INTERNATIONAL COMMISSION FOR THE CONSERVATION
OF ATLANTIC TUNAS

COMMISSION INTERNATIONALE POUR LA CONSERVATION
DES THONIDES DE L'ATLANTIQUE

COMISION INTERNACIONAL PARA LA CONSERVACION
DEL ATUN ATLANTICO

STANDING COMMITTEE ON RESEARCH AND STATISTICS

REPORT OF THE MEETING OF THE SPECIAL WORKING GROUP ON STOCK ASSESSMENT OF YELLOWFIN TUNA

(Abidjan, June 12 - 16, 1972)

MADRID, 1972

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The Special Working Group on Stock Assessment of yellowfin tuna assigned at the Second Regular Meeting of ICCAT (Madrid, November-December, 1971), met in Abidjan June 12-16, 1972 under the chairmanship of Dr. J.C. Le Guen.

The group was welcomed by Ivory Coast Minister of Animal Production Dicoh Garba, whose Government hosted the meeting. A list of the participants is attached as Annex 1.

A. Fonteneau and W. Lenarz were elected Rapporteurs and were assisted by several other members of the group.

I. YELLOWFIN AND SKIPJACK CATCHES

Estimated catches of yellowfin and skipjack are shown in Table 1 and plotted in Fig. 1. Skipjack catches are included because varying amounts of surface fishing effort are devoted to this species. The total catch of yellowfin declined between 1963 and 1967, increased sharply between 1967 and 1969, and decreased between 1969 and 1971. The highest catch of yellowfin occurred in 1969. The major portion of the yellowfin catch was taken by the longline fishery prior to 1965. After that year the surface fishery has produced the majority of the catch. Contrary to a slightly increasing trend shown in the yellowfin catch, a definite upward trend is observed in the case of skipjack. The total catch of yellowfin and skipjack has increased considerably during the period. The highest combined catch occurred in 1971 when about 150,000 tons of yellowfin and skipjack were landed.

Available data on nominal effort[1/] indicate that longline effort increased between 1963 and 1965, then decreased as Japanese effort was reduced and, since 1968, has increased as Korea and Taiwan have expanded their fleets. Effort in the surface fishery has increased. Since 1967, the introduction of large purse seiners has added considerably to the surface effort. The sharp increase in total catch of yellowfin and skipjack probably reflects an increase in nominal effort of the surface fishery. In the last two years the yellowfin catch by the surface fishery has remained constant, the skipjack catch has increased from 58,000 to 81,000 M.T., and yellowfin catch by the longline fishery has decreased from 31,000 to 24,000 M.T.

II. NOMINAL EFFORT

Reported effort of the Japanese longline, French-Côte d'Ivoirean-Senegalese (FIS) surface gears and American large purse seiners are shown in Table 2. Nominal effort by FIS average

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1/ Fishing effort refers to fishing mortality. Nominal effort refers to reported effort and may not be proportional to fishing mortality.

seiners has remained fairly constant. Nominal effort by large American purse seiners increased sharply between 1967 and 1970, and then dropped sharply in 1971.

Table 3 presents number of longliners, baitboats and purse seiners that fished for tropical tunas in the Atlantic. The table is incomplete but probably includes most of the effort between 1969 and 1971. While the number of baitboats dropped between 1969 and 1971, the number of longliners and purse seiners increased. The average size of purse seiners showed an upward trend during the same period.

III. INDICES OF ABUNDANCE

Data on catches per unit effort for several sections of the fishery are presented in Table 4. It is hoped that each of these provides an index of abundance for certain sizes of fish in a particular area. Each index is subject to the usual sources of error involved in any measure of catch per unit effort; such as change in the skill or behavior of fishermen, especially in a new fishery, changes in the size and performance of vessels, sampling variations when only a few vessels are operating, etc. As indicated below, certain individual points have been omitted because of such probable errors. Within certain fleets the relative performance of difference size-classes of vessels was calculated in the usual way.

The above account for only some of the differences in trends observed in Table 4. The major cause for such differences is that abundance indices for different groups of fish are being estimated. For example, longline data refer to large fish, which have steadily declined since the onset of heavy fishing, while data for surface fisheries refer to all sizes of fish in specific and somewhat localized areas.

Although the precise population structure of Atlantic yellowfin is not known, it is clear that at least when the fish are small, they form a number of distinguishable groups. On the other hand, even if the large adult fish do not mix completely, the longline fishery does cover essentially the whole distribution range of large yellowfin in the Atlantic, so that catch per unit effort of longliners can be treated as an index of abundance of the large fish considered as a unit. For convenience, the eastern Atlantic has been divided here into three areas (Fig. 2) for the purpose of analysis of the surface fisheries.

1. East of the Greenwich meridian (including the Pointe-Noire fishery).

2. West of the Greenwich meridian, and south of 10ºN (including the Abidjan fishery).

3. North of 10ºN (including the Dakar fishery).

The lines have been set according to fishing areas adopted for FIS fleet statistics. It is emphasized that these divisions are provisional and somewhat arbitrary. The dividing line along the Greenwich meridian cuts through a major concentration of U.S. purse seine fishing and it should probably be moved. As a guide-line to possible modification of abundance, it is recommended that a single chart should be prepared before the next meeting of the Standing Committee on Research and Statistics, to show distribution of total catches, by 1º or 5º squares, of all surface fisheries for which data are available.

Standardized catches per unit effort in each area are shown in Table 5. For easy comparison, the figures for each gear have been expressed in percentages for the years 1969-1971. There is reasonable agreement between the indices obtained from different gears. The relation among indices of different gears is better within areas than when the areas are combined. The unweighted mean of the available indices has been used as our best single index of abundance in each area. The indices for the three areas then need to be combined to provide a single index of the abundance of yellowfin tuna, of the sizes available to these surface fishing gears. Again, lacking any strong reason for using any other weighting, e.g., according to the areas of the three regions, the simple arithmetic mean has been used.

In addition to these indices of abundance of all yellowfin, the catches per unit effort can be used in conjunction with size composition data to provide indices of abundance of particular size or age classes (Figs. 3-6). Of particular interest in this regard are trends in the CPUE of the incoming year class to the northern and southern areas respectively. The apparent increasing trend is therefore encouraging and might suggest that the reduction in abundance of large adult fish has not yet shown an effect on recruitment. However, actual catches of these sizes of fish (of incoming year class) depend, possibly to a considerable extent, on the degree of the fishermen's interest in them and effort they concentrate on same. With the decline in large fish, such interest might grow and therefore the increasing trend in CPUE may be on artifact. Caution should be exercised in the interpretation of these data.

IV.- RELATION BETWEEN TOTAL CATCH AND EFFORT

Sets of figures plotting catch, or catch per unit effort, against effort were made using estimates of catch, effort and catch per unit effort data (Figs. 7-9). Three relations were plotted.

1. For longline fisheries alone (Fig. 7).

2. For surface fisheries alone (Fig. 8).

3. For total fishery (Fig. 9).

Fig. 7, in agreement with previous analyses (FAO Miami report, Hayasi et al), shows that longline effort is beyond the level at which further increase in fishing yields no significant increase in total catch. This asymptotic level of total longline catch has fallen in the last decade, following the increase in surface catches and resultant decrease in recruitment to the longline fishery. The curves labelled I, II and III in Fig. 7 suggest the nature of changes in the production curve of the longline fishery as recruitment was reduced.

Fig. 8 shows the relationship, for the surface fishery, between catch and effort given in Table 5. The figure suggests that present fishing effort is approaching the level beyond which increasing effort yields no appreciable increase in catch. The same data are presented somewhat differently in Fig. 10, where the index of abundance in one year has been plotted against the mean of fishing effort for that year and the previous one. Fig. 10 also shows the corresponding relation between catch and effort. This procedure is believed to give a better representation of equilibrium relations between catch, index of abundance, and effort in a fishery in which the effort is changing rapidly from year to year.

It should be noted that the surface fishery is restricted to the eastern part of the Atlantic and the results apply only to the fish in this area. If, as is likely, there is only slow mixing among fish further westward, increased surface catches could be achieved from greater fishing on western fish.

Fig. 10 needs to be interpreted with caution because of the interactions between surface and longline fisheries. There is considerable overlap in sizes of the catch in the two fisheries (see Fig. 11). During the period under analysis there have been considerable changes in longline effort that could have affected the CPUE in the surface fishery. Also, as discussed above, increased surface fishing reduced recruitment to the longline fishery, so that the trends in total catch as well as trends in the surface catch should be considered with changes in surface effort.

An attempt is made in Fig. 9 to take these effects into account. Total catch has been plotted here against the total effort by all gears, i.e., total catch divided by the index of abundance in the surface fishery as given in Table 5. Though this index is not the best measure of abundance of larger fish exploited by the longline fishery, and may in later years overestimate their abundance and hence underestimate the longline effort, this procedure is believed the best simple approximation to the total effort. This figure shows that, as in the surface and longline fisheries considered separately, the curve flattens out at the present high level of effort. This conclusion is in agreement with those based on the yield-per-recruit analyses discussed in the following section.

Total yield-per-recruit for both surface and longline fisheries was prepared by Hayasi et al (Fig. 12). When their estimates of present values of F, i.e., about 1.0 for surface fishery and about 2.0 for longline fishery, were plotted, they concluded that further increases in either fishery may not result in substantial increase in yield.

It should be emphasized that yield-per-recruit analyses explicity exclude any consideration of the effect of the fishery on the level of recruitment. The same is also more or less true of catch and effort analyses, since changes in recruitment, if any, would take at least one generation to become effective, whereas the higher levels of effort have only occurred for a short period. At some low level of adult stock the average recruitment must be reduced, but it is not known at what adult stock level this effect becomes significant. There is a possibility that this critical level might be approached if fishing effort is increased. Since increasing effort will not give much increase in catch-per-recruit, and may cause a reduction in recruitment and therefore in total catch, the group believes it would be desirable to discourage any rapid increase in fishing beyond the present level, particularly in the existing geographical boundaries of the surface fishery of the eastern Atlantic.

