S P E C I A L F I S H E R I E S R E P O R T NO. 14

PRELIMINARY INVESTIGATION OF THE HAPUKU FISHERY OF COOK STRAIT

by

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H A P U K U

Early in 1962 work began on the hapuku or groper. The first phase of this investigation was an examination of the fishing returns for the past 22 years from the Wellington groper boats, both line and trawl. This information was put into graph form and is contained in this first report.

Classification

Two species of groper are commonly taken in Cook Strait, which is the principal commercial area. One is the Bass-groper Polyprion moeone (Phillipps) and the other is the common groper Polyprion oxygeneios (Bloch and Schneider).

The two species of groper are very similar in appearance and up until 1927 when W.J. Phillipps separated them, they were classed together as the same fish, the Bass-groper being considered a deep water form of the common groper.

The Bass-groper is closely allied to the Queensland groper and to the wreckfish or stone-bass Polyprion americanus. It differs from the common groper in that the first dorsal fin is shorter and the 6th spine of this fin is shorter than the length of the pectoral fin; the body is also deeper with bigger eyes and larger scales. It is generally taken from deeper water than the common groper and is not so abundant.

The common groper P. oxygeneios is commonly called any of the following names, hapuku, hapuka, whapuka or habuka, and is related to one of the most important food fishes found in the rivers of Australia, the Murray Cod. It is the common groper or hapuku which forms the bulk of the catches and is the species which is now being investigated.

The average length is 26 inches and the average weight 30 lbs. It can grow up to 60 inches with a weight of 100 lbs.

Distribution and Abundance

Hapuku is widespread, occurring around most of the New Zealand coast. Figures for 1960 catches show the principal ports in order of importance:

Wellington	-	7,749 cwt.
Timaru	-	1,667 "
Napier	-	1,383 "
Oamaru	-	1,335 "
Picton	-	1,044 "
Bluff and Stewart Island	-	963 "
Tauranga	-	835 "

Hapuku was the 6th most important fish in weight, being 4.43% of the total weight landed, but 4th most important in value, being 8.96% of the total value of fish landed in New Zealand during 1960.

Method of Fishing

Hapuku is caught mostly by lines set on the bottom (which may be mud or rock) at a depth of from 80 to 180 fathoms depending on the time of the year and the area being fished. Each line consists of a length of wire mainline to which is attached 50 to 60 hemp or cotton snoods with a hook on the end of each. A grapnel or weight at one end provides an anchorage and a long line with a canvas buoy on the other end provides a marker and means of retrieving the line. The lines are left on the bottom for several hours and are set with the tide and raised at slack water.

DEVELOPMENT OF THE ISLAND BAY HAPUKU LINE FISHERY FROM 1940 TO 1961

Introduction

Prior to 1925 fishing for Hapuku was by handlines, each line having 20 hooks. Crews numbered about 5 per boat and a good day's catch would be from 100 to 200 fish. In 1925 the boats changed over to set lines with canvas floats as marker buoys. In 1940 the boats began to fish the deeper water off the Brothers' Islands. By 1940 the fishery was stable, in that the gear was standardized and the main fishing grounds in Cook Strait had been found. In about 1956 echosounders were installed in most of the boats.

The general trend in later years has been for the amount of gear to increase and the number of men per boat to decrease. The sizes of the boats have remained constant and the number of lines each boat has used have been from 12 to 20 per boat. On the average, for the period under consideration, the increase in gear has only been slight, generally only an additional 2 to 4 lines, i.e. 120 to 240 hooks per boat, and in the last few years the number of crew of the larger boats has dropped from 5 to 3 men. The reduction in crew numbers has limited this increase in the number of lines as all the lines have to be prepared and set by hand.

Any change in the number of hooks fished will affect the weight per unit of fishing effort, which is taken to be 10 days' fishing per boat. However, as each boat fishes a different number of lines, the number of lines per boat varies from day to day according to weather conditions etc., and the number of lines fished each year since 1940 has remained fairly constant; it is not considered that any variation which has occurred would affect to any great extent the final figures of the weight per unit of fishing effort.

EXPLANATION OF THE GRAPHS I TO VII

Graphs I and Ia - Show the average weight of Hapuku or groper per unit of fishing effort, caught by line and trawl boats working from Wellington between the years 1940 to 1961.
The unit of fishing effort used throughout this study is 1 unit equals 10 days actual fishing time.

Graph II - Shows the average number of line boats per month fishing out of Wellington between 1940 to 1961 and the average number of days each boat fished.

Graph III - Shows the fishing effort expressed as the total number of days fished by both line and trawl boats. Note that the trawlers do not specially fish for groper and that the number of days fishing each year by the trawlers, represent fishing for all types of fish.

Graphs IV & V - Represent the average weight of groper per unit of fishing effort caught by both line and trawl boats landing at Wellington. In this case, however, the weight has been expressed as a catch per month, to try and find out if there is a seasonal pattern of catches.

Graph VI - Is a summary of Graphs IV and V.

Graph VII - Shows the total weight of line and trawl caught groper landed at Wellington per year over the last 22 years.

