.8°	3	11.25	652	12,062	12,714	1,113
Mar. 4	4 W	60-40	--	2	7.15	17,604	326	17,930	2,472
Mar. 5	4 W	40-55	0.8°	2	6.45	489	163	652	96
Mar. 6	4 W	40-45	5°	2	4.20	36,675	31,296	67,971	15,685
Mar. 8	4 W	42-48	--	1	3.-	----------			
Mar. 9	4 W	38-45	2.3°	3	9.50	26,406	7,090	33,496	3,406
Mar. 10	4 W	40-45	2.4° ( ) 5.8° (	2	6.30	26,117	978 ( ) (	27,095	4,018
Mar. "	4 W	45-55							
Mar. 11	4 W	55-35	0.8°	4	10.-	3,993	1,141	5,134	513
Mar. 12	4 W	46-42	2.7°	3	8.-	5,800	5,379	11,179	1,397
Mar. 16	4 W	45-35	2.1°	2	8.05	2,445	10,269	12,714	1,572
Mar. 18	4 W	50-70	3.2°	3	12.15	5,216	4,890	10,106	824
Mar. 19	4 W	35-45	2.9°	2	8.-	4,075	6,520	10,595	1,324

..... table cont'd p. 15

TABLE 1 (cont'd)

INFORMATION RELATING TO CATCHES OF COD BY PAIR TRAWLERS
FISHING IN ICNAF DIVISIONS DURING FEBRUARY, MARCH AND APRIL, 1962

Date	ICNAF Division	Depth fms.	Temp on Bottom	No. of Tows	Hours Towing	LANDED FISH			
						Own Ship(1)	The Other Ship	Total	K/h
Mar. 20	4 W	25-45	4°	3	13.-	6,520	1,793	8,313	639
Mar. 21	4 W	45-35	2.2°	2	6.15	4,401	10,595	14,996	2,399
Mar. 25	4 W	40-44	--	2	7.30	4,890	2,445	7,335	1,018
Mar. 26	4 W	44-60	8.5°	3	11.50	5,379	1,630	7,009	592
Mar. 28	4 V_s	50-70	1.6°	3	7.-	14,344	3,260	17,604	2,514
Mar. 29	4 V_s	35-100	--	2	4.25	489	652	1,141	258
Mar. 30	4 V_s	90-50	1°	2	10.20	4,890	1,793	6,683	646
Mar. 31	4 V_s	35-48	1°	3	10.25	2,445	15,485	17,930	1,740
Apr. 1	4 V_s	62-80	--	3	10.-	11,410	10,758	22,168	2,216
Apr. 3	4 V_s	45-65	3.4°	3	11.20	11,410	5,920	17,330	1,529
Apr. 4	4 W	34-62	3.6°	4	12.30	7,498	8,965	16,463	1,316
Apr. 5	4 W	45-55	2.7°	3	10.40	4,075	6,250	10,325	962
Apr. 6	4 W	25-70	1.9°	3	11.10	15,485	40,750	56,235	5,035

..... table cont'd p. 16

TABLE 1 (cont'd)

INFORMATION RELATING TO CATCHES OF COD BY PAIR TRAWLERS
FISHING IN ICNAF DIVISIONS DURING FEBRUARY, MARCH AND APRIL, 1962

Date	ICNAF Division	Depth fms.	Temp on Bottom	No. of Tows	Hours Towing	LANDED FISH			
						Own Ship(1)	The Other Ship	Total	K/h
Apr. 7	4 W	35-100	2.7°	3	12.40	14,670	10,106	24,776	1,956
Apr. 8	4 W	55-26	1.3°)	4	10.-	18,093	2,445)	)	)
Apr. "	4 V_s	70-64	1.2°)			38,825	3,260)	62,623(	6,262(
Apr. 10	4 V_s	75-80	--	3	7.35	8,150	32,111	40,261	5,309
Apr. 12	4 V_s	74-85	2°	3	12.35	3,260	8,150	11,410	944
Apr. 13	4 W	45-90	2°	3	9.40	5,878	4,564	10,442	1,280
Apr. 15	4 W	45-68	--	3	8.-	1,956	1,630	3,586	448
Apr. 16	4 W	40-45	3.7°	1	1.45	13,855	--	13,855	7,974
Apr. 17	4 W	36-50	4.8°	3	10.-	407	29,014	29,421	2,942
Apr. 18	4 W	44-35	4.2°	3	10.50	19,234	3,260	22,494	2,076

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TABLE 2

INFORMATION RELATING TO CATCHES OF COD BY PAIR TRAWLERS
FISHING IN ICNAF DIVISIONS DURING SEPTEMBER AND OCTOBER, 1962

Date	ICNAF Division	No. of Tows	Hours Towing	Average Depth (fm)	LANDED FISH (Kg.) "P. Ondarreta"	"P. Concha"	Total	Catch in Kg/H
Sept								
13	3L	2	5h 55'	27	2,445	9,780	12,225	2,065
14	3L	4	6h 30'	28	20,212	25,265	45,477	6,996
15	3L	4	6h 15'	25	38,468	10,432	48,900	7,344
16	3L	5	6h 45'	27	1,711.5	1,793	3,504	518
17	3L	2	4h 30'	37	1,304	652	1,956	435
18	3L	4	10h 30'	37	5,379	4,075	9,454	900
20	3L	4	10h 15'	42	8,476	1,793	10,269	1,002
21	3L	2	5h 30'	40	1,956	978	2,934	533
22	3L		9h	32			326	36
23	3L	3	9h 30'	31	4,075	2,287	6,357	669
24	3L	4	11h	40	10,921	2,934	13,855	1,260
26	3L	1	3h	40	40.75	-	40	14
27	3L	4	11h	42	4,401	4,890	9,291	845
30	3L	1	1h 30'	29	8,150	-	8,150	5,433

..... table cont'd p.18

TABLE 2 (cont'd)

INFORMATION RELATING TO CATCHES OF COD BY PAIR TRAWLERS
FISHING IN ICNAF DIVISIONS DURING SEPTEMBER AND OCTOBER, 1962

Date	ICNAF Division	No. of Tows	Hours Towing	Average Depth (fm)	LANDED FISH (Kg.) "P. Ondarreta"	"P. Concha"	Total	Catch in Kg/H
Oct.								
1	4W	3	9h 30'	28	14,670	4,075	18,475	1,973
2	4W	3	8h 30'	24	3,260	13,040	16,300	1,918
3	4Vs	2	7h 30'	35	-	1,304	1,304	174
4	4Vs	4	11h	38	-	13,692	18,582	1,689
5	4W	3	7h 30'	42	-	2,934	2,934	391
6	4W	2	7h	35	-	2,934	2,934	419
12	4W	2	8h 30'	28	16,300	3,260	19,560	2,301
14	4W	3	10h	28	4,075	18,256	22,601	2,260
15	4W	2	10h	27	1,630	4,564	6,194	619
16	4Vs	3	10h	27	8,150	17,930	26,080	2,608
17	4Vs	3	11h 30'	30	1,630	13,040	14,670	1,275
18	4Vs	4	9h	30	1,304	8,965	10,269	1,141
19	4W	3	12h 45'	29	11,410	19,234	30,644	2,404

..... table cont'd p. 19

TABLE 2 (cont'd)

INFORMATION RELATING TO CATCHES OF COD BY PAIR TRAWLERS
FISHING IN ICNAF DIVISIONS DURING SEPTEMBER AND OCTOBER, 1962

Date	ICNAF Division	No. of Tows	Hours Towing	Average Depth (fm)	LANDED FISH (Kg.) "P. Ondarreta"	"P. Concha"	Total	Catch in Kg/H
Oct.								
20	4W	3	12h 45'	33	4,890	815	5,705	447
22	4W	4	15h 45'	27	8,150	6,520	14,670	931
23	4W	3	14h	28	24,450	7,009	31,459	2,247
24	4W	3	11h 20'	34	11,410	16,300	27,710	2,245
25	4W	2	7h 45'	26	-	3,912	3,912	505
26	4W	1	3h 45'	28	-	13,040	13,040	3,477
27	4W	2	6h 50'	23	-	2,771	2,771	405
28	4W	1	1h 45'	25	-	2,445	2,445	1,398
29	4W	3	7h 45'	28	2,445	10,106	12,551	1,619
30	4W	3	8h 15'	29	4,401	15,485	19,886	2,410
31	4W	2	7h 45'	26	-	815	815	105

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TABLE 3

CONVERSION FACTOR - WEIGHT IN Kg.