V. YIELD-PER-RECRUIT

The Working Group discussed papers prepared by Lenarz and Sakagawa, and Joseph and Tomlinson on yield-per-recruit in the Atlantic yellowfin fishery. It was agreed that such analyses are complicated by the presence of gear types which harvest different and varying proportions of the total catch for each length or age of yellowfin. The surface fishing gear, baitboats and small and large purse seiners, catch about twice the tonnage taken by the longline gear, with half of this being from the range of sizes harvested by the longline fleet (Fig. 11). Thus, surface gears for the years shown take one-third of the

total yellowfin catch before the fish are recruited to the longline fishery and then compete directly with these vessels for the remainder of the catch (Fig. 11).

Yield-per-recruit analysis is limited by the quality of information on sizes of yellowfin harvested by the fishery, on growth rates, and on natural and fishing mortality.

Lenarz and Sakagawa evaluated the effect on yield-per-recruit of changes in recruitment size and in instantaneous rate of fishing mortality. Joseph and Tomlinson utilized a similar technique to examine yield-per-recruit, but in addition partitioned fishing mortality by size increments, by type of gear, over the range of sizes of yellowfin taken by the fishery in recent years. This permitted examination of the effects of changes in recruitment size and fishing effort on the yields by each gear type.

The studies indicated that at low levels of fishing effort (for example, F = .2) the yield-per-recruit would not be increased measurably by any increase in the size of first capture. However, if fishing mortality is higher (for example, 1.0 and above), an increase in the size of recruitment to the optimum level indicated in Table 6 would result in about a 10% increase in yield-per-recruit. In addition, this increase in the entering size would shift the share of total catch among the gears. Baitboats, which take a high percentage of smaller sizes, would suffer a loss of share, while the small purse seiners, large purse seiners, and the longline vessels divide the gains. It was noted that size regulations could cause unanticipated changes in fishing strategy that might change size specificity of fishing mortality. Thus, yield may be affected in an unpredictable fashion by size regulations.

The Working Party discussed the difficulties in increasing the size of yellowfin caught. If fishermen cannot distinguish sizes of tuna in the water and/or there is a wide variety of sizes within schools, it is likely that many fish below the minimum size will be captured and discarded. Most of the discarded yellowfin will be dead and thus wasted. Fishing on mixed schools of skipjack and small yellowfin will result in additional wastage of undersized yellowfin that would be discarded under minimum size regulations. The losses from these effects following establishment of minimum size regulations may exceed the gains that may be expected from yield-per-recruit calculations.

No data are available on the relationship between small yellowfin and skipjack and limited information is available on the distribution of yellowfin by size within single schools fished by the surface gear in the Atlantic fishery (Table 7). The latter indicates substantial mixing (5 of 12 schools sampled) of yellowfin below 5 Kg. with larger yellowfin. The Working Group strongly recommends that more effort be devoted to this problem in the Atlantic.

Extensive data on single school relationships are available for the eastern Pacific surface fishery (Calkins, 1965) and indicate that the tendency to aggregate by size is stronger than the tendency to aggregate by species. In addition (Calking, 1965), there was sufficient size variation among pure schools of yellowfin to greatly complicate any management program aimed at maximizing the yield-per-recruit through an increase in size at first capture.

However, the isopleth diagrams presented to the group indicated that a reduction of the size at first capture below the present value would substantially reduce the yield-per-recruit. Therefore, any future shift in fishing effort to very small sizes should be prevented. The regulation of minimum landing size of 3.2 Kg. edicted in Senegal, the Ivory Coast and the Congo, should help prevent a decrease in the size of first capture.

VI. ESTIMATION OF MORTALITY RATES

It should be mentioned at the outset that in most instances catch-per-unit statistics are utilized for estimating mortality rates. As indicated in Section III, these statistics are subject to various sources of error. Therefore, we emphasize that there may be errors in the mortality rates that are related to errors in CPUE.

We next consider the estimation of Z and F. These are treated simultaneously in the next section because the value of M for yellowfin tuna in the Atlantic is assumed to be similar to the value of M estimated for yellowfin tuna in the Pacific Ocean (M = 0.8). Under this assumption an estimate of Z automatically produces an estimate of F, and an estimate of F automatically produces an estimate of Z. Some feeling was expressed that an estimate of M = 0.6 might be better than an estimate of M = 0.8.

VII. ESTIMATION OF Z, F, and M

Several estimates of Z were presented. Fonteneau used the method of Pianet and Le Hir (1972). The results are shown in Table 8. These show values of Z = 1.7 for ice boats, Z = 2.5 for baitboats, and Z = 1.2 for French medium purse seiners (the average of these values is 1.8). The method used involves taking the ratios of the apparent abundance of successive year classes and, as mentioned above, the assumption that our measures of CPUE are proportional to abundance, as well as the use of a growth curve to estimate age groups of yellowfin require evaluation. The value of Z for baitboat fishery must have been overestimated, since availability of fish to this fishery declines very rapidly with the age of the fish.

The paper by Lenarz and Sakagawa presented several methods for estimation of Z. The log CPUE estimates by year classes were regressed on age to obtain estination of Z. These are

presented in Table 10 in above paper, reproduced herein as Table 9. There does not appear to be a striking time trend in these values of Z. This may relate either to a real absence of trend or to an existing trend being masked by the vagaries of the estimation procedure. In addition, the same problem of representativeness of CPUE and the growth estimate obtains. We note that the average estimate of Lenarz and Sakagawa is similar to that obtained by Fonteneau. As indicated above, these estimates of Z give estimates of F under the above mentioned assumption on natural mortality.

Additional estimates of F were made in the paper presented by Joseph and Tomlinson. These were made using combined 1967-71 size composition data, a growth estimate and an iterative solution of the catch equation. These gave size specific values of F as high as about 0.6 but were, on the average, about 0.25. Using the assumption of 0.8 for natural mortality therefore produces average values of Z of about 1.05. There was some feeling that the value of Z = 1.05 might be too low. On the other hand, the value of Z = 1.8 might be too high. Additional estimates of F were made in Lenarz and Sakagawa based on estimated reduction in recruitment to the longline fishery, using the formula

$$\ln\left(\frac{R_i + 1}{R_i}\right) = - F_i + F_{i-1}$$

This method is based on the work of Suda (1970).

There are several assumptions in this method and these are discussed in above paper. Given the assumption the simple method indicates about a 10-fold increase in average F from the late 1950's to a value of 1.2 in the early 1970's.

A calculation by Hayasi et al approximated the F caused by longline fishing in 1969 as 2.1, and F caused by surface fishing in 1967 as 0.4. They assumed that F was about 2.0 for longline fishing and 0.9 for surface fishing in 1970. They concluded that these values should be subjected to further examination.

Many assumptions are involved in estimating Z, It does, however, appear that in recent years Z is somewhat less than 1.8.

Estimates of t'_p

It was pointed out in Lenarz and Sakagawa that the usual computations of yield isopleths or other indices of best size of first capture give correct "knife-edge" results. Given that the fishery does not select fish on a "knife-edge" basis, is the

size of first capture greater or less than the recommended "knife-edge" value? As a special case, where Z is constant and the exponential model holds, the mean size of first capture can be calculated from Z and the average age of the catch. The mean size of first capture thus calculated is equivalent to the size of first capture that would occur if "knife-edge" recruitment occurred.

VIII. THE DATA PROBLEM

The Working Group was pleased to note that considerable progress has been made since the 1971 SCRS meeting in improving data on yellowfin and skipjack fishing in the Atlantic. Catches by size of yellowfin were made available for the longline fishery of Japan (Table 10) - 1965-1970 - combined surface fisheries of France, the Ivory Coast and Senegal (FIS) (Table 11) - 1969-1971 - and combined purse seine fishery of the U.S.A., Canada and Panama (America) (Table 12) 1968-1971. Catch per effort by 1º square and in summarized form were presented for the FIS fleets for 1969-71. Korea and Taiwan contributed catch and effort data by 5º square for 1966-1970 and 1967-1969, respectively, and Japan presented catch per effort statistics for its purse seiner fleet in addition to the longline data. Catch statistics of Spain have been improved through the efforts of the Spanish Government and ICCAT.

Although the data have been improved, the Working Party was still hindered in its work due to inadequacy of some of the data. Summaries of data supplied by countries that fish for yellowfin in the Atlantic are shown in Tables 13, 14 and 15. These tables note some of the shortcomings in the data. At present, data prior to 1969 for France and Senegal, an important component of the surface fishery, needs to be compiled. This work is already in progress and it is hoped that significant improvement will be made in time for the 1972 meeting of the SCRS.

The Working Party observed that the length frequency sampling programs differ among countries. In some cases size and frequency of samples were inadequate and in others it was suggested that more effort than was necessary may have been devoted to length frequencies. The Working Party noted with interest that the IATTC is investigating its length frequency sampling program. Meanwhile it was suggested that member countries use the ICCAT "Field Manual for Statistical and Biological Sampling" as a guideline for designing length frequency sampling programs.

The W rking Party recognized that the ICCAT Secretariat has been in contact with fishing nations in an attempt to encourage improvement in the collection and compilation of statistics. However, the Working Party is aware that further efforts along these lines are required. The Working Party recommended that the Executive Secretary continue in his efforts, corresponding with fishing nations, indicating the positive and negative points of data supplied to ICCAT, and recommending specific means for improving their contributions. Such efforts should be directed towards those countries which account for the major portion (90%) of each of the surface and longline catches. The Working Party also noted that there is occasionally a considerable delay in reporting statistics. It may be necessary to implement management measures in the near future. The Working Party recommended that in his correspondence with fishing nations the Executive Secretary stress the importance of timeliness in statistical reporting. Such correspondence should be initiated as soon as possible so that the results will be available in time for the 1972 meeting of the SCRS.

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TABLE 1 ATLANTIC OCEAN

YELLOWFIN AND SKIPJACK TUNA CATCHES

(thousands of metric tons)

Table 1.