INFORMATION OBTAINED FROM THE FISHING RETURNS FOR 1940 to 1961

This period, 1940 to 1961, has been divided into several sections for the convenience of analysis.

1. 1940 - 1944 (5 years)

The total weight of fish landed, declined from a peak of 900 thousand pounds to a low of 590 thousand pounds. This later figure is the smallest amount of groper ever landed in the last 22 years. However, this does not indicate a decline in fish stocks, as the catch per unit of fishing effort had increased over this period by 1,400 pounds weight. The drop in total catch can be attributed to a decline in the number of boats and the number of hours fished.

2. 1945 - 1949 (5 years)

Over the period the total catches rose steadily reaching an all time peak in 1949. However, the fish stocks available (expressed as weight per fishing effort) fluctuated greatly. In 1946 they had reached a peak but in the following year they dropped down to a very low level. Over the next two years they built up reaching another peak in 1949.

The number of boats fishing increased steadily over this period. Although the average catch per unit of fishing effort dropped sharply in 1947, the overall total of fish landed increased. This was due to an increase in the number of boats fishing and the fact that the number of days fishing per boat rose to a very high level. Thus a decrease in fish stocks was counteracted by a greatly increased fishing effort resulting in a continuing high

level of total weight of fish landed.

3. 1950 - 1956 (7 years)

Over the next 6 years, the total catches dropped steadily except for one upsurge in 1952. This increase in total catch is a reflection of the upsurge in the weight of fish caught per unit of fishing effort indicating that in 1952 more fish became available to the industry. This is a valid conclusion as the number of boats and the hours fished remained constant. The next period from 1952 to 1956 inclusive, is interesting in that while the total catches dropped steadily, the catch per unit of fishing effort remained constant, or in other words, the population of fish available to the industry remained static. This drop in total catch is, therefore, expected to be due to a decrease in the number of boats fishing, and when the graphs are studied this is seen to be the case. This static population could indicate that the rate of catch and the rate of replacement were equal. If the number of boats had remained constant would the weight per unit of fishing effort have declined? The answer is not known.

4. 1957 - 1961 (5 years)

The last period of 5 years showed a steady increase in total catches up until 1958. In this year the greatest amount of groper since 1949 was landed. This peak in 1958 is due firstly to a big increase in the catch per unit of fishing effort and secondly to the advent of 3 more boats fishing. In the three years after 1958 the total catches dropped steadily reaching their lowest level since 1945. In 1961 the amount of fish available increased but this increase was not reflected in the total catch because of a decrease in the hours fished per boat.

Summary

During the war years the total catch declined as fewer boats fished. In 1947, although the fish stocks decreased, more fish were landed as the boats increased their fishing effort. Over the next two years the fishing effort dropped but total catches still increased as there was an increase in the fish stocks. During the following two years, fish stocks dropped and this resulted in less fish being landed. The following year fish stocks increased and the total catch also rose. Over the next 4 years the fish stocks remained static but total catches declined as fewer boats fished. In 1958 both fish stocks and the total catch reached a high level. After 1958 the fish stocks showed a decline which continued until 1961. Total catches have declined steadily since 1958.

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A COMPARISON BETWEEN TRAWL AND LINE CATCH PER UNIT OF FISHING EFFORT

A comparison between the graphs of weight per unit of fishing effort of the trawl and line fisheries for hapuku show a somewhat similar pattern of fluctuations year to year of catch per fishing time.

The graph can be divided into 3 sections for ease of analysis.

1. 1946 to 1952

Over this period the line fishery catches showed two major increases followed in each case by a significant decrease. In the trawl fishery, a similar pattern of changes occurred on a much reduced scale. However, the years of increase in line catches do not correspond to the years of increase in trawl catches but rather to the opposite.

This could indicate one of the following factors:

(a) That either the catches of the trawl fishery influences the line or that the catches of the line fishery influences the trawl catches.

(b) That the factors or conditions causing the fluctuations in the two fisheries do not affect both fisheries at the same time and that there is a time lag of 1 to 2 years.

(c) That movement of the trawlers from one ground to another would affect the quantity of groper caught.

2. 1952 to 1955

In 1952 the catch per fishing effort of the line boats rose sharply but the trawl catches did not follow this pattern but rather showed a decrease in this year, not rising until the following year. From 1953 to 1955 both fisheries showed no decrease, the line catch per effort remaining stable and the trawl rising.

3. 1956 to 1961

In 1956 both fisheries showed a fall off in catches which continued into the next year. In 1958, however, both fisheries showed a substantial increase in catches followed in 1959 and 1960 by a steady decrease. In 1961 the similarity between the two fisheries ceased, the line fishery showing an increase and the trawl fishery a further decrease.

There is enough correlation between the fluctuations of the catches from the two types of fisheries to draw the following conclusions:

That the two types of fisheries, working in different areas, are fishing the same population of fish; or that they are separate populations of fish undergoing similar fluctuations in numbers.

This correlation also indicates that at least since 1952 the fluctuations in catch per effort have not been caused by variableness of the efficiency of the gear or the selectivity of the fish but by changes in the actual numbers of the population.

The line fishery depends on the fish allowing themselves to be taken; therefore variations in the feeding habits or condition of the fish would alter the catches. In trawling, however, a sample of the population is taken irrespective of the feeding habits or condition of the fish.