Round Fresh	Fresh Split (1)	Salted (2)	Round Fresh	Fresh Split (1)	Salted (2)
10	6	4	2.00	1.25	0.75
8.75	5.50	3.25	1.75	1.00	0.75
7.25	3.75	2.50	1.75	1.00	0.75
6.25	3.25	2.00	1.75	1.00	0.75
5.75	3.50	2.00	1.75	1.00	0.75
5.50	3.25	2.00	1.75	1.25	1.00
5.00	3.00	2.00	1.75	1.00	0.75
5.00	3.25	2.00	1.75	1.00	0.75
5.00	3.00	2.00	1.75	1.00	0.75
4.50	2.00	1.00	1.50	1.00	0.75
4.50	2.50	1.50	1.50	1.00	0.50
4.00	2.25	1.25	1.50	1.00	0.75
4.00	2.50	1.50	1.50	1.00	0.50
3.75	2.50	1.50	1.50	1.00	0.50
3.75	1.75	1.00	1.50	1.00	0.50
3.75	2.25	1.25	1.50	1.00	0.50
3.75	2.25	1.50	1.50	1.00	0.50
3.50	2.25	1.50	1.50	1.00	0.50
3.50	2.25	1.50	1.50	1.00	0.50
3.25	1.50	0.75	1.50	1.00	0.50
3.00	1.75	1.25	1.50	1.00	0.50
3.00	1.75	1.00	1.50	1.00	0.50
3.00	2.00	1.25	1.25	1.00	0.50
3.00	2.00	1.00	1.25	0.75	0.50
3.00	1.75	1.25	1.25	0.75	0.50
3.00	2.00	1.00	1.25	0.75	0.50
2.75	1.50	1.00	1.25	0.50	0.50
2.75	1.75	1.00	1.25	0.75	0.50
2.75	1.50	1.00	1.25	1.00	0.50
2.75	1.75	1.00	1.25	1.00	0.50
2.50	1.50	1.00	1.25	0.75	0.50
2.50	1.75	1.00	1.25	0.75	0.50
2.50	1.50	1.00	1.25	1.00	0.50
2.25	1.50	1.00	1.25	0.75	0.50
2.25	1.50	1.00	1.25	0.75	0.50
2.25	1.50	1.00	1.00	0.50	0.25
2.25	1.50	0.75	1.00	0.75	0.50
2.25	1.50	0.75	1.00	0.75	0.50
2.25	1.50	0.75	1.00	0.75	0.50
2.25	1.50	1.00	0.75	0.50	0.25
2.25	1.25	0.75			
2.00	1.25	0.75			
2.00	1.25	0.75			
2.00	1.50	1.00			
2.00	1.25	0.75			
2.00	1.25	0.75			
2.00	1.00	0.75			
2.00	1.25	0.75			
2.00	1.25	0.75			
2.00	1.00	0.75			
2.00	1.25	0.75			
2.00	1.50	1.00			
2.00	1.50	1.00			
2.00	1.25	0.75			
2.00	1.25	0.75			

(1) Beheaded and gutted.

(2) When landed at the factory.

TABLE 4

SEXUAL STAGES - DIVISION 3L

Stage	September	
	♂ %	♀ %
Resting (or virginity)	92	100
Developing	-	-
Spawning	-	-
Post-spawning	8	-
No. observed	24	25

TABLE 5

SEXUAL STAGES - DIVISION 4Vs

Stage	March		October	
	♂ %	♀ %	♂ %	♀ %
Resting (or virginity)	50	66	94	92
Developing	21.5	33	6	-
Spawning	-	-	-	-
Post-spawning	28.5	1	-	8
No. observed	14	9	18	12

TABLE 6

SEXUAL STAGES - DIVISION 4W

Stage	February		March		April		October	
	♂ %	♀ %	♂ %	♀ %	♂ %	♀ %	♂ %	♀ %
Resting (or virginity)	50	76	44	43	25	51	77	85
Developing	-	19	12	30	10	28	13	19
Spawning	40	-	21	3	32	4	2	-
Post-spawning	10	5	23	24	33	17	7	6
No. observed	30	21	34	30	69	45	62	73

TABLE 7

TEMPERATURE AT LARGEST CATCHES

Temperature ° C	Catch Kg.	Hours Towing
1.3°	62,623	10h
1.9°	56,235	11h 10'
2.3°	33,496.5	9h 50'
2.5°	18,419	9h 10'
3°	61,588	9h 25'
4.2°	22,494	10h 50'
4.8°	29,421.5	10h
5°	67,971	4h 20'
5°	27,095	3h 30'

TABLE 8

TEMPERATURE AT SMALLEST CATCHES

Temperature ° C	Catch Kg.	Hours Towing
0.8°	625	6h 45'
0.8°	5,134.5	10h
1.8°	6,683	10h 20'
2°	2,445	4h 30'
4°	8,313	13h
8°	7,009	11h 50'

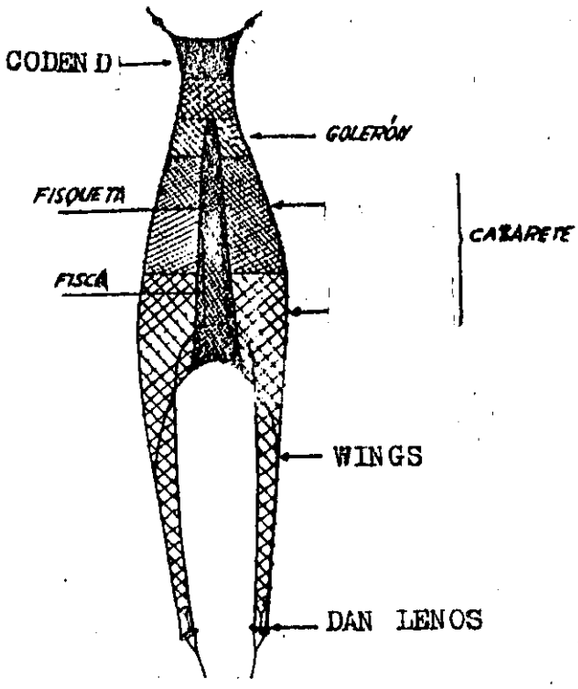


Fig. 1.- Diagram of the gear

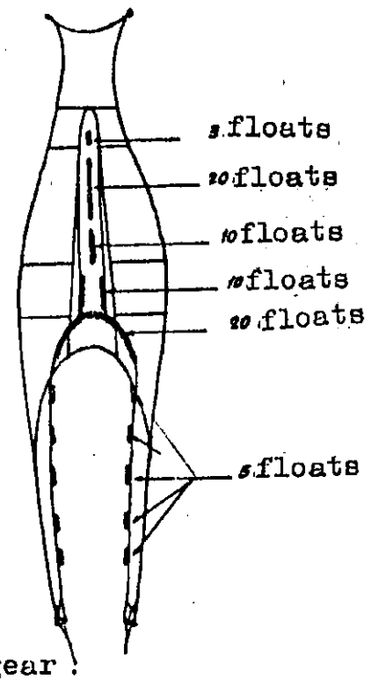


FIG.2

Diagram of the gear :