	Y E L L O W F I N								
	1963	1964	1965	1966	1967	1968	1969	1970	1971
LONGLINE FISHERY									
Argentina	0.1	0.1	0.1	-	0.1	0.2	0.1	-	(-)
China b/	0.5	0.3	0.1	1.0	2.6	7.8	11.5	8.3	4.7 a/
Cuba	1.7	0.9	0.8	0.8	3.0	1.9	1.6	1.6	(1.6)
Japan	37.7	35.1	36.6	22.1	12.8	13.9	9.8	6.7	5.8 /
Korea b/	-	-	-	-	-	2.3	6.0	13.2	11.4 a/
Venezuela	3.1	1.9	1.8	2.1	2.1	1.2	1.6	1.4	(1.4)
TOTAL LONGLINE	43.1	38.3	39.4	26.0	20.6	27.3	30.6	31.2	24.9
SURFACE FISHERY									
Canada	-	-	-	0.6	0.7	0.7	0.9	0.2	c/
France, Ivory Coast & Senegal	21.8	21.4	17.0	23.4	23.8	32.5	29.0	26.1	26.4
Japan	0.9	2.5	2.4	5.3	6.5	9.6	6.7	2.3	5.3 a/
Portugal (Angola)	4.4	4.5	2.8	2.4	1.6	1.6	1.0	0.1	(0.1)
Spain	1.2	0.9	1.5	6.0	2.8	4.0	5.9	7.1	8.3
U.S.A.	0.2	0.1	-	-	1.0	6.1	18.2	8.9	3.8 a/c/
TOTAL SURFACE	28.5	29.4	23.7	37.7	36.4	54.5	61.7	44.7	43.9
OTHERS									
Ghana	'''	'''	1.0	1.0	1.0	1.0	1.0	1.0	1.0
South Africa	-	0.2	-	-	-	-	-	-	-
GRAND TOTAL	71.6	67.9	64.1	64.7	58.0	82.8	93.3	76.9	69.8

Table 1. (Cont'd)

	SKIPJACK								
SURFACE FISHERY	1963	1964	1965	1966	1967	1968	1969	1970	1971
Brazil	0.3	0.4	0.5	0.7	1.5	0.8	-	0.4	(0.4)
Canada	-	0.4	-	-	0.6	1.0	0.1	0.6	c/
Cuba	0.7	0.7	1.0	1.0	1.1	1.6	1.2	1.8	(1.8)
France, Ivory Coast & Senegal	(0.5)a/	(0.4)a/	(12.2)a/	6.6	5.5	13.0	8.6	13.5	20.1
Japan	9.2	3.1	8.1	5.8	5.9	13.6	5.9	11.0	14.7 a/
Morocco	-	-	3.2	1.5	0.9	0.9	0.1	1.1	-
Portugal (Angola)	3.3	3.5	6.4	6.3	8.3	10.6	4.6	0.6	'''
Spain d/	1.4	4.5	9.5	18.5	13.6	19.1	18.3	22.2	27.1
U.S.A.	3.0	4.0	0.1	-	0.5	3.2	3.8	10.7	16.9 a/, c/
TOTAL SURFACE	18.4	17.0	41.0	40.4	37.9	63.8	42.6	61.9	81.0

- nil catch
''' data not available
( ) in parenthesis, estimates based on previous years
a/ provisional data
b/ converted to round weight by multiplying 1.15 times official statistics
c/ Canadian catch included in U.S. catch
d/ data for 1969 and thereafter estimated more accurately than in previous years

TABLE 2 - REPORTED EFFORT STATISTIC IN ATLANTIC

	1965	1966	1967	1968	1969	1970	1971
JAPANASE LONGLINE (1. 000.000'S hooks)	97.6	53.8	31.2	30.2	29.7	41.6	32.5
France-Ivory Coast-Senegal (Fishing days)							
Ice boats					5585	2276	2730
Bait boats					8575	5757	5140
Average purse seiners					11830	11251	12323
Large purse seiners					2900	6706	5700
American large purse seiners (fishing days)			129	266	1818	2253	1480

TABLE 3. TOTAL NUMBER OF BOATS FISHING IN ATLANTIC,
BY YEAR, BY COUNTRY, BY TYPES OF GEAR AND BY SIZE-CLASSES

Table 3

GEAR / COUNTRY	SIZE CLASSES	1963	1964	1965	1966	1967	1968	1969	1970	1971
LONGLINE										
Argentina		...	...	...	...	...	...	...	...	...
Taiwan		...	...	2	2	19	101	195	197	...
Cuba		...	...	...	...	...	...	...	...	...
Japan *		55.004	84.998	97.581	53.814	31.154	30.247	29.676	41.580	
Korea	Total		1	9	54	46	34	57	105	117
(G.T.)	(51-200		-	7	41	30	9	11	14	11
	)201-500		1	1	3	6	15	36	77	92
	(501-1000		-	1	10	10	10	10	14	14
Venezuela		...	...	...	...	...	...	...	...	...
BAIT BOAT										
France + Ivory Coast + Senegal (G.T.)	Total							69	60	43
	with ice (less 95)							21	21	14
	(95-100)							25	19	9
	Freeze (95-100)							11	9	6
	(101-300)							12	11	14
Japan (G.T.)	Over 151		6	6	6	6	6	6	6	7
Portugal		...	...	...	...	...	...	...	...	...
Spain	100 or less	-	...	...	...	6	7	7	8	10

TOTAL NUMBER OF BOATS FISHING IN ATLANTIC,
BY YEAR, BY COUNTRY, BY TYPES OF GEAR AND BY SIZE-CLASSES

Table 3 (Cont'd)

PURSE SEINE											
France +	Total							24	28	38
Ivory Coast +	101-300							14	14	16
Senegal	301-450							5	7	14
(G.T.)	451-750							4	6	7
	750 over							1	1	1
Japan	1-boat Total				2	2	2	2	2	3
	(Capac.) 201-300				2	2	2	2	2	2
	MT 401-									1
	2-boat Total		3	3	3	3	3	3	3	3
	(Units) 51-100		2	2	2	2	2	2	2	2
	(G.T.) 101-200		1	1	1	1	1	1	1	1
Spain	Total	--	'''	'''	'''	4	6	9	9	13
(Capac.)	101-200					3	3			5
(S.T.)	201-300					1	1			1
	301-400									2
	401 over						2		3	5
American	Over 400 (Capa. S.T)					3	8	25	23	24

Table 4

SEVERAL SECTIONS OF THE ATLANTIC YELLOWFIN

CATCHES PER UNIT EFFORT

	1963	64	65	66	67	68	69	70	71
AREA 1									
Pointe Noire BB t/day at sea		3.0	2.3	3.1	3.3	3.4	1.8	1.5	1.4
Pointe Noire PS t/day at sea			1.7	4.3	4.3	4.6	3.5	2.0	1.9
French BB t/fishing day							2.09	1.73	2.06
French MPS t/fishing day							3.82	2.96	3.27
French LPS t/fishing day							6.56	4.24	3.50
Angola	1.2	1.5	0.7	0.8	0.4	0.6	0.7		
AREA 2									
BB with ice t/fishing day							0.85	0.84	0.45
BB t/fishing day							1.90	0.93	0.79
MPS t/fishing day							3.13	2.56	2.45
LPS t/fishing day							9.23	6.35	2.70
AREA 3									
Dakar BB t/day at sea				1.31	0.60	0.91	0.80	0.58	0.86
BB w/ice t/fishing day							1.10	0.63	1.26
BB t/fishing day							0.74	0.96	1.11
MPS t/fishing day							4.58	1.52	2.08
LPS t/fishing day								0.38	1.15
Total Atlantic									
Japan LL fish/100 hooks	1.13	0.90	0.76	0.69	1.01	0.82	0.72	0.51	0.57
U.S. PS t/day fished							10.9	4.0	2.5

Table 5

INDICES OF ABUNDANCE (STANDARDIZED CPUE)
IN SURFACE FISHERIES

	64	65	66	67	68	69	70	71	
AREA 1									
Pte Noire Bait Boats	191	147	198	211	217	115	96	89	Days at sea
Pte Noire Purse Sein.			174	174	186	142	81	77	
French Bait boats						107	88	105	
" M P S						114	88	98	Fishing days
" L P S						138	89	73	
Mean	191	147	186	192	201	123	88	88	
AREA 2									
Bait boats with ice						119	118	63	
Bait boats						157	77	65	Fishing days
M P S						115	94	90	
LPS						152	104	44	
Mean						136	98	66	
AREA 3									
Dakar bait boats			175	80	122	107	78	115	Days at sea
Bait boats w/ice						110	63	126	
Bait boats						79	102	118	Fishing days
M P S						168	56	76	
Mean			175	80	122	116	75	109	
Average of area means	191	147	180	136	161	125	87	88	
Total Surface catch (.000 tons)	29.5	23.7	37.7	36.4	52.8	61.8	44.8	43.9	
Index of effort	154	161	209	202	328	494	515	499	

Table 6 - Yield of yellowfin (Kg.) for varying lengths at entry from 32.5 cm to 117.5 cm, for 2 values of F for four gear types and all gears combined. Percent of yield taken by each gear is also given.

	1F					2F				
Entry length cms.	All gear	SPS	BB	LPS	LL	All gear	SPS	BB	LPS	LL
32.5	3.50239	.69935	.84520	.83622	1.12149	4.20384	.84221	1.30399	.91064	1.14706
%		19.96	24.13	23.87	32.02		20.03	31.02	21.66	27.29
37.5	3.50292	.69947	.84528	.83631	1.12170	4.20518	.84250	1.30433	.91086	1.14750
%		19.96	24.13	23.87	32.02		20.03	31.02	21.66	27.29
42.5	3.51321	.70166	.84618	.83861	1.12658	4.23194	.84815	1.31013	.91612	1.15749
%		19.97	24.09	23.87	32.07		20.04	30.96	21.65	27.35
47.5	3.53178	.70572	.84606	.84284	1.13698	4.28258	.85902	1.31850	.92604	1.17897
%		19.98	23.96	23.87	32.19		20.06	30.79	21.62	27.53
52.5	3.56472	.71052	.84156	.85237	1.16009	4.37996	.87500	1.32881	.94872	1.22738
%		19.93	23.61	23.91	32.55		19.98	30.34	21.66	28.02
57.5	3.60636	.71320	.82544	.86766	1.19986	4.52150	.89192	1.32997	.98653	1.31299
%		19.78	22.89	24.06	33.27		19.73	29.41	21.82	29.04
62.5	3.62920	.71520	.80465	.87466	1.23449	4.62139	.90644	1.31732	1.00768	1.38986
%		19.71	22.17	24.10	34.02		19.61	28.51	21.81	30.08
67.5	3.63651	.72031	.78423	.87097	1.26080	4.67963	.92513	1.29848	1.00605	1.44985
%		19.81	21.57	23.95	34.67		19.77	27.75	21.50	30.98
72.5	3.63333	.72466	.75172	.86729	1.28947	4.72303	.94372	1.25724	1.00504	1.51690
%		19.95	20.69	23.87	35.49		19.98	26.62	21.28	32.12
77.5	3.61780	.72763	.70152	.86831	1.32012	4.74803	.96110	1.18175	1.01424	1.59079
%		20.11	19.39	24.00	36.49		20.24	24.89	21.36	33.51
82.5	3.59162	.72657	.64710	.86908	1.34866	4.75098	.97051	1.09534	1.02303	1.66196
%		20.23	18.02	24.20	37.55		20.43	23.06	21.53	34.98
87.5	3.55757	.72093	.59194	.87075	1.37374	4.73497	.97022	1.00420	1.03341	1.72698
%		20.27	16.64	24.48	38.62		20.49	21.21	21.83	36.47
92.5	3.51757	.71492	.54021	.86795	1.39427	4.70389	.96862	.91707	1.03463	1.78341
%		20.33	15.34	24.68	39.64		20.59	19.50	22.00	37.91
97.5	3.47499	.70984	.49592	.85993	1.40905	4.66294	.96799	.84196	1.02476	1.82803
%		20.43	14.27	24.75	40.55		20.76	18.06	21.98	39.21
102.5	3.41227	.68802	.44077	.85818	1.42504	4.59498	.93664	.74749	1.02941	1.88123
%		20.16	12.92	25.15	41.77		20.38	16.27	22.40	40.94
107.5	3.32362	.64254	.37163	.86560	1.44358	4.49117	.86026	.62677	1.05554	1.94837
%		19.33	11.18	26.05	43.44		19.16	13.96	23.50	43.38
112.5	3.23235	.60804	.31302	.86718	1.44389	4.37865	.80375	.52363	1.07059	1.98050
%		18.81	9.68	26.82	44.66		18.35	11.95	24.45	45.23
117.5	3.14282	.59211	.26959	.86132	1.41957	4.26490	.78302	.44798	1.07077	1.96295
%		18.84	8.58	27.41	45.17		18.36	10.50	25.11	46.03