To sum it up: The fact that two entirely different methods of fishing, acting on the fish in different ways, should show a similar pattern of catches seems to indicate that these fluctuations in catch per fishing effort can be attributed to actual changes in the number of fish being available to the industry.

There have been 3 major increases followed in each case by a substantial decrease. The fishery at present is just recovering from one of these depressions. One of the problems is to find out the cause or causes of these significant fluctuations. Several theories can be advanced but at present there is no proof for the acceptance of any one.

There was a poor survival of eggs in a past spawning year.

There was a period of excessive mortality of the adult fish.

The fish moved away from the normal fishing grounds due to some factor such as weather condition or supply of food; or that the adult fish concentrated on the fishing ground for some reason, so that an excessive number were caught in one year resulting in fewer fish being available in a following year.

VARIATION OF MONTHLY CATCHES

A study of Graph VI, the Average Monthly Weight of Fish Landed per Unit of Fishing Effort over the years 1950 to 1961, reveals the following pattern of catches of hapuku:

1. Line Fishery

From January to April there is a decline in catches with March being the worst month. May, June and July show significant increases with catches reaching a peak in July which is the best month and forms what is called the winter fishery. A second smaller increase occurs in October and this is called the summer fishery.

2. Trawl Fishery

On the other hand, trawl catches show a rather more even monthly distribution with catches increasing steadily from January, reaching a peak in September and then decreasing over the next 3 months, reaching a low in December. Thus the greatest trawl catches are made in the summer period.

Graphs IV and V show the catches per month for the individual years from 1950 to 1961. It can be seen that although the general pattern as stated above is the usual, there are some variations each year.

It is interesting to note that in 1958, which was the best year for the last 12 years, the catches were much higher each month than normal, although there was still a slight increase in July, a decrease in August and another slight rise near the end of the year.

This difference in catches per month may be related to biological habits of the fish and it is probably spawning conditions which dominate the pattern of catches, especially in the line fishery. Prior to spawning, catches are poor but as the fish reach spawning condition, catches rise reaching a peak in July. At this time the fish appear to be congregated in localized areas and it is the belief of the fishermen that the hapuku or groper are on the move to, or at, their spawning grounds. On or after spawning, catches slump but soon rise again and remain fairly steady until the end of the year.

The different monthly pattern of the line and trawl fisheries is probably due to the different methods of fishing. The trawl catching fish actually available and not depending on their feeding or spawning habits except as far as it influences the movement of the fish onto the trawling grounds.

Fishing Seasons

There are two main seasons for groper each year. The first is the winter season in June and July when catches reach a peak for the year. The main ground for this is by the Brothers' Islands, where the lines are set on a soft mud bottom at a depth of 100 to 180 fathoms. The fish taken from here are very fat, in good condition, and with developing gonads. It seems likely that this area could be a spawning ground.

Catches drop after July and do not rise again until October and November. This later period is said to be the summer season. During the summer season the best fish are taken on a rocky bottom in shallower water. Fish taken off the soft bottom grounds of Island Bay, Palliser Bay and Cook Strait, are not in good condition but are battered and thin, although generally being of a good size.

Fish Sizes

The fishermen state that the size of the fish have not changed over the years, but that they still catch the small and large fish together. They state that the numbers of groper are becoming fewer every year, but do recognise that in some years catches are greater than others.

Another factor which has affected the line fishery from Wellington is the falling off of the catches of ling. Ten to fifteen years ago, large catches of ling were taken from Cook Strait and Palliser Bay by the line boats, but now very little is landed. Thus the line fishery is now more concentrated on one species of fish and therefore becomes more vulnerable to any fluctuations in the abundance of this one species of fish which is hapuku.

Fishing Grounds

Since 1940 no new big grounds have been found. Small areas have been located such as Cape Campbell around the East Coast and small pockets in the main Cook Strait grounds. The fishermen state that these new grounds do carry fish but cannot be fished as heavily as similar types of new grounds found in past years. Up until 12 to 15 years ago, the Cook Strait ground was the mainstay of the fishing boats, consistently yielding good catches all the year round, and it was a result of the fall off in this area that the boats began looking for new grounds.

A factor which can affect catches is the condition of the fishing grounds. An example of this can be seen in the year 1961. Fishermen state that during this year much of the normal Cook Strait ground was covered by dirty water and occupied by excessive numbers of sharks and skates. Groper appear to be effected by conditions such as these and move away from the area.

Conclusions

1. The total amount of fish landed is influenced by the density of the population and the fishing effort.

2. That the trawl and line boats are fishing either a single population of fish in Cook Strait or separate populations with similar fluctuations in numbers.

3. Yearly fluctuations in catch numbers are related to abundance of stock rather than to changes in methods of fishing.

4. The monthly variations in catches of the line boats are caused by biological changes in the fish.

5. On the evidence of the graphs it could not be said that the fishery is showing signs of overfishing. However, when additional information is examined, the picture becomes slightly more complicated. Whereas the boats prior to 1950 were concentrated more in one area they are now spread over a much wider field and although the number of boats has increased and echosounders were introduced about 1956, the amount of fish caught per unit of fishing effort has not noticeably increased. Or to put it another way, none of the above factors, which would have expected to increase the catches, have caused an increase in catch per fishing effort.