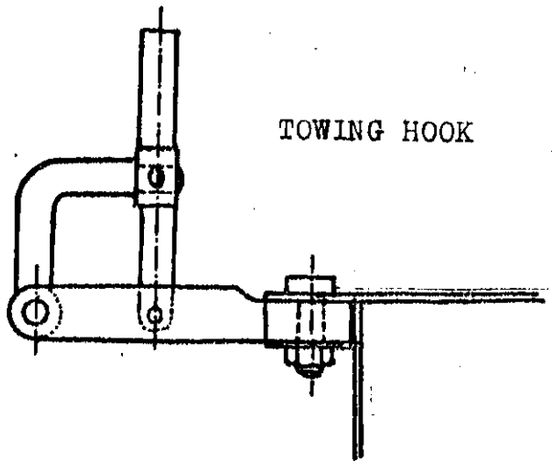


FIG.3
Towing hook and peak rollers

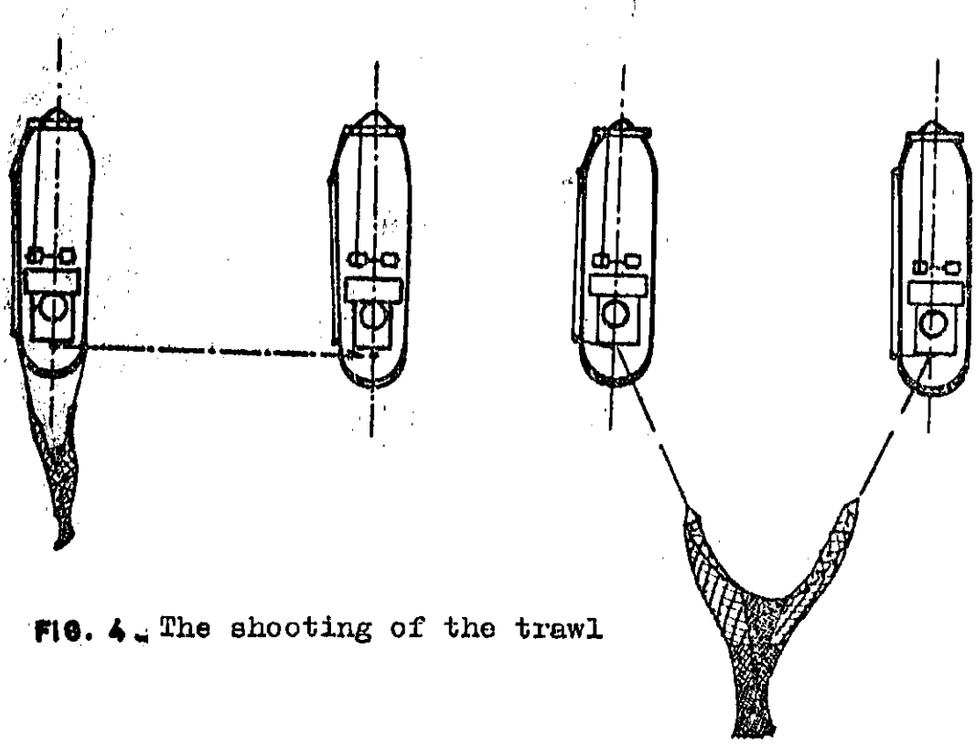


FIG. 4 . The shooting of the trawl

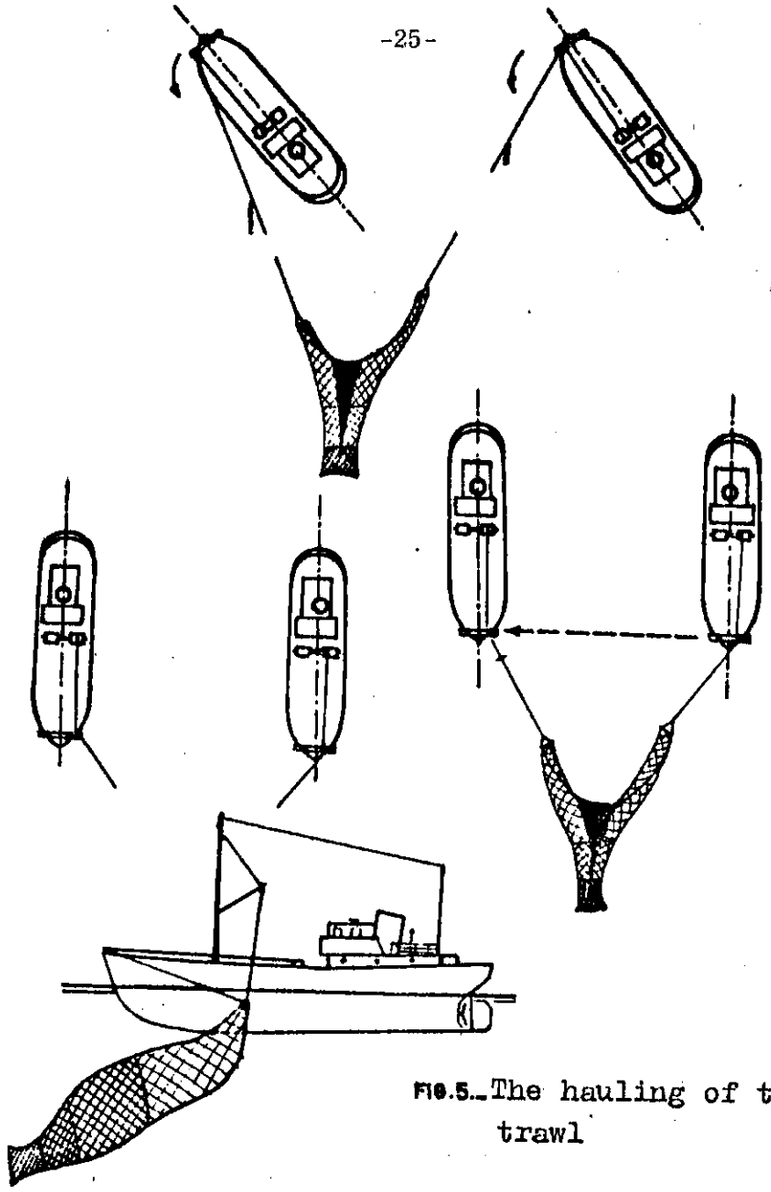
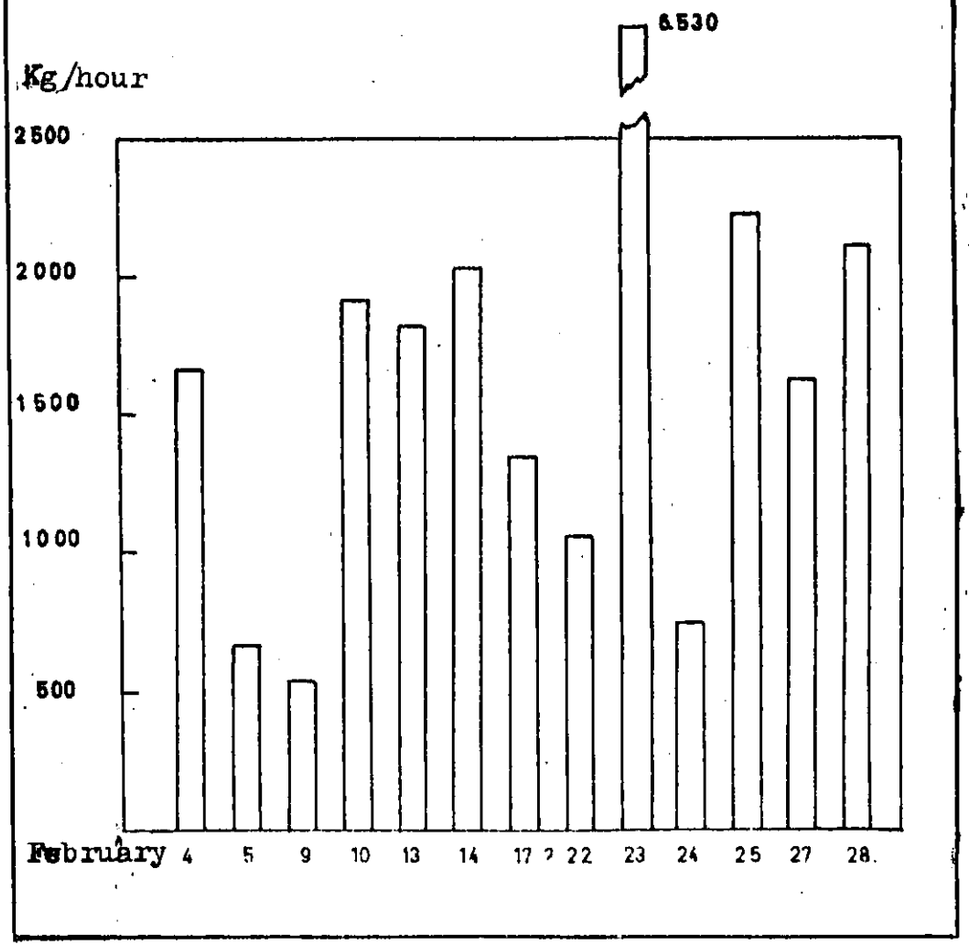