Table 7 -

SIZE COMPOSITION IN PERCENT OF YELLOWFIN FROM SINGLE CATCHES FROM THE POINTE-NOIRE AREA DURING, 1972 (LLGUEN) SKIPJACK WERE ALSO PRESENT IN FIVE OF THE CATCHES.

SIZE	BAIT BOATS					PURSE SEINERS						
- 5 kg	27	98	66	100	100	35	0	0	90	67	0	0
5-10 kg	63	1	34	0	0	65	0	0	10	33	0	0
- 10 kg	0	1	0	0	0	0	100	100	0	0	100	100
SIZE OF SAMPLE A	120	110	90	120	130	90	30	70	60	90	80	80

AVERAGE WEIGHT (KG) OF YELLOWFIN CAUGHT IN EASTERN TROPICAL ATLANTIC

GEAR/YEAR	1968	1969	1970	1971
French Ice Boats		18.7	9.9	7.5
French Bait Boats		11.5	5.5	6.5
French Small Seiners		24.7	11.4	14.3
French Large Seiners		17.6	10.4	11.4
American Seiners	20.9	38.2	11.1	14.1

ESTIMATE OF INSTANTANEOUS RATE OF TOTAL APPARENT MORTALITY

Table 8

BAIT BOAT WITH ICE	AREA 1 (PN)			AREA 2 (ABJ)			AREA 3 (DK)			AVERAGE
	Z 2/3	Z 3/4	Z 1/4	Z 2/3	Z 3/4	Z 1/4	Z 2/3	Z 3/4	Z 1/4	
69-70				1.35	0.84	1.10	1.90	1.51	1.70	1.40
70-71				2.64	2.30	2.47	1.07	1.72	1.40	1.93
						1.78			1.55	1.66
BAIT BOAT										
69-70	3.15	2.70	2.93	3.51	1.99	2.75	-	-	-	2.84
70-71	2.41	1.35	1.88	3.26	-	3.26	1.87	-	1.87	2.33 / 2.58
			2.40			3.00			1.87	
MEDIUM PURSE SEINER										
69-70	2.21	1.57	1.89	0.62	1.01	0.80	-	-	-	1.35
70-71	1.33	- 0.20	0.56	1.07	1.58	1.37	-	-	-	0.96
			1.22			1.08			-	1.15

Table 9. Estimates of instantaneous rate of total mortality (Z) for yellowfin tuna from the eastern tropical Atlantic

Year class	French baitboat	French seiner	American seiner	Average	
				French baitboat and seiner	All vessels
1963	1.24	1.96	2.11	1.60	1.77
1964	1.61	1.75	3.19	1.68	2.18
1965	1.60	0.99	3.80	1.30	2.13
1966	2.03	1.10	2.34	1.57	1.82
1967	1.78	1.50	1.21	1.64	1.50
Average	1.65	1.46	2.53	1.55	1.88

Table 10a. Length composition of yellowfin caught by Japanese longliners. Area = Western Atlantic.

Length (cm)	1965		1966		1967		1968		1969		1970	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
36	22	.009										
38	22	.009										
40												
42												
44												
46												
48												
50												
52												
54												
56												
58											36	.032
60											147	.129
62											161	.141
64	27	.010									125	.110
66	54	.021									88	.077
68	54	.021			150	.200					176	.154
70	39	.015	406	.194	300	.401					704	.618
72	61	.024	322	.154	0		8	.009	18	.022	800	.702
74	39	.015	1102	.526	320	.428	79	.089	18	.022	1247	1.095
76	354	.138	1106	.528	0		17	.019	90	.111	1283	1.126
78	593	.231	280	.134	170	.227	25	.028	55	.068	1158	1.017
80	538	.209	50	.024	150	.200	311	.350	119	.147	1071	.940
82	839	.326	42	.020	470	.628	617	.695	75	.093	1071	.940
84	320	.124	22	.011	170	.227	1706	1.921	403	.498	2337	2.051
86	310	.121	24	.012	0		2129	2.397	237	.293	1731	1.520
88	383	.150	75	.036	0		3492	3.932	213	.263	1.298	1.139
90	406	.158	70	.033	842	1.125	5501	6.195	391	.483	1.009	.886

Table 10a. (Continued)

	1965		1966		1967		1968		1969		1970	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
92	238	.093	101	.048	170	.227	3094	3.484	179	.221	0	
94	448	.171	481	.230	170	.227	1517	1.708	354	.437	1628	1.429
96	631	.248	832	.397	170	.227	1047	1.179	756	.934	1683	1.477
98	728	.283	671	.320	170	.227	519	.584	463	.572	1584	1.391
100	922	.358	1167	.557	305	.408	583	.657	934	1.154	1947	1.709
102	1093	.425	1280	.611	34	.045	1049	1.181	1166	1.440	2695	2.366
104	2599	1.010	741	.354	823	1.100	1642	1.849	1952	2.411	4263	3.742
106	4008	1.558	503	.240	1306	1.745	1123	1.265	2337	2.886	5861	5.145
108	4351	1.691	549	.262	3002	4.012	526	.592	2450	3.026	5499	4.827
110	3549	1.380	413	.197	1714	2.290	441	.497	1209	1.493	3125	2.743
112	6308	2.452	1163	.555	2155	2.880	584	.658	1905	2.353	2976	2.612
114	4172	1.622	1648	.787	1680	2.245	750	.845	3239	4.000	5144	4.516
116	4043	1.572	1617	.772	1063	1.421	1419	1.598	2925	3.613	3537	3.105
118	4562	1.773	1863	.890	2075	2.773	1250	1.408	3009	3.716	4584	4.024
120	2109	.820	2093	1.000	1385	1.851	820	.923	2257	2.788	4621	4.056
122	3534	1.374	1962	.937	879	1.175	1186	1.336	2580	3.187	4652	4.084
124	4759	1.850	2303	1.100	1835	2.452	1407	1.584	1718	2.122	2635	2.313
126	4527	1.760	2726	1.302	2949	3.941	1616	1.820	1925	2.378	2453	2.153
128	6330	2.461	1914	.914	3737	4.994	1880	2.117	2099	2.592	2783	2.443
130	4843	1.883	2766	1.321	3423	4.574	902	1.016	1768	2.184	2334	2.049
132	6484	2.521	5398	2.578	2186	2.921	869	.979	1069	1.320	2475	2.173
134	7414	2.882	6975	3.307	2907	3.885	2201	2.479	2725	3.366	3237	2.841
136	10395	4.041	7420	3.543	3291	4.398	2596	2.923	2170	2.680	3726	3.271
138	14734	5.728	8970	4.284	3721	4.972	1993	2.244	2562	3.164	3819	3.352
140	18899	7.347	10288	4.913	2997	4.005	2175	2.449	1357	1.676	3128	2.746
142	18958	7.370	11216	5.356	3759	5.023	2735	3.080	1831	2.261	3722	3.267
144	21875	8.504	17955	8.574	2960	3.956	4065	4.578	2688	3.320	2612	2.293
146	19896	7.734	20489	9.785	2435	3.254	3387	3.814	3178	3925	3137	2.754

Table 10a. (Continued)

	1965		1966		1967		1968		1969		1970	
	No.	%	No	%	No.	%	No.	%	No.	%	No.	%
148	16113	6.264	19478	9.302	2047	2.735	4634	5.218	3921	4.843	1862	1.634
150	13234	5.145	18411	8.792	2554	3.413	3576	4.027	3023	3.734	1300	1.141
152	10796	4.197	17006	8.121	1919	2.564	3787	4.265	3303	4.077	1490	1.308
154	8475	3.295	13069	6.241	2429	3.246	3462	3.899	3261	4.028	1548	1.359
156	7285	2.832	7003	3.344	2169	2.899	3494	3.935	3096	3.824	1183	1.038
158	3276	1.274	5580	2.665	1646	2.200	3349	3.771	2359	2.914	734	.644
160	3291	1.279	3891	1.858	1012	1.352	3225	3.632	2399	2.963	315	.277
162	3477	1.352	2924	1.396	1496	1.999	3149	3.546	2448	3.024	403	.354
164	2422	.942	1903	.909	504	.674	1725	1.943	1441	1.780	191	.168
166	840	.327	753	.360	1012	1.352	193	.217	305	.377	191	.168
168	848	.330	230	.110	1515	2.025	721	.812	704	.870	191	.168
170	323	.126	24	.011	170	.227	142	.160	268	.331	191	.168
172	148	.058	180	.086								
174	22	.009	46	.022	170	.227						
176												
178	22	.009										
180												
182												
184												
186	148	.058										
188							66	.074				
TOTAL	257841		209402		74833		88803		80967		113919	

Table 10b -

Length composition of yellowfin caught by Japanese longliners.