In addition, some new areas have been found with conditions which appear ideal for groper, yet few fish were found and those new areas, which do have some fish, cannot be fished as heavily as the fishermen expected.

These conditions point to a decline in the abundance of groper, yet the sizes of the fish have not changed, the fishermen are still catching the same percentage of large fish as in years past. If the fishery was being overfished, then the fish sizes would be expected to become smaller as the large adult population was fished out. Furthermore, overfishing would have been expected to have caused the catch per unit of fishing effort to have declined more evenly and definitely each year. This has not been the case, as the most outstanding factor which has become evident from a study of the graphs, are these very large fluctuations in catch per fishing effort which have

occurred over the last 22 years.

It appears evident that the fishing effort has had some effect on the abundance of the stocks but that the abundance or scarcity of the hapuku or groper in any one year is due to the affect of natural phenomena rather than to the influence of the line boats themselves.

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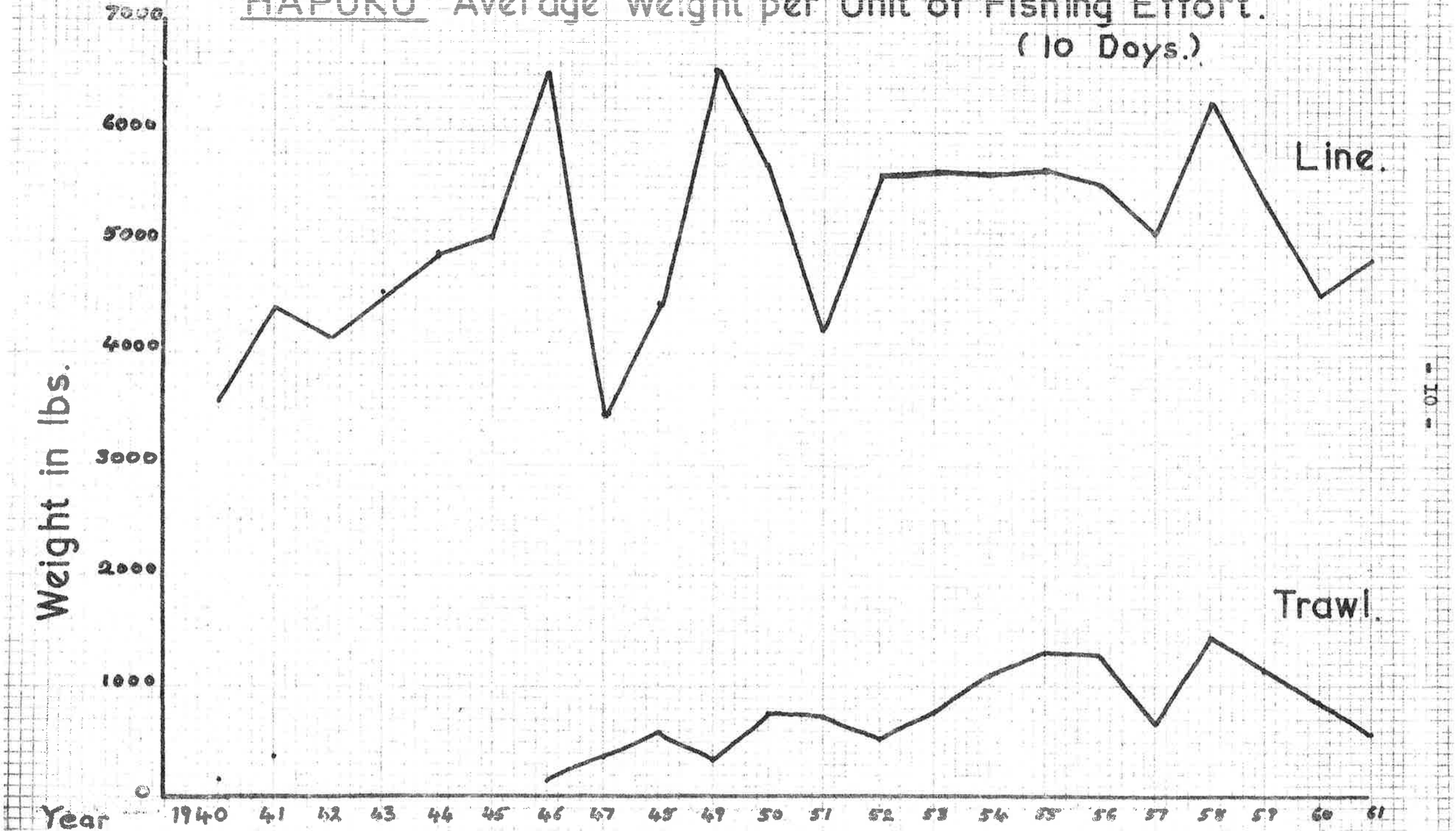
GRAPH I

HAPUKU Average Weight per Unit of Fishing Effort.

(10 Days.)