FIG.5.- The hauling of the trawl

Fig. 6.- Catches of the pair trawler in Kg/hour



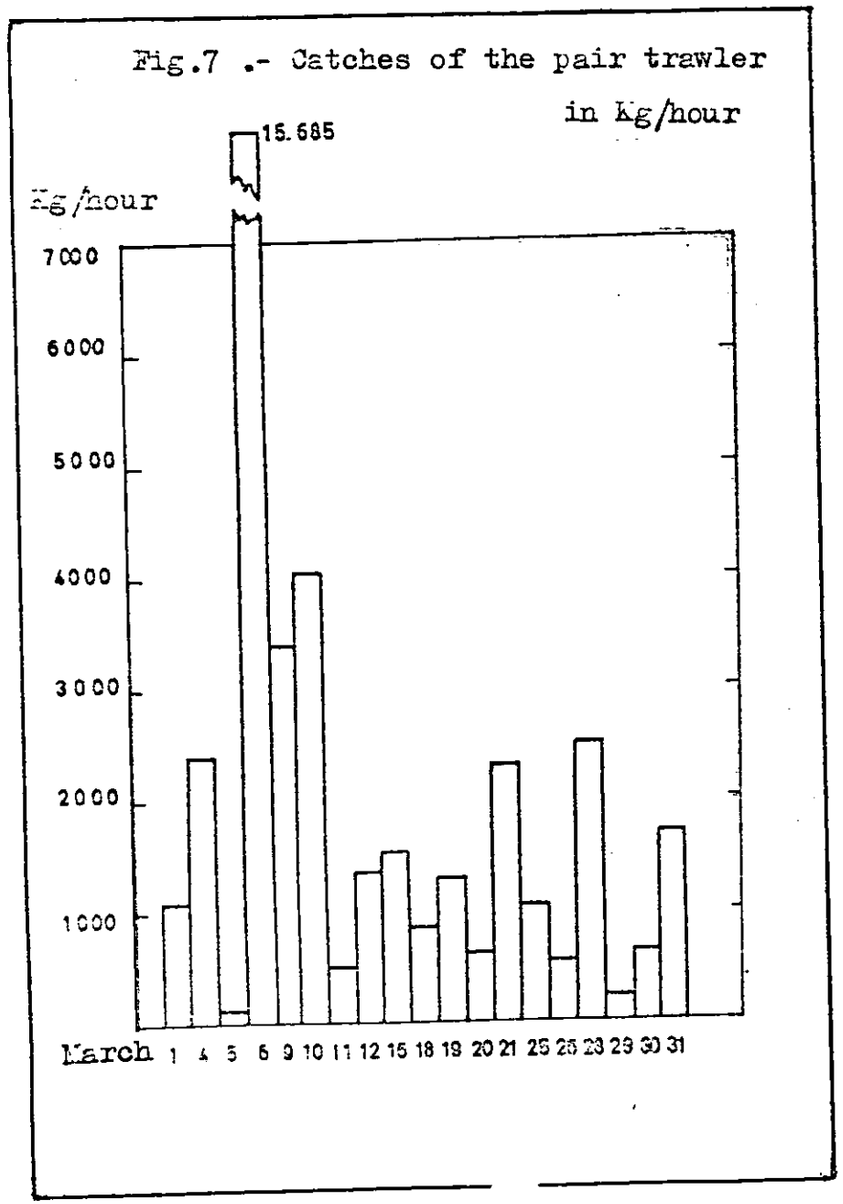


Fig.7 .- Catches of the pair trawler
in Kg/hour
15.685
Kg/hour
7000
6000
5000
4000
3000
2000
1000
March 1 4 5 6 9 10 11 12 15 18 19 20 21 25 26 28 29 30 31