AREA = Eastern Atlantic

Length cm	1965		1966		1967		1968		1969		1970	
	Number	Frequency	Number	Frequency								
32.34												
34												
36	83	.01										
38	83	.01										
40												
42												
44												
46												
48												
50												
52							73	.04				
54												
56												
58							73	.04				
60							73	.04				
62							73	.04				
64	15	.00					73	.04				
66	31	.01					147	.09				
68	31	.01										
70	208	.03	435	.25	388	.14	101	.06	28	.02	6	.01
72	291	.05	1923	1.12			37	.02	0	—		
74	363	.06	3685	2.14	388	.14	451	.26	152	.12	24	.04
76	1.106	.17	3050	1.76			193	.11	87	.07	18	.03
78	1053	.16	742	.43			457	.27	93	.07	12	.02
80	1.063	.17	297	.17			324	.19	59	.05	12	.02

Table 10b (Continued)

Year	1965		1966		1967		1968		1969		1970	
	Number	Frequency	Number	Frequency								
82	1369	.21	0	—	388	.14	62	.04	118	.09	24	.04
84	1054	.16	0	—			209	.12	1044	.84	522	.94
86	539	.08	135	.08			380	.22	716	.57	299	.54
88	1176	.18	135	.08			539	.31	931	.74	329	.59
90	1199	.19	186	.11	39	.01	293	.17	1365	1.09	588	1.06
92	1172	.18	658	.38	432	.16	242	.14	461	.37	95	.17
94	2418	.38	823	.48	739	.27	482	.28	785	.63	306	.55
96	3135	.49	793	.46	216	.08	838	.49	2059	1.65	854	1.54
98	4625	.72	999	.58	296	.11	482	.28	822	.66	307	.55
100	3570	.55	328	.19	254	.09	747	.44	1709	1.37	790	1.42
102	4177	.65	774	.45	80	.03	1374	.79	1644	1.32	595	1.07
104	5689	.88	500	.29	870	.32	993	.57	2395	1.92	1072	1.93
106	6154	.96	223	.13	642	.24	1555	.90	4807	3.85	2309	4.16
108	10482	1.63	469	.27	1030	.38	1059	.61	5814	4.65	2997	5.39
110	4770	.74	408	.24	549	.20	568	.33	2392	1.91	1247	2.24
112	6505	1.01	662	.39	562	.21	919	.53	3960	3.17	2014	3.63
114	11418	1.77	1223	.71	1514	.56	1535	.89	6812	5.45	3505	6.31
116	9107	1.41	1482	.86	468	.17	1269	.74	4181	3.34	2230	4.01
118	13641	2.12	1904	1.11	3158	1.17	3406	1.98	2939	2.35	1505	2.71
120	10731	1.67	2609	1.52	1727	.64	3713	2.15	2796	2.24	1483	2.68
122	14209	2.21	3563	2.07	7051	2.61	6246	3.62	5013	4.01	2713	4.88
124	20492	3.18	4304	2.56	14238	5.27	10318	5.98	4290	3.43	2260	4.07
126	18256	2.83	5677	3.30	18990	7.03	12328	7.15	5068	4.05	2579	4.64
128	24349	3.78	5358	3.12	21788	8.06	13821	8.02	5434	4.35	2785	5.01

Table 10b – (Continued)

Length (cm)	1965		1966		1967		1968		1969		1970	
	Number	frequency										
130	20177	3.23	7526	4.38	11840	4.38	8589	4.98	4851	3.88	2368	4.26
132	16471	2.56	4824	2.81	7513	2.78	6808	3.95	1954	1.56	855	1.54
134	20722	3.22	7438	4.33	8414	3.11	4574	2.65	5025	4.02	2404	4.33
136	24890	3.86	5920	3.43	7455	2.76	5201	3.02	3326	2.66	1595	2.88
138	37268	5.79	6937	4.04	13129	4.86	8341	4.84	4137	3.31	1898	3.42
140	49111	7.63	4717	2.75	15262	5.65	9529	5.53	1723	1.38	814	1.47
142	46595	7.28	7801	4.54	13271	4.91	12646	7.34	1905	1.52	692	1.25
144	54464	8.46	10477	6.10	17838	6.60	11276	6.54	2998	2.40	1211	2.18
146	44297	6.88	11213	6.53	13704	5.07	8075	4.68	4313	3.45	1943	3.50
148	32935	5.12	8154	4.75	15939	5.90	6935	4.02	4603	3.68	2002	3.60
150	22867	3.55	10071	5.86	7983	2.95	3422	1.98	2755	2.20	1152	2.13
152	17864	2.77	9071	5.28	10774	3.99	3517	2.04	3493	2.79	1473	2.65
154	18586	2.89	9119	5.31	11850	4.38	2570	1.49	3490	2.79	1479	2.66
156	15482	2.40	5588	3.25	10939	4.05	2956	1.71	2883	2.31	1201	2.16
158	9446	1.48	5473	3.19	9674	3.58	3227	1.87	1564	1.25	466	.84
160	6674	1.04	4443	4.44	7003	2.59	2834	1.64	1183	.95	243	.44
162	5022	.78	1529	.89	3788	1.40	3348	1.94	1771	1.42	509	.92
164	7713	1.20	3261	1.90	3452	1.28	1929	1.18	984	.79	354	.64
166	3289	.51	1564	.91	3077	1.14	871	.51	510	.41	259	.46
168	2753	.43	1978	1.15	3252	1.20	885	.51	724	.58	301	.54
170	851	.13	246	.14	629	.23	190	.11	493	.39	253	.46
172	231	.05	0	—	468	.17	73	.04	0	—	0	—
174	631	.10	607	.35	161	.06	0	—	0	—	0	—
176	0	—	111	.06	0	—	0	—	0	—	0	—
178	83	.01	223	.13	0	—	0	—	0	—	0	—
180	0	—	0	—	0	—	37	.02	0	—	0	—
182	0	—	0	—	0	—	0	—	0	—	0	—
184	0	—	51	.03	0	—	0	—	0	—	0	—
186	72	.01	0	—	0	—	0	—	0	—	0	—
188			111	.06	0	—	37	.02	0	—	0	—
	644086		171784		273223		173317		122662		56989	

Table 11 - Number of yellowfin by size (predorsal = LD1, fork length = LF) landed by FIS vessel in Atlantic

ALL AREAS 1969

LENGTH(CM) LONGUEUR		ICE BOAT GLACIER	BAIT BOAT CONGELATEUR	AVERAGE SEINER SENNEUR	LARGE SEINER GD SENNEUR	TOTAL
LI 1	LF					
10	28	0.	0.	0.	0.	0.
11	31	35.	0.	0.	0.	35.
12	35	50.	1059.	645.	0.	1754.
13	38	362.	2885.	26.	0.	3273.
14	42	2931.	6278.	10362.	1865.	21437.
15	45	5347.	26943.	9711.	8394.	50394.
16	49	3198.	44077.	6176.	8394.	61845.
17	52	4138.	65707.	13234.	10259.	93337.
18	56	9702.	103162.	25933.	16787.	155583.
19	60	7109.	85606.	14235.	11191.	118141.
20	63	4317.	48171.	10543.	2798.	65829.
21	67	4757.	23889.	14486.	0.	43131.
22	71	8418.	29788.	14763.	1865.	54834.
23	75	11398.	30348.	19252.	0.	60999.
24	79	25538.	29627.	17488.	0.	72652.
25	82	34274.	21971.	14024.	0.	70269.
26	86	27753.	31786.	16819.	0.	76357.
27	90	19081.	27166.	6587.	0.	52834.
28	94	10943.	14959.	4533.	0.	30435.
29	98	11073.	17702.	14914.	1449.	45138.
30	102	11573.	29297.	34041.	1032.	75944.
31	106	14004.	19705.	33064.	2064.	68836.
32	110	17689.	18688.	28050.	1032.	65459.
33	115	25811.	15757.	22688.	2134.	66390.
34	119	19006.	11010.	23498.	1866.	55381.
35	123	10193.	6472.	20467.	1350.	38481.
36	127	4787.	5185.	16365.	348.	26684.
37	131	2188.	4768.	13040.	2366.	22362.
38	135	1888.	1729.	7053.	3607.	14278.
39	139	942.	1273.	6306.	2853.	11374.
40	144	379.	1480.	5871.	5947.	13678.
41	148	183.	2636.	5077.	1044.	8940.
42	152	89.	1974.	5274.	2551.	9888.
43	156	37.	917.	5921.	2720.	9594.
44	161	55.	898.	5494.	2550.	8998.
45	165	0.	1138.	3805.	2897.	7840.
46	169	14.	402.	3784.	2798.	6997.
47	174	0.	100.	1500.	1965.	3565.
48	178	0.	100.	989.	933.	2022.
49	182	0.	0.	278.	0.	278.
50	187	0.	0.	0.	0.	0.
51		0.	0.	0.	0.	0.

Table 11 - (Continued)

AREA 1. 1969

LENGTH(CM) LONGUEUR LD 1 LF		ICE BOAT GLACIER	BAIT BOAT CONGELATEUR	AVERAGE SEINER SENNEUR	LARGE SEINER GO SENNEUR	TOTAL
10	28	0.	0.	0.	0.	0.
11	31	0.	0.	0.	0.	0.
12	35	0.	1033.	630.	0.	1663.
13	38	0.	2832.	26.	0.	2858.
14	42	0.	6054.	10346.	1121.	17521.
15	45	0.	24238.	9572.	5047.	38857.
16	49	0.	41412.	5611.	5047.	52070.
17	52	0.	62588.	12687.	6168.	81443.
18	56	0.	94549.	24359.	10093.	129001.
19	60	0.	78295.	10529.	6729.	95553.
20	63	0.	44964.	8010.	1682.	54656.
21	67	0.	20908.	5144.	0.	26051.
22	71	0.	17208.	6121.	1121.	24450.
23	75	0.	17937.	13125.	0.	31062.
24	79	0.	17363.	10057.	0.	27420.
25	82	0.	9087.	6380.	0.	15467.
26	86	0.	14535.	11714.	0.	26249.
27	90	0.	17125.	4542.	0.	21667.
28	94	0.	9036.	3414.	0.	12450.
29	98	0.	15437.	13442.	1077.	29956.
30	102	0.	25744.	32248.	1032.	59025.
31	106	0.	15589.	26520.	2064.	44173.
32	110	0.	9919.	18407.	1032.	29359.
33	115	0.	8776.	9130.	2098.	20004.
34	119	0.	6382.	7857.	1276.	15515.
35	123	0.	4785.	8974.	760.	14518.
36	127	0.	4663.	8630.	166.	13459.
37	131	0.	4286.	8711.	1128.	14125.
38	135	0.	1576.	4988.	2259.	8823.
39	139	0.	1231.	5248.	1360.	7840.
40	144	0.	1421.	4072.	4148.	9640
41	148	0.	2600.	4409.	497.	7507.
42	152	0.	1476.	4328.	2297.	8100.
43	156	0.	917.	5248.	2647.	8812.
44	161	0.	893.	4842.	2142.	7877.
45	165	0.	1138.	3566.	2154.	6858.
46	169	0.	402.	3452.	1682.	5536.
47	174	0.	100.	1493.	1593.	3186.
48	178	0.	100.	897.	561.	1558.
49	182	0.	0.	277.	0.	277.
50	187	0.	0.	0.	0.	0.
51		0.	0.	0.	0.	0.