GRAPH II

HAPUKU LINE FISHERY

AVERAGE NUMBER OF BOATS FISHING PER MONTH.

No of Boats Fishing

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

AVERAGE NUMBER OF DAYS FISHING PER BOAT.

No of Days Fishing.

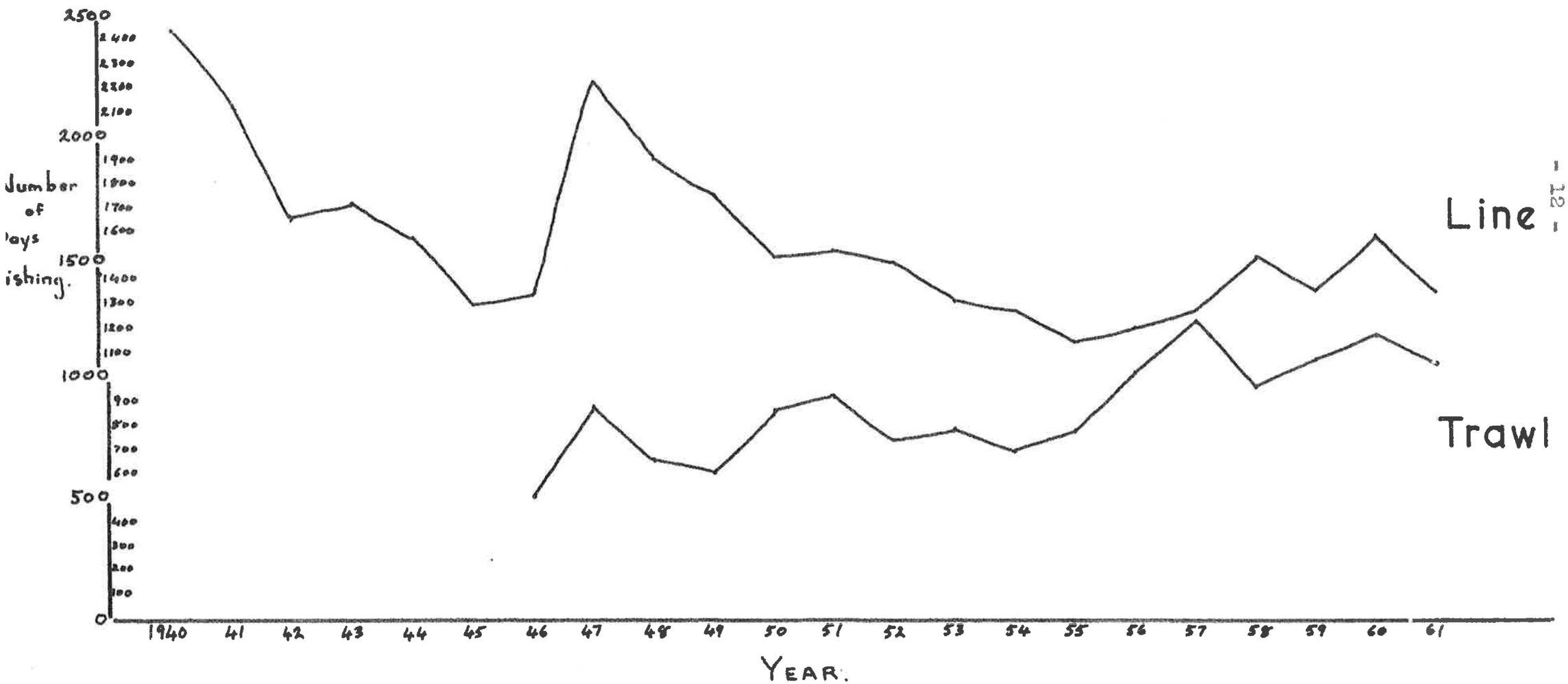
0 20 40 60 80 100 120 140

YEAR

1940 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61

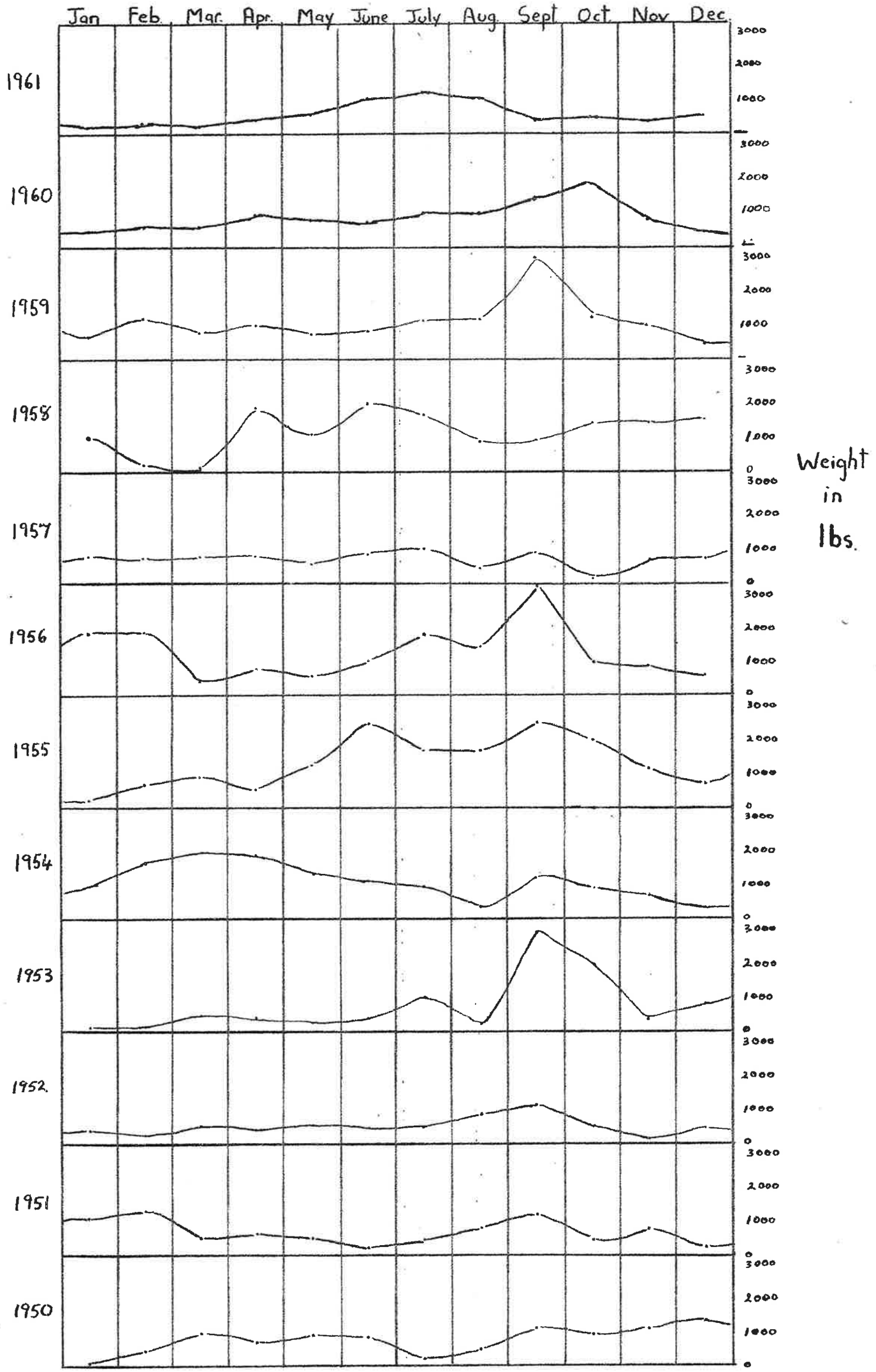
GRAPH III

HAPUKU Total Number of Days Fishing per Year.