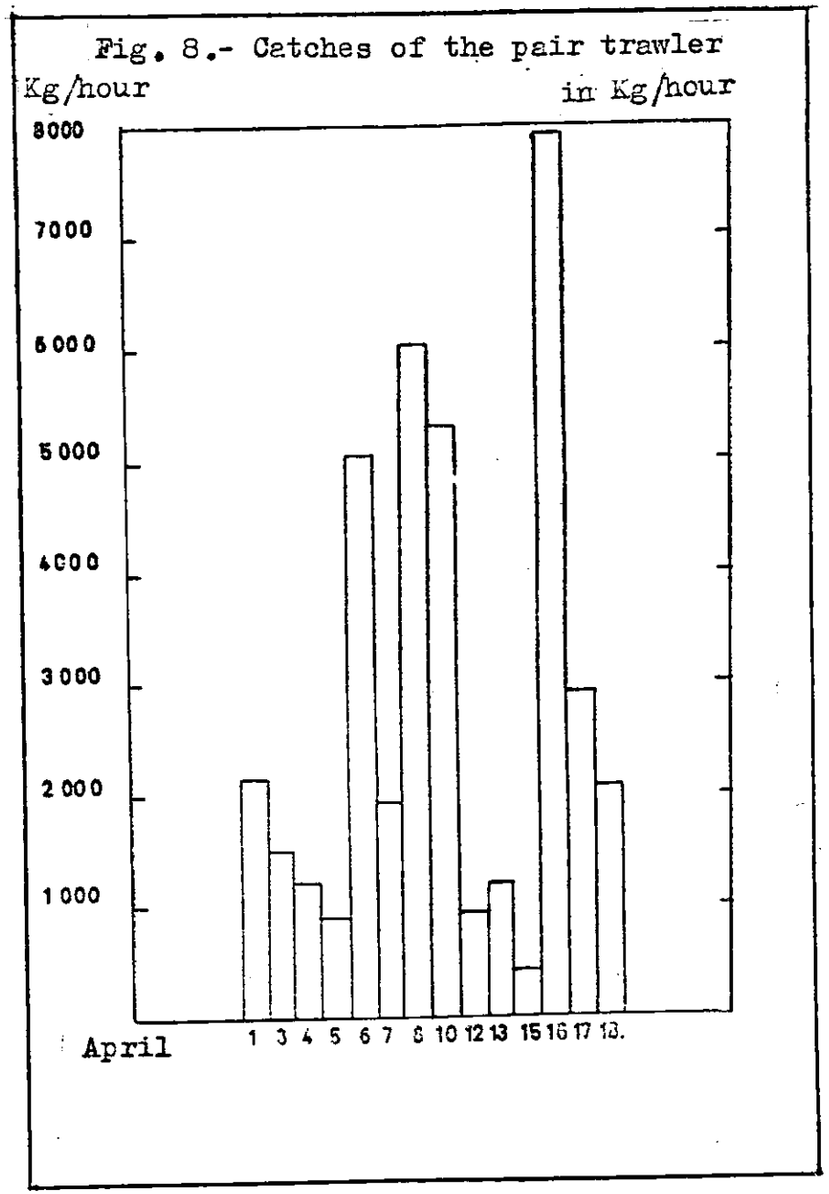


Fig. 8.- Catches of the pair trawler
Kg/hour
in Kg/hour
8000
7000
6000
5000
4000
3000
2000
1000
April 1 3 4 5 6 7 8 10 12 13 15 16 17 18.

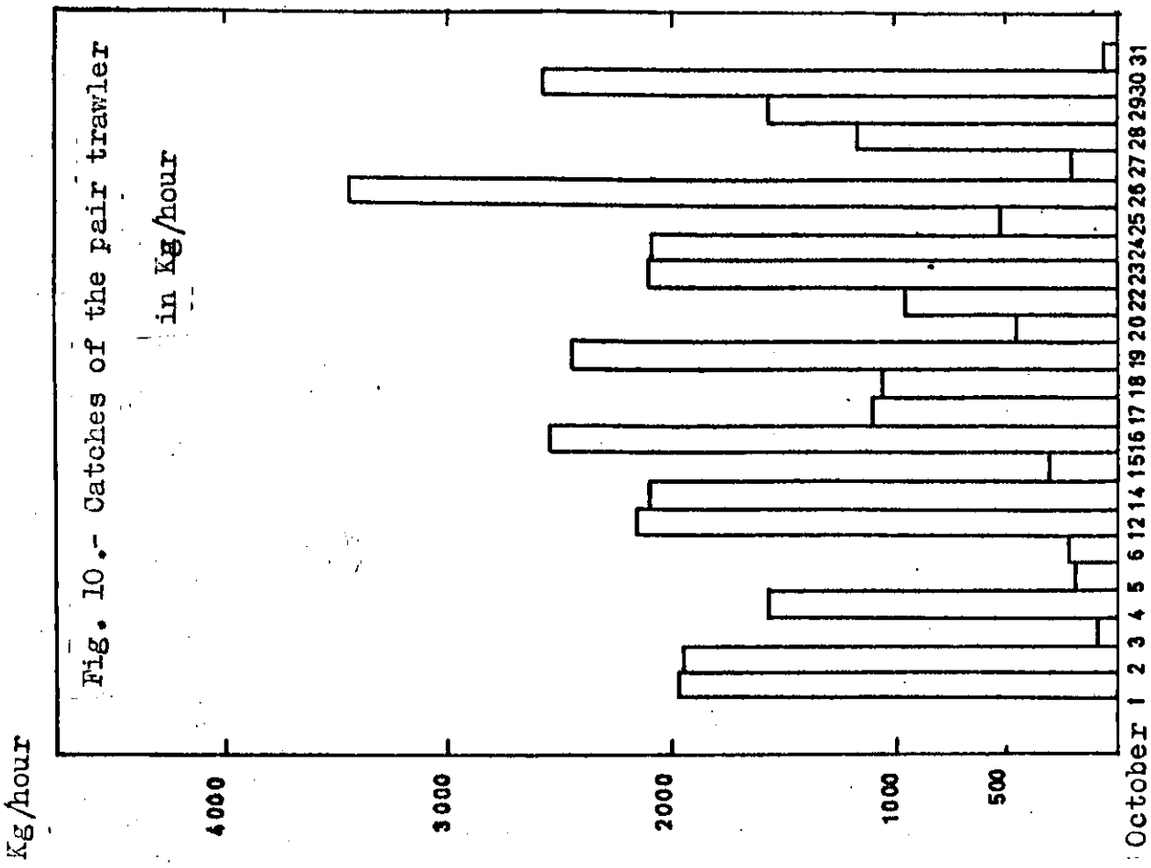


Fig. 10.- Catches of the pair trawler
in Kg/hour
Kg/hour
4000
3000
2000
1000
500
October 1 2 3 4 5 6 12 14 15 16 17 18 19 20 22 23 24 25 26 27 28 29 30 31

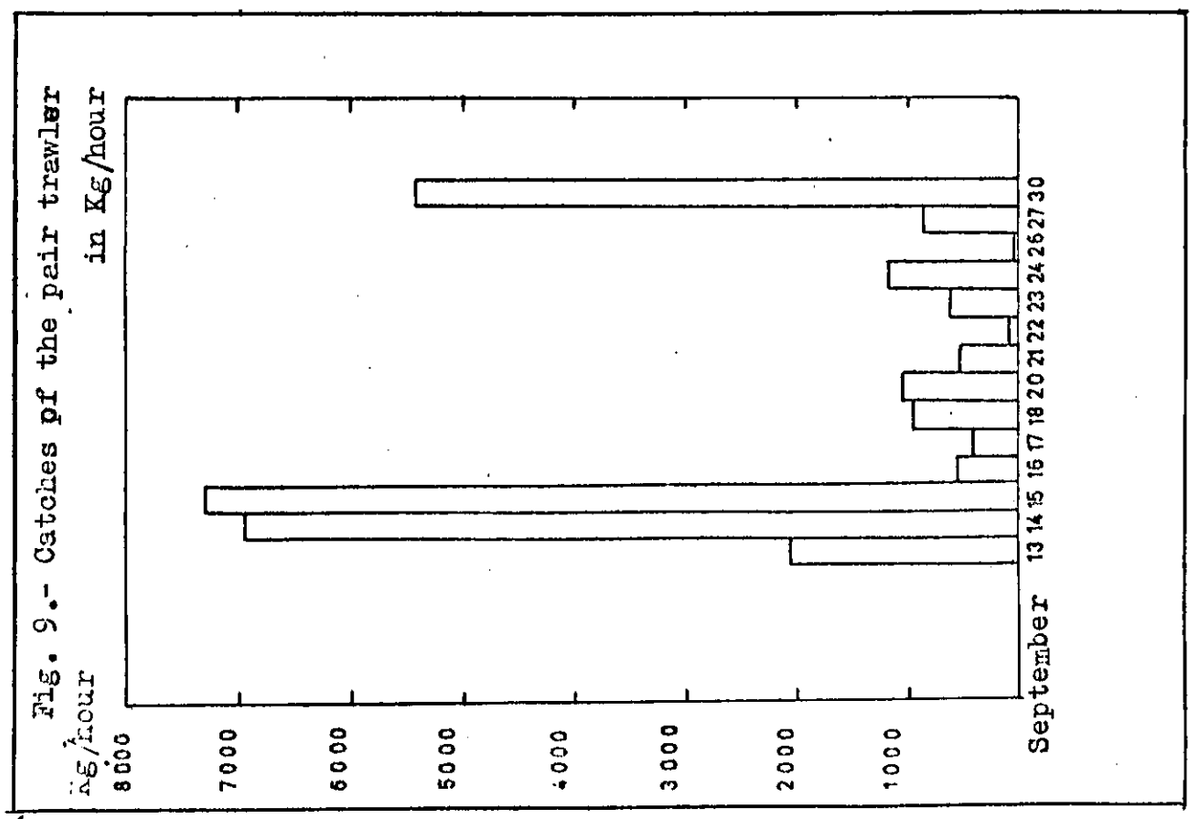


Fig. 9.- Catches of the pair trawler
in Kg/hour
Kg/hour
8000
7000
6000
5000
4000
3000
2000
1000
September 13 14 15 16 17 18 20 21 22 23 24 26 27 30