Table 11 - (Continued)

AREA 2. | 1969

LENGTH(CM) LONGUEUR LD 1 LF	ICE BOAT GLACIER	BAIT BOAT CONGELATEUR	AVERAGE SEINER SENNEUR	LARGE SEINER GD SENNEUR	TOTAL
10 28	0.	0.	0.	0.	0.
11 31	0.	0.	0.	0.	0.
12 35	0.	27.	15.	0.	42.
13 38	9.	53.	0.	0.	62.
14 42	9.	224.	17.	744.	993.
15 45	129.	2310.	138.	3347.	5924.
16 49	301.	2139.	310.	3347.	6097.
17 52	251.	2554.	546.	4091.	7443.
18 56	543.	7363.	1278.	6694.	15878.
19 60	990.	6126.	2157.	4463.	13735.
20 63	809.	2916.	2257.	1116.	7098.
21 67	1616.	2692.	7995.	0.	12303.
22 71	6365.	11660.	6541.	744.	25310.
23 75	6701.	11494.	4720.	0.	22915.
24 79	5104.	10986.	6115.	0.	22205.
25 82	2450.	10044.	6543.	0.	19036.
26 86	2069.	10180*	4045.	0.	16294.
27 90	1596.	4598.	1199.	0.	7394.
28 94	2491.	2894.	762.	0.	6147.
29 98	5469.	847.	1350.	372.	8037.
30 102	3801.	1947.	1091.	0.	6839.
31 106	2216.	2851.	6203.	0.	11269.
32 110	1619.	6615.	8558.	0.	16792.
33 115	1873.	5175.	10487.	36.	17572.
34 119	1012.	3485.	8671.	590.	13759.
35 123	578.	860.	7273.	590.	9302.
36 127	367.	521.	5560.	182.	6630.
37 131	162.	482.	2859.	1238.	4741.
38 135	55.	154.	1745.	1347.	3301.
39 139	62.	42.	1058.	1493.	2655.
40 144	44. ✓	60. ✓	1479. ✓	1800. ✓	3383.
41 148	0.	36.	668.	546.	1251.
42 152	22.	338.	946.	255.	1561.
43 156	0.	0.	673.	73.	746.
44 161	0.	6.	652.	408.	1066.
45 165	0.	0.	239.	744.	983.
46 169	0.	0.	332.	1116.	1447.
47 174	0.	0.	7.	372.	379.
48 178	0.	0.	92.	372.	464.
49 182	0.	0.	1.	0.	1.
50 187	0.	0.	0.	0.	0.
51	0.	0.	0.	0.	0.

Table 11 - (Continued)

AREA 3. 1969

LENGTH(CM) LONGUEUR LD 1 LF	ICE BOAT GLACIER	BAIT BOAT CONGELATEUR	AVERAGE SEINER SENNEUR	LARGE SEINER GD SENNEUR	TOTAL
10 28	0.	0.	0.	0.	0.
11 31	35.	0.	0.	0.	35.
12 35	50.	0.	0.	0.	50.
13 38	353.	0.	0.	0.	353.
14 42	2922.	0.	0.	0.	2922.
15 45	5218.	395.	0.	0.	5613.
16 49	2897.	526.	255.	0.	3678.
17 52	3887.	564.	0.	0.	4452.
18 56	9158.	1251.	296.	0.	10705.
19 60	6119.	1184.	1549.	0.	8852.
20 63	3508.	292.	275.	0.	4075.
21 67	3141.	289.	1347.	0.	4777.
22 71	2053.	921.	2101.	0.	5075.
23 75	4697.	917.	1407.	0.	7021.
24 79	20433.	1278.	1316.	0.	23027.
25 82	31824.	2840.	1102.	0.	35765.
26 86	25683.	7070.	1060.	0.	33814.
27 90	17485.	5443.	846.	0.	23773.
28 94	8453.	3029.	357.	0.	11838.
29 98	5604.	1418.	122.	0.	7145.
30 102	7772.	1606.	701.	0.	10079.
31 106	11788.	1265.	340.	0.	13394.
32 110	16070.	2154.	1085.	0.	19308.
33 115	23939.	1806.	3070.	0.	28815.
34 119	17994.	1143.	6970.	0.	26107.
35 123	9615.	826.	4220.	0.	14661.
36 127	4420.	0.	2175.	0.	6595.
37 131	2026.	0.	1470.	0.	3496.
38 135	1833.	0.	320.	0.	2154.
39 139	879.	0.	0.	0.	879.
40 144	335.	0.	320.	0.	655.
41 148	183.	0.	0.	0.	183.
42 152	67.	160.	0.	0.	227.
43 156	37.	0.	0.	0.	37.
44 161	55.	0.	0.	0.	55.
45 165	0.	0.	0.	0.	0.
46 169	14.	0.	0.	0.	14.
47 174	0.	0.	0.	0.	0.
48 178	0.	0.	0.	0.	0.
49 182	0.	0.	0.	0.	0.
50 187	0.	0.	0.	0.	0.
51	0.	0.	0.	0.	0.

Table 11 - (Continued)

ALL AREAS 1970

LENGTH(CM) LONGUEUR LD	LF	ICE BOAT GLACIER	BAIT BOAT CONGELATEUR	AVERAGE SEINER SENNEUR	LARGE SEINER GD SENNEUR	TOTAL
10	28	419.	0.	0.	0.	419.
11	31	418.	0.	1.	0.	420.
12	35	650.	703.	4.	0.	1357.
13	38	2036.	2596.	262.	1237.	6131.
14	42	4039.	13595.	2196.	10841.	30671.
15	45	11748.	53673.	23236.	11894.	100551.
16	49	30999.	178061.	70760.	7783.	287603.
17	52	37280.	271560.	136620.	6673.	452132.
18	56	30100.	221581.	265146.	26368.	543195.
19	60	17457.	76609.	181433.	27596.	303095.
20	63	13313.	45859.	47934.	7611.	114718.
21	67	13750.	21563.	23733.	5909.	64954.
22	71	12624.	20664.	20196.	4626.	58110.
23	75	10284.	18000.	15753.	6470.	50507.
24	79	6764.	12648.	10245.	3641.	33298.
25	82	3555.	6195.	6744.	4987.	21482.
26	86	3090.	8493.	7495.	2584.	21662.
27	90	1405.	4689.	11394.	4571.	22059.
28	94	1911.	3131.	8586.	3655.	17283.
29	98	1870.	2237.	6111.	4518.	14736.
30	102	1879.	1171.	9344.	8114.	20507.
31	106	1200.	1650.	5530.	2002.	10383.
32	110	873.	1292.	6189.	1469.	9823.
33	115	1304.	2297.	5034.	2115.	10750.
34	119	2419.	2190.	8930.	6575.	20114.
35	123	4954.	4041.	13090.	12624.	34710.
36	127	4795.	3563.	13117.	10360.	31835.
37	131	4184.	2970.	11804.	9131.	28089.
38	135	2737.	2161.	11270.	14853.	31021.
39	139	1515.	2105.	9439.	9825.	22883.
40	144	930.	1579.	12010.	8830.	23350.
41	148	797.	1127.	5529.	7169.	14621.
42	152	514.	365.	6355.	8822.	16056.
43	156	232.	753.	6830.	7252.	15068.
44	161	160.	514.	2916.	2150.	5740.
45	165	10.	78.	7038.	1429.	8554.
46	169	0.	87.	73.	1839.	2000.
47	174	0.	188.	1684.	56.	1927.
48	178	10.	38.	0.	69.	117.
49	182	0.	0.	0.	0.	0.
50	187	0.	0.	1540.	0.	1540.
51		0.	0.	0.	0.	0.

Table 11 - (Continued)

AREA 1. 1970

LENGTH(CM) LONGUEUR LD 1	LF	ICE BOAT GLACIER	BAIT BOAT CONGELATEUR	AVERAGE SEINER SENNEUR	LARGE SEINER GD SENNEUR	TOTAL
10	28	0.	0.	0.	0.	0.
11	31	0.	0.	1.	0.	1.
12	35	0.	584.	4.	0.	588.
13	38	0.	1742.	3.	0.	1745.
14	42	0.	10378.	32.	0.	10410.
15	45	1.	46948.	4812.	0.	51761.
16	49	9.	169817.	45389.	5.	215219.
17	52	2.	254310.	76287.	9.	330607.
18	56	17.	185761.	16070.	11	201859.
19	60	22.	57602.	7739.	0.	65364.
20	63	15.	29944.	3432.	1.	33392.
21	67	5.	5153.	1814.	0.	6972.
22	71	11.	6987.	650.	1.	7649.
23	75	22.	4505.	632.	0.	5159.
24	79	7.	4289.	1947.	1.	6244.
25	82	3.	2551.	404.	0.	2958.
26	86	2.	6091.	2448.	0.	8541.
27	90	4.	3212.	5698.	0.	8905.
28	94	4.	776.	366.	0.	1147.
29	98	5.	502.	80.	757.	1344.
30	102	12.	342.	24.	765.	1143.
31	106	10.	632.	16.	8.	666.
32	110	6.	899.	21.	7.	932.
33	115	4.	1885.	41.	5.	1935.
34	119	13.	959.	163.	0.	1136.
35	123	33.	1361.	575.	757.	2726.
36	127	31.	1456.	1188.	1513.	4187.
37	131	19.	1622.	1691.	759.	4091.
38	135	5.	1205.	1503.	4553.	7266.
39	139	1.	1136.	1405.	2281.	4823.
40	144	1.	997.	5734.	2278.	9009.
41	148	0.	684.	409.	1518.	2611.
42	152	0.	58.	2103.	2275.	4436.
43	156	1.	299.	5181.	4538.	10018.
44	161	0.	215.	1546.	757.	2516.
45	165	0.	58.	6175.	757.	6990.
46	169	0.	0.	2.	1514.	1517.
47	174	0.	120.	1542.	0.	1662.
48	178	0.	38.	0.	0.	38.
49	182	0.	0.	0.	0.	0.
50	187	0.	0.	1540.	0.	1540.
51		0.	0.	0.	0.	0.