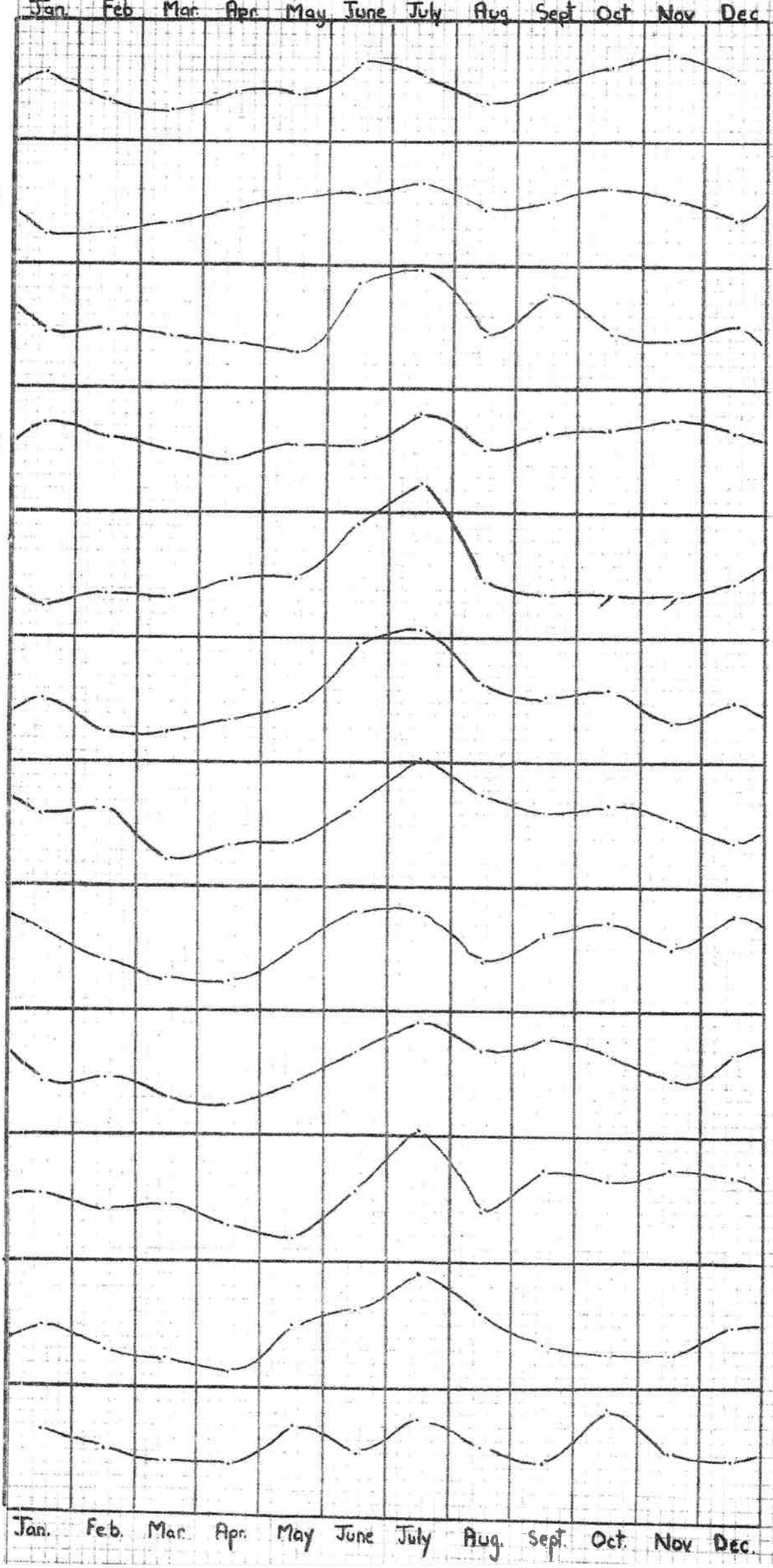
HAPUKU TRAWL FISHERY WGTN GRAPH IV

AVERAGE WEIGHT PER UNIT OF FISHING EFFORT (10 DAYS)



HAPUKU

AVERAGE WEIGHT PER UNIT OF FISHING EFFORT.



10,000 lbs.