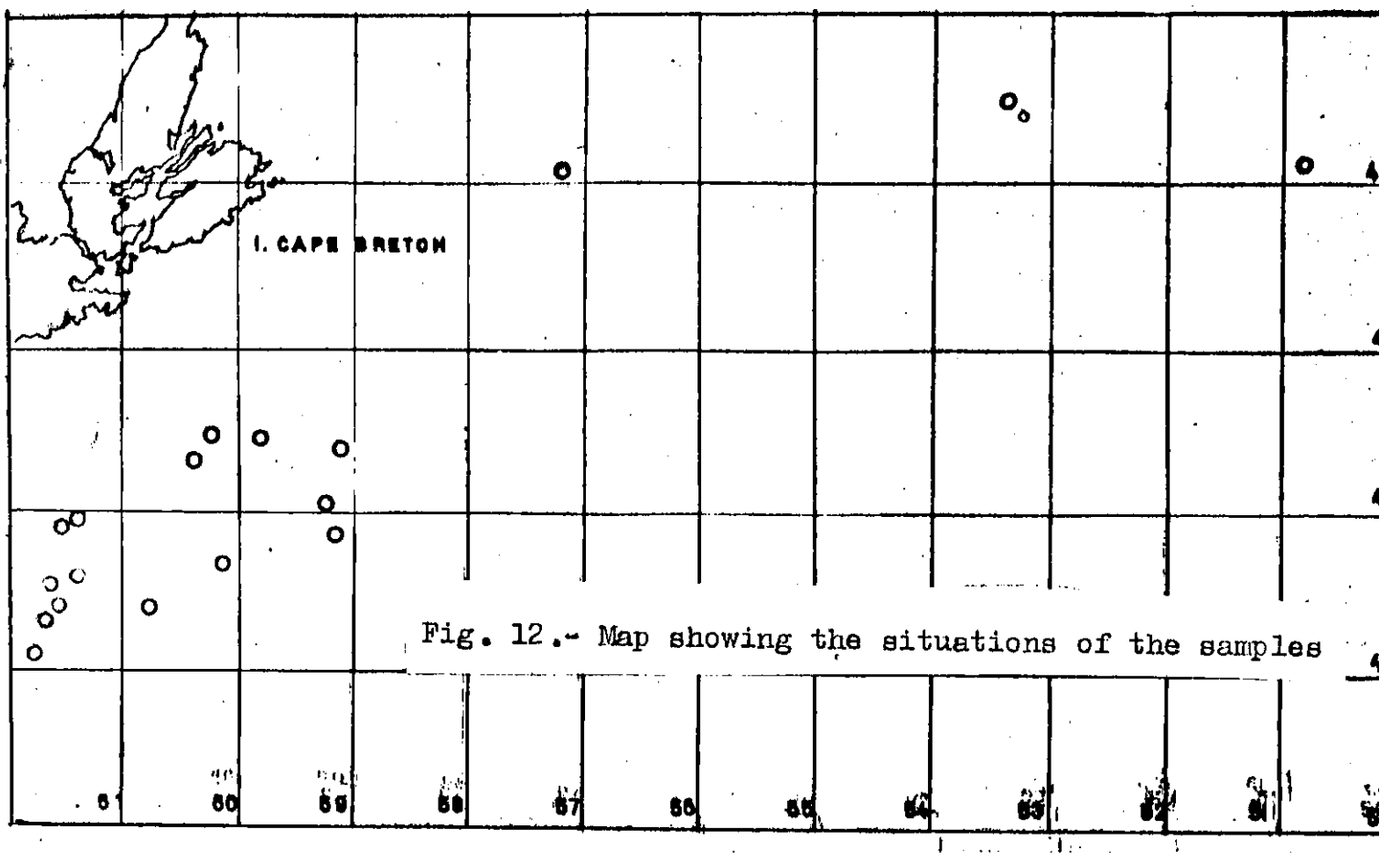
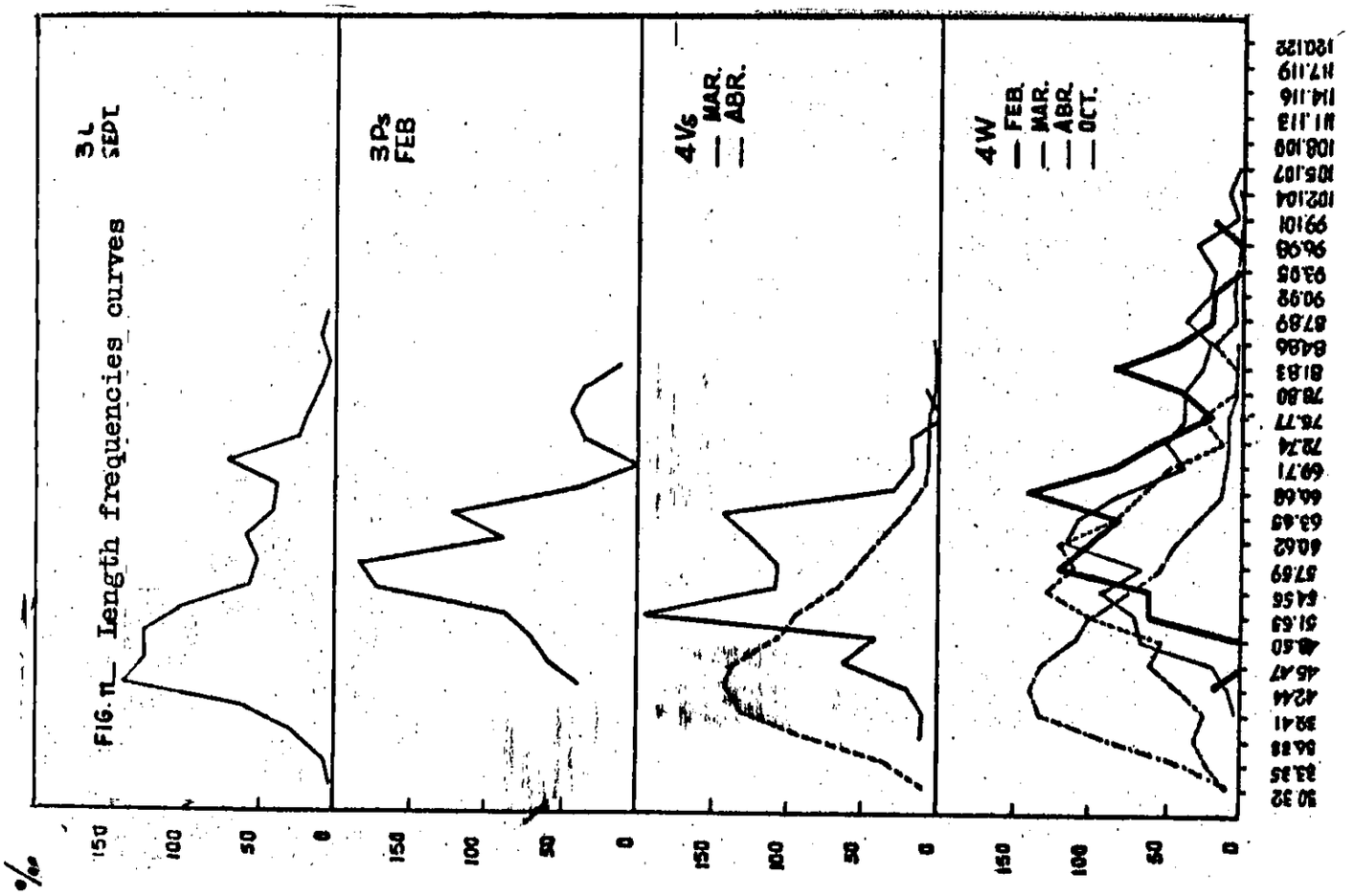