Table 11 - (Continued)

AREA 2. 1970

LENGTH(CM) LONGUEUR LD 1	LF	ICE BOAT GLACIER	BAIT BOAT CONGELATEUR	AVERAGE SEINER SENNEUR	LARGE SEINER GD SENNEUR	TOTAL
10	28	133.	0.	0.	0.	133.
11	31	142.	0.	0.	0.	142.
12	35	132.	119.	0.	0.	251.
13	38	755.	618.	259.	1237.	2868.
14	42	1959.	1667.	2150.	10807.	16582.
15	45	6372.	2742.	18058.	11822.	38994.
16	49	9328.	5770.	22830.	7710.	45638.
17	52	5270.	9936.	57898.	6533.	79638.
18	56	6894.	21343.	246405.	26061.	300703.
19	60	6614.	13433.	172106.	27313.	219466.
20	63	4430.	10150.	42508.	7597.	64685.
21	67	4224.	7624.	19734.	5908.	37490.
22	71	4400.	3763.	15922.	4626.	28711.
23	75	3140.	7575.	11884.	6470.	29068.
24	79	1514.	2717.	6963.	3640.	14834.
25	82	588.	1556.	5352.	4987.	12483.
26	86	1032.	722.	3719.	2584.	8057.
27	90	398.	426.	3938.	4570.	9333.
28	94	470.	357.	6754.	3655.	11236.
29	98	718.	439.	4689.	3761.	9606.
30	102	1277.	292.	8065.	7349.	16983.
31	106	857.	143.	5231.	1994.	8225.
32	110	431.	158.	5410.	1462.	7461.
33	115	396.	300.	4737.	2110.	7543.
34	119	1030.	742.	8358.	6570.	16701.
35	123	2472.	2538.	12075.	11868.	28952.
36	127	2667.	2107.	10933.	8848.	24555.
37	131	1985.	1287.	8959.	8372.	20603.
38	135	733.	925.	7713.	10279.	19650.
39	139	317.	877.	6192.	7513.	14900.
40	144	179. ✓	521. ✓	4391. ✓	6553. ✓	11643.
41	148	118.	351.	3341.	5639.	9448.
42	152	69.	215.	3035.	6488.	9807.
43	156	51.	301.	976.	2681.	4009.
44	161	28.	176.	681.	1372.	2258.
45	165	10.	19.	491.	672.	1192.
46	169	0.	87.	31.	325.	443.
47	174	0.	67.	63.	56.	186.
48	178	10.	0.	0.	69.	79.
49	182	0.	0.	0.	0.	0.
50	187	0.	0.	0.	0.	0.
51		0.	0.	0.	0.	0.

Table 11 - (Continued)

AREA 3. 1970

LENGTH(CM) LONGUEUR LD 1 LF	ICE BOAT GLACIER	BAIT BOAT CONGELATEUR	AVERAGE SEINER SENNEUR	LARGE SEINER GD SENNEUR	TOTAL
10 28	286.	0.	0.	0.	286.
11 31	276.	0.	0.	0.	276.
12 35	518.	0.	0.	0.	518.
13 38	1282.	236.	0.	0.	1518.
14 42	2081.	1550.	15.	34.	3680.
15 45	5375.	3983.	367.	72.	9797.
16 49	21662.	2475.	2542.	68.	26747.
17 52	32008.	7314.	2435.	131.	41887.
18 56	23189.	14477.	2671.	296.	40632.
19 60	10821.	5573.	1588.	283.	18265.
20 63	8869.	5765.	1994.	13.	16641.
21 67	9521.	8786.	2185.	0.	20492.
22 71	8213.	9914.	3624.	0.	21750.
23 75	7122.	5920.	3237.	0.	16279.
24 79	5244.	5642.	1335.	0.	12220.
25 82	2964.	2088.	989.	0.	6040.
26 86	2056.	1680.	1328.	0.	5064.
27 90	1003.	1060.	1758.	0.	3821.
28 94	1437.	1997.	1466.	0.	4901.
29 98	1147.	1296.	1342.	0.	3785.
30 102	589.	537.	1255.	0.	2381.
31 106	333.	875.	284.	0.	1492.
32 110	436.	236.	759.	0.	1430.
33 115	904.	111.	256.	0.	1271.
34 119	1375.	489.	409.	4.	2277.
35 123	2450.	142.	440.	0.	3032.
36 127	2097.	0.	996.	0.	3093.
37 131	2180.	61.	1154.	0.	3395.
38 135	2000.	31.	2054.	21.	4105.
39 139	1197.	92.	1842.	30.	3160.
40 144	751.	61.	1885.	0.	2697.
41 148	679.	92.	1779.	13.	2563.
42 152	445.	92.	1217.	59.	1813.
43 156	181.	153.	673.	34.	1041.
44 161	131.	123.	689.	21.	964.
45 165	0.	0.	372.	0.	372.
46 169	0.	0.	40.	0.	40.
47 174	0.	0.	79.	0.	79.
48 178	0.	0.	0.	0.	0.
49 182	0.	0.	0.	0.	0.
50 187	0.	0.	0.	0.	0.
51	0.	0.	0.	0.	0.

Table 11 - (Continued)

ALL AREAS 1971

LENGTH (CM) LONGUEUR LD	LF	ICE BOAT GLACIER	BAIT BOAT CONGELATEUR	AVERAGE SEINER SENNEUR	LARGE SEINER GD SENNEUR	TOTAL
10	28	0.	0.	0.	0.	0.
11	31	0.	65.	0.	0.	65.
12	35	455.	284.	167.	0.	906.
13	38	979.	3241.	1734.	358.	6313.
14	42	2766.	13245.	7247.	9283.	32541.
15	45	5691.	59418.	17763.	36362.	119234.
16	49	15037.	114137.	33214.	41776.	204164.
17	52	47413.	124281.	111355.	19713.	302762.
18	56	48348.	119921.	137419.	18588.	324276.
19	60	28477.	85038.	66188.	13568.	193270.
20	63	18340.	71189.	39591.	13507.	142628.
21	67	16248.	27278.	26563.	3400.	73489.
22	71	23086.	18253.	42978.	10385.	94701.
23	75	31094.	20660.	51281.	19535.	122571.
24	79	27386.	15992.	36816.	5159.	85354.
25	82	20361.	16228.	31624.	3601.	71813.
26	86	11700.	11702.	32996.	3517.	59915.
27	90	4234.	15097.	23175.	3614.	46120.
28	94	4684.	14812.	16691.	3340.	39526.
29	98	4254.	15137.	17564.	8182.	45138.
30	102	6012.	10278.	21570.	12229.	50089.
31	106	4106.	6052.	27678.	10743.	48579.
32	110	2353.	2975.	18619.	6887.	30834.
33	115	915.	1954.	4128.	1904.	8900.
34	119	544.	601.	3103.	2826.	7075.
35	123	518.	895.	2813.	2420.	6647.
36	127	168.	250.	1188.	2830.	4435.
37	131	179.	363.	5056.	3393.	8991.
38	135	265.	157.	4223.	3347.	7993.
39	139	227.	140.	6097.	4002.	10466.
40	144	199.	238.	8311.	5755.	14503.
41	148	158.	320.	16921.	7387.	24786.
42	152	34.	705.	15808.	9001.	25549.
43	156	173.	368.	9711.	5794.	16047.
44	161	0.	149.	7892.	3052.	11093.
45	165	22.	208.	3566.	2972.	6768.
46	169	17.	74.	783.	1702.	2576.
47	174	0.	41.	137.	1166.	1344.
48	178	0.	41.	64.	331.	435.
49	182	0.	0.	0.	13.	13.
50	187	0.	0.	0.	0.	0.
51		0.	0.	0.	0.	0.
B/1000		326	772	852	302	2252

Table 11 - (Continued)

AREA 1. 1971

LENGTH(CM) LONGUEUR LD 1	LF	ICE BOAT GLACIER	BAIT BOAT CONGELATEUR	AVERAGE SEINER SENNEUR	LARGE SEINER GD SENNEUR	TOTAL
10	28	0.	0.	0.	0.	0.
11	31	0.	0.	0.	0.	0.
12	35	0.	69.	58.	0.	128.
13	38	0.	2356.	430.	198.	2984.
14	42	0.	5624.	2489.	685.	8799.
15	45	0.	13037.	5839.	2027.	20903.
16	49	0.	36411.	5955.	3800.	46167.
17	52	0.	68341.	14054.	5174.	87569.
18	56	0.	92388.	21929.	7542.	121859.
19	60	0.	74754.	9125.	5407.	89286.
20	63	0.	66787.	12902.	8182.	87871.
21	67	0.	20077.	8020.	2739.	30836.
22	71	0.	10591.	7328.	1294.	19213.
23	75	0.	11511.	5615.	1229.	18355.
24	79	0.	6962.	3632.	2099.	12694.
25	82	0.	6231.	4076.	2227.	12534.
26	86	0.	10136.	5905.	2279.	18321.
27	90	0.	9940.	5925.	1361.	17226.
28	94	0.	12699.	4787.	1098.	18583.
29	98	0.	13001.	2495.	472.	15968.
30	102	0.	9944.	2555.	261.	12759.
31	106	0.	4354.	1680.	259.	6293.
32	110	0.	2303.	1459.	343.	4105.
33	115	0.	1616.	1248.	569.	3433.
34	119	0.	529.	804.	1115.	2448.
35	123	0.	889.	968.	1049.	2906.
36	127	0.	249.	421.	781.	1451.
37	131	0.	362.	1183.	1407.	2952.
38	135	0.	157.	1090.	1862.	3109.
39	139	0.	140.	1455.	3234.	4829.
40	144	0.	238.	2909.	4596.	7743.
41	148	0.	320.	4570.	4929.	9819.
42	152	0.	705.	6331.	6051.	13087.
43	156	0.	368.	4138.	3043.	7549.
44	161	0.	149.	2669.	2059.	4876.
45	165	0.	208.	1647.	1426.	3281.
46	169	0.	74.	694.	1477.	2245.
47	174	0.	41.	137.	486.	664.
48	178	0.	41.	40.	269.	350.
49	182	0.	0.	0.	13.	13.
50	187	0.	0.	0.	0.	0.
51		0.	0.	0.	0.	0.