GRAPH V

LONGLINE FISHERY WELLINGTON

Weight in lbs.

Each Square Equals 1000lb

WEIGHT PER UNIT = WEIGHT FOR 10 DAYS FISHING

10,000 lbs.

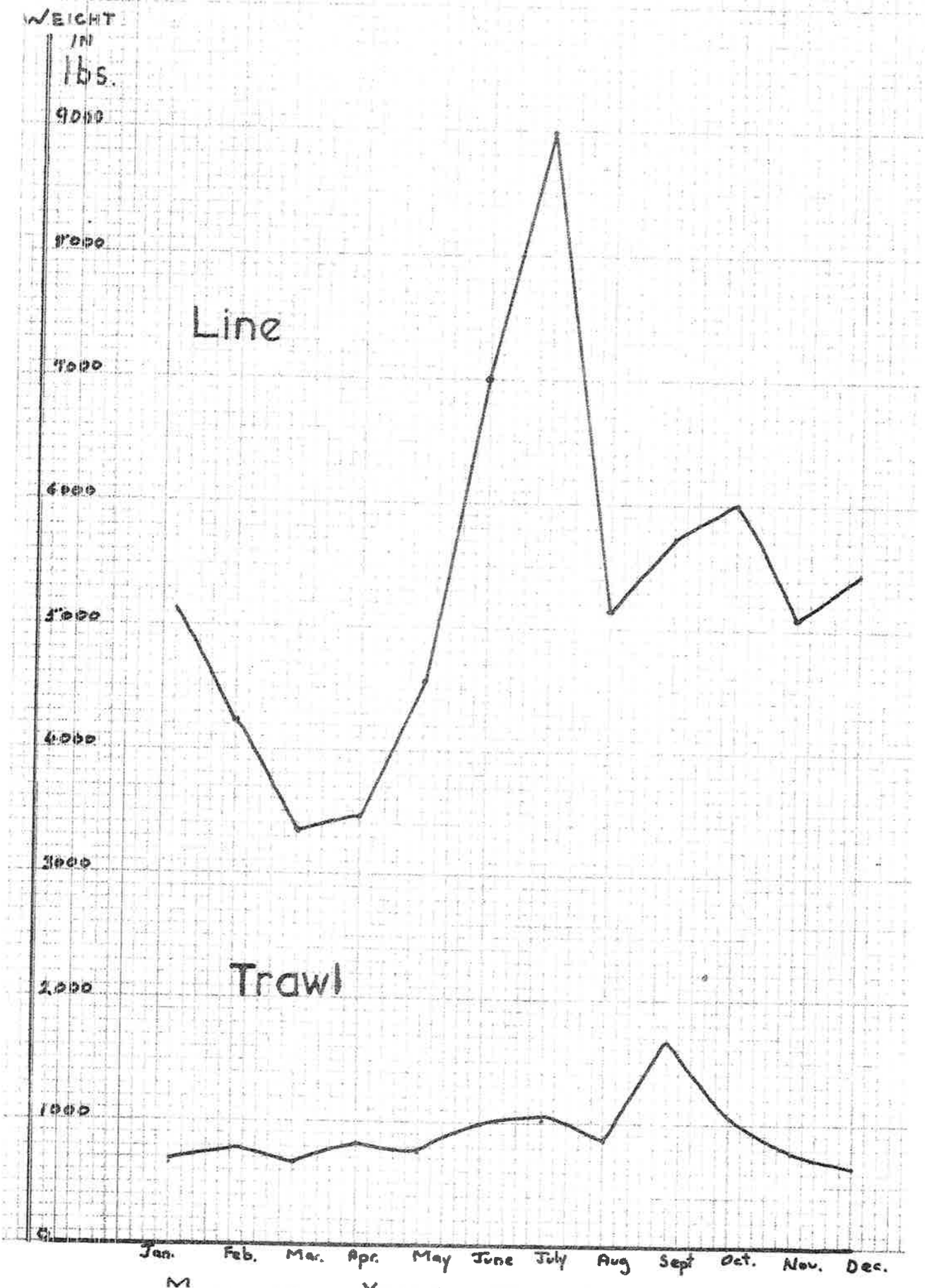
10,000 lbs.