Fig. 12.- Map showing the situations of the samples



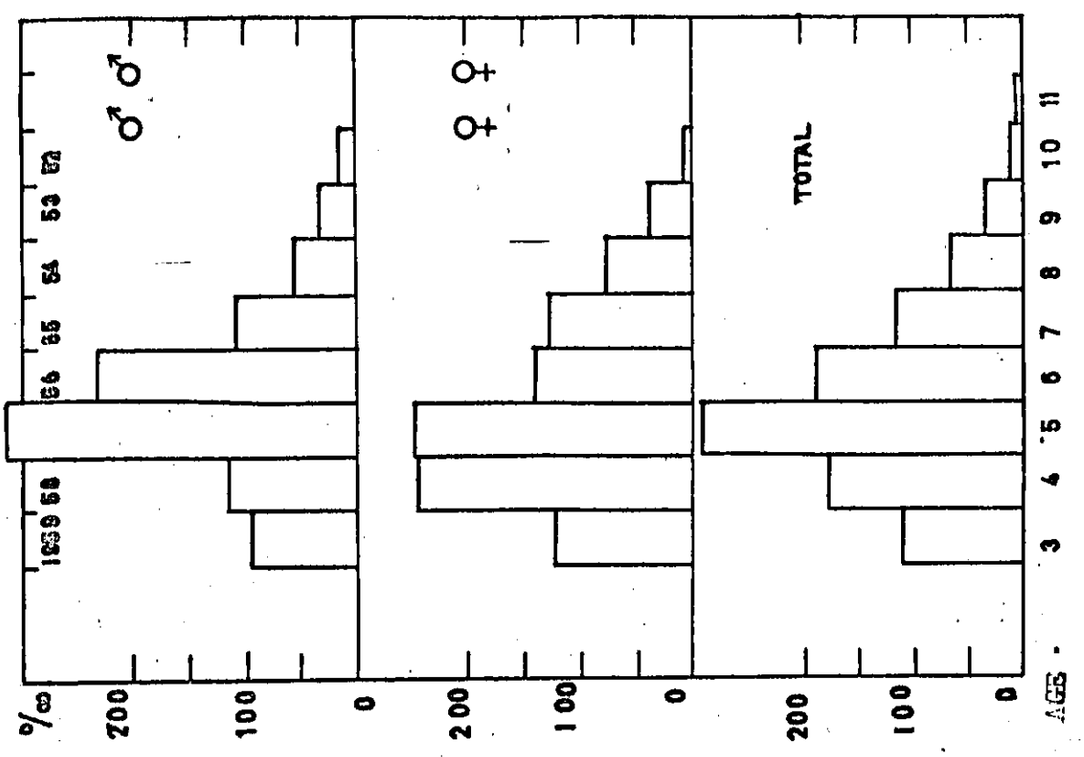


Fig. 14.- Age frequencies, division 4F

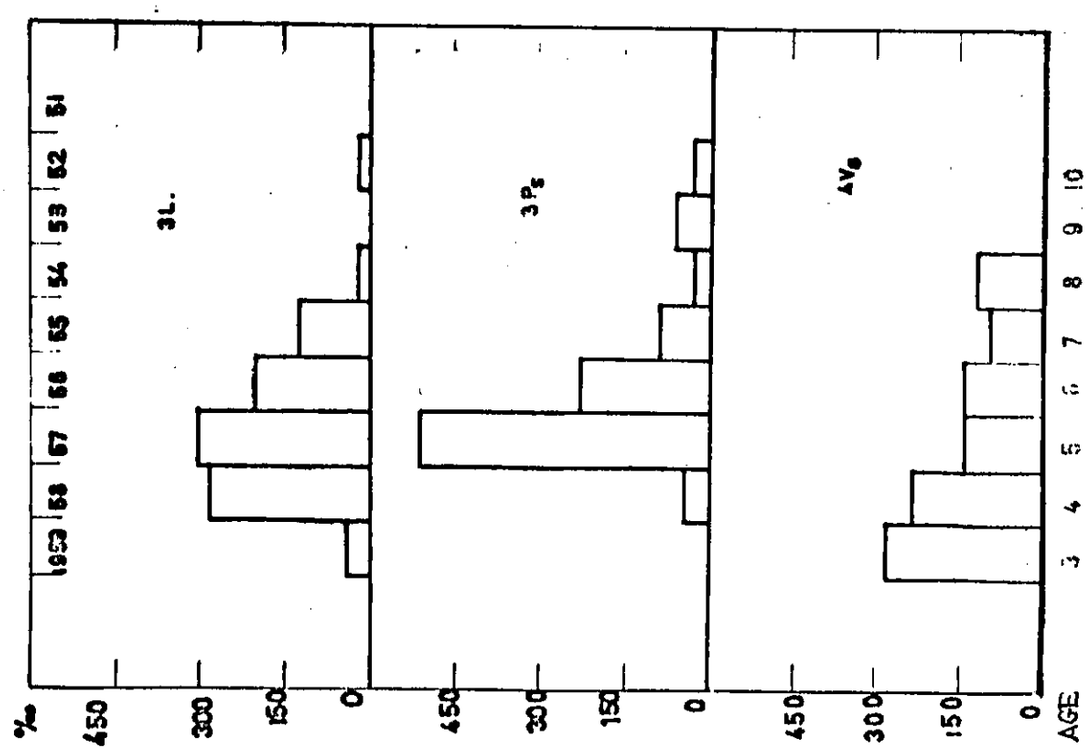


Fig. 15.- Age frequencies, divisions 3L, 3Ps and 4Vs