10,000 lbs.

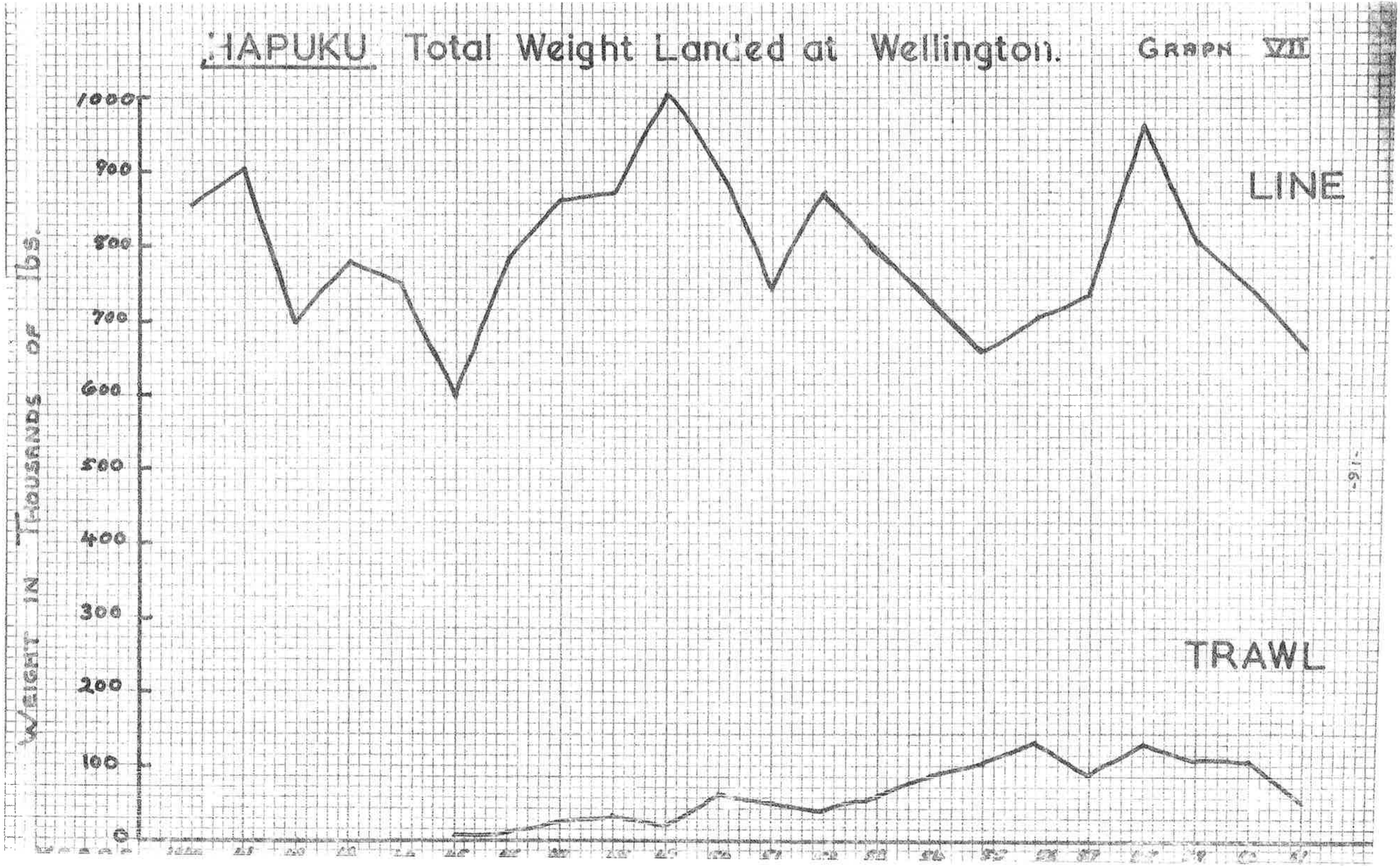
10,000 lbs.

GRAPH VI

HAPUKU. AVERAGE MONTHLY WEIGHT PER UNIT OF FISHING EFFORT FOR THE YEARS 1950 – 61.



MONTHS YEARS 1950 – 61


HAPUKU Total Weight Landed at Wellington.
GRAPH VII
1000
900
800
700
600
500
400
300
200
100
0
WEIGHT IN THOUSANDS OF lbs.
LINE
TRAWL