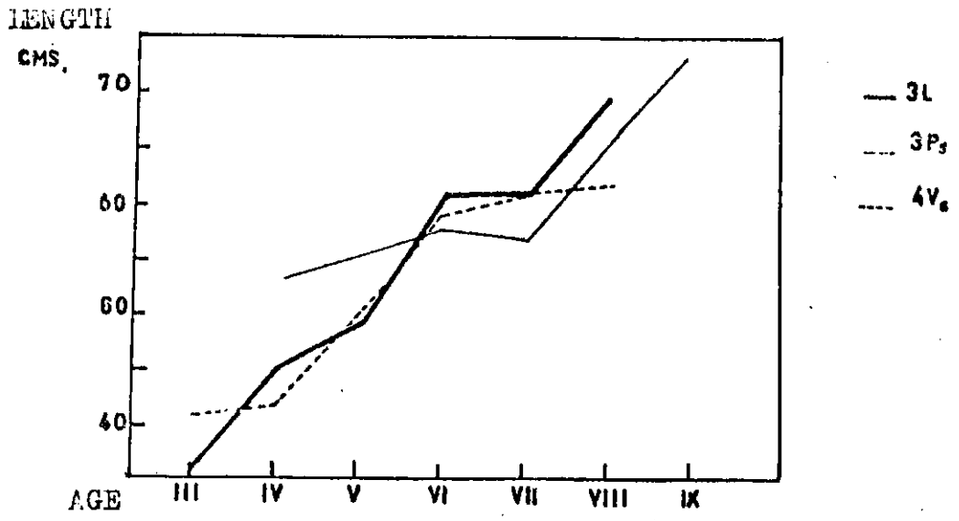
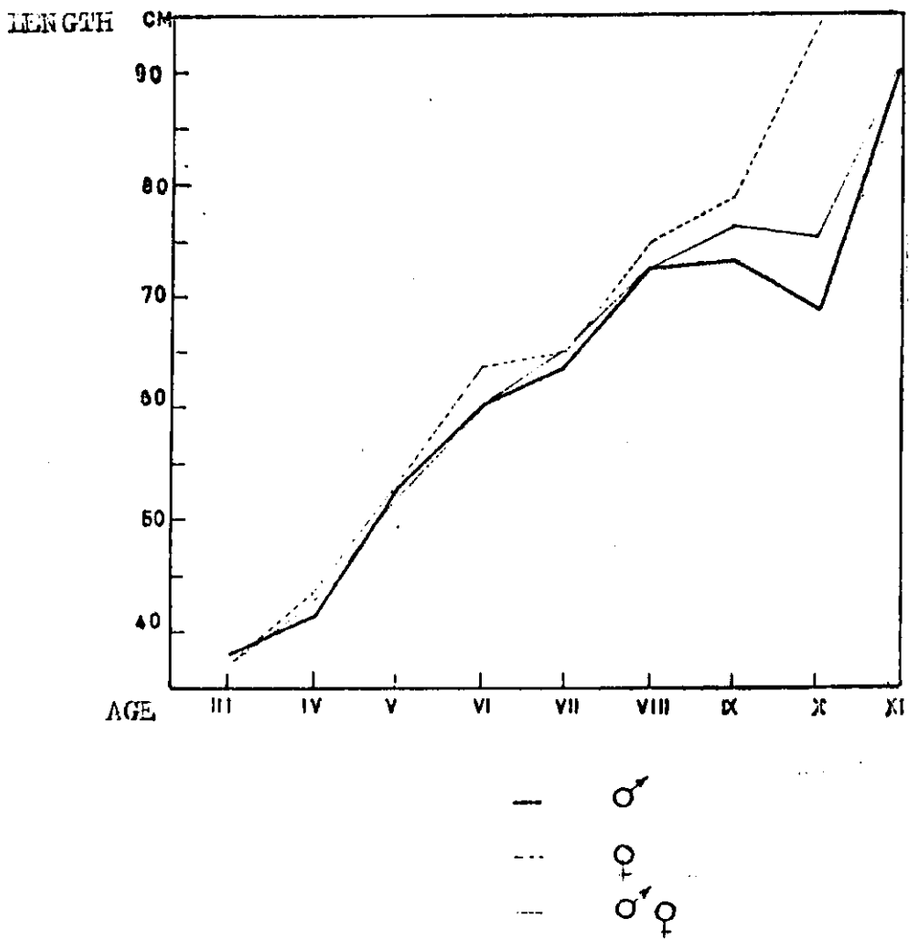


FIG. 15.- Growth curves, divisions 3L, 3Ps and 4Vs

FIG. 16.- Growth curves, division 4W



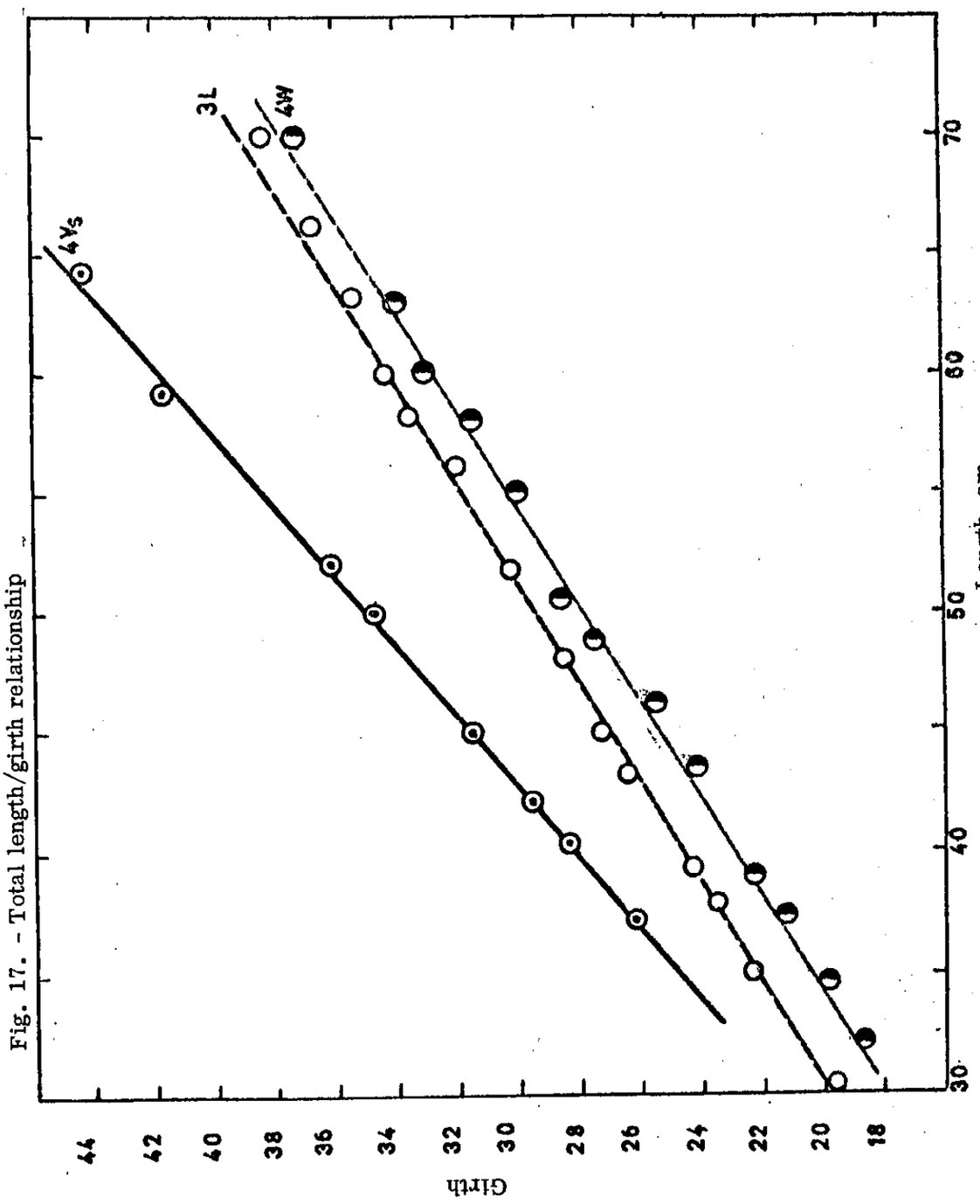


Fig. 17. - Total length/girth relationship