Table 11 - (Continued)

AREA 2. | 1971

LENGTH (CM) LONGUEUR LD 1	LF	ICE BOAT GLACIER	BAIT BOAT CONGELATEUR	AVERAGE SEINER SENNEUR	LARGE SEINER GO SENNEUR	TOTAL
10	28	0.	0.	0.	0.	0.
11	31	0.	62.	0.	0.	62.
12	35	0.	208.	0.	0.	208.
13	38	20.	874.	655.	161.	1709.
14	42	614.	6858.	3041.	8598.	19111.
15	45	2121.	37122.	10509.	33604.	83356.
16	49	3411.	65582.	22149.	37610.	128753.
17	52	2122.	29947.	22429.	13077.	67574.
18	56	981.	9329.	14170.	10455.	34934.
19	60	721.	5119.	19247.	6623.	31711.
20	63	810.	3371.	13457.	5068.	22705.
21	67	1319.	4460.	15347.	575.	21700.
22	71	2149.	4741.	19501.	9090.	35481.
23	75	2110.	4627.	30819.	18307.	55863.
24	79	1234.	3546.	22957.	3060.	30797.
25	82	375.	2606.	21644.	1373.	25998.
26	86	370.	733.	16190.	1238.	18531.
27	90	72.	702.	11099.	2253.	14127.
28	94	634.	302.	8508.	2242.	11687.
29	98	347.	148.	12051.	7667.	20214.
30	102	1503.	211.	13626.	11700.	27040.
31	106	278.	445.	18258.	9984.	28965.
32	110	275.	459.	12826.	6087.	19647.
33	115	208.	216.	1421.	1198.	3042.
34	119	256.	72.	1759.	1680.	3767.
35	123	164.	7.	1690.	1371.	3232.
36	127	145.	1.	412.	2049.	2607.
37	131	20.	1.	3702.	1976.	5699.
38	135	35.	0.	3025.	1475.	4535.
39	139	35.	0.	4480.	758.	5273.
40	144	0.	0.	5294.	1148.	6442.
41	148	0.	0.	11918.	2458.	14376.
42	152	0.	0.	8881.	2920.	11801.
43	156	0.	0.	5302.	2721.	8022.
44	161	0.	0.	5061.	973.	6034.
45	165	0.	0.	1811.	1515.	3325.
46	169	0.	0.	35.	225.	260.
47	174	0.	0.	0.	680.	680.
48	178	0.	0.	24.	61.	85.
49	182	0.	0.	0.	0.	0.
50	187	0.	0.	0.	0.	0.
51		0.	0.	0.	0.	0.

Table 11 - (Continued)

AREA 3. 1971

LENGTH (CM) LONGUEUR LD	LF	ICE BOAT GLACIER	BAIT BOAT CONGELATEUR	AVERAGE SEINER SENNEUR	LARGE SEINER GD SENNEUR	TOTAL
10	28	0.	0.	0.	0.	0.
11	31	0.	4.	0.	0.	4.
12	35	455.	7.	108.	0.	571.
13	38	959.	11.	650.	0.	1620.
14	42	2151.	764.	1717.	0.	4632.
15	45	3570.	9259.	1414.	731.	14974.
16	49	11625.	12143.	5110.	366.	29244.
17	52	45292.	25993.	74872.	1462.	147619.
18	56	47368.	18204.	101320.	591.	167483.
19	60	27756.	5164.	37816.	1537.	72273.
20	63	17531.	1032.	13232.	258.	32052.
21	67	14929.	2741.	3197.	86.	20952.
22	71	20937.	2921.	16149.	0.	40008.
23	75	28984.	4523.	14847.	0.	48354.
24	79	26152.	5484.	10227.	0.	41863.
25	82	19986.	7391.	5903.	0.	33280.
26	86	11330.	832.	10901.	0.	23063.
27	90	4162.	4455.	6150.	0.	14767.
28	94	4050.	1811.	3396.	0.	9257.
29	98	3907.	1988.	3018.	43.	8956.
30	102	4510.	122.	5389.	268.	10289.
31	106	3827.	1253.	7740.	500.	13321.
32	110	2077.	213.	4333.	457.	7081.
33	115	707.	122.	1459.	136.	2425.
34	119	289.	0.	540.	31.	860.
35	123	354.	0.	155.	0.	509.
36	127	22.	0.	355.	0.	377.
37	131	158.	0.	171.	10.	339.
38	135	230.	0.	108.	10.	349.
39	144	192.	0.	162.	10.	365.
40	148	199.	0.	108.	10.	318.
41	152	158.	0.	433.	0.	591.
42	156	34.	0.	596.	31.	661.
43	161	173.	0.	271.	31.	475.
44	165	0.	0.	162.	21.	183.
45	169	22.	0.	108.	31.	162.
46	174	17.	0.	54.	0.	71.
47	178	0.	0.	0.	0.	0.
48	182	0.	0.	0.	0.	0.
49	187	0.	0.	0.	0.	0.
50		0.	0.	0.	0.	0.
51		0.	0.	0.	0.	0.

Table 12 -

NUMBER OF YELLOWFIN CAUGHT
BY SIZE (FORK LENGTH - cm)
BY AMERICAN PURSE SEINERS IN ATLANTIC

FORK LENGTH (cm)	1968	1969	1970	1971
37				71
39				4275
41				9693
43		464	2942	13564
45			7847	9056
47		1664	7795	8338
49		1932	12725	6944
51		2012	18807	6944
53		3521	39112	12250
55		2942	128280	23630
57		4712	128547	30543
59	957	8988	60947	21932
61	2749	9529	39700	6084
63	15130		40612	5407
65	28810	500	22525	4578
67	21770		34179	3911
69	20872	500	22707	1294
71	12852		21084	1405
73	14273		14927	586
75	10257		16833	1243
77	15166		13418	2365
79	7705		13861	1506
81	9672		7824	1708
83	10289		17600	1617
85	10491		10423	1819
87	6268		4364	2759
89	3754		4510	2638
91	10204	505	2001	5003
93	7276		3264	3194
95	2862	505	4785	5175
97	3406	505	6423	4791
99	1584	505	3725	7287
101	2825		1405	6650
103	712	1011	3398	4740
105	49	3031	3579	2992
107	892	9830	3818	1324
109		33568	6294	809

Table 12 ·Continued

Table 12
(Cont'd)

FORK LENGTH (cm)	1968	1969	1970	1971
111	941	40645	5087	869
113	147	46131	5210	81
115	98	33420	4425	344
117	810	23828	1231	313
119		20566	134	232
121	147	21113	268	303
123	147	17555	1978	283
125	49	15409	2005	374
127	789	18852	520	960
129	957	17795	772	1223
131	2216	19634	1312	1182
133	6994	14356	785	1840
135	7317	14043	521	131
137	5618	8810	8016	546
139	5070	6113	3607	1385
141	4611	5492	1156	1253
143	6256	8383	9534	1102
145	5217	9884	3303	1243
147	5315	12684	6735	2314
149	3370	10646	2228	2426
151	2897	10442	1263	1840
153	3756	11090	3834	1920
155	1628	11184	386	3113
157	2433	12163	3422	2992
159	2683	7987	4879	1324
161	1088	5362	3384	2971
163	1432	3418	8119	1627
165	687	3482	757	1567
167	785	490	2151	445
169	1301	500	891	536
171	245	464	649	202
173	343	1501	252	
175	98		267	
177	49			
179				

Table 13 -

SUMMARY OF AVAILABLE STATISTICS ON THE CATCH OF ATLANTIC YELLOWFIN TUNA FOR THE MAJOR FLEETS

Country	Years	Collected by	Fishing Area	Comments
Longline Fishery				
China *	1963-71	Government	Entire Atlantic	Reported as dressed weight
Cuba	1963-70	Government	Entire Atlantic	1963-64 catches include other tuna species
Japan	1957-71	Government	Entire Atlantic	Longest series of data
Korea	1968-71	Government	Entire Atlantic	Catches for earlier years not reported
Venezuela *	1957-70	Government	Western Atlantic	Catches reported as dressed weight. 1957-66 catches include other tuna species
Surface Fishery				
Canada	1966-71	Government	S.Leone to Angola	Annual catch less than 1,000 tons. Catch for 1971 included in US catches
France	1955-71	ORSTOM	Senegal to Angola Antilla since 72	**
Ivory Coast *	1970-71	ORSTOM	Senegal to Angola	Catches were reporte by ORSTOM
Japan	1962-71	Government	I. Coast to Congo	Catches by two-boat seiners, seiners and bait boats
Portugal	1963-70	Government	Angola	Landing of a small fleet of baitboats
Senegal	1966-71	ORSTOM	Senegal to Angola	Catches for earlier years reported by ORSTOM
Spain	1963-71	Government	Canary Islands to Angola	Catches have been estimated by ICCAT
U.S.A.	1963-71	Government	S.Leone to Angola	Catches from landing statistics

* non-member countries

** Complete statistics for the years 69 to 71
Partial results from 66 to 68
The data from 1955 to 1965 need to be rewieved

Table 14 -

SUMMARY OF AVAILABLE STATISTICS ON CATCH PER EFFORT OF ATLANTIC YELLOWFIN TUNA FOR THE MAJOR FLEETS

Country	Catch-effort by 5° areas for LL or 1° areas for surface fishery	Years	Comments
Longline			
Rep. China (1)	Yes	1967-69	Log book coverage is low; need data on undressed weight of catch
Cuba (1)	None		Need data
Japan	Yes	1957-70	Need data on weight of catch which will be available for 71 in early 73
Korea	Yes	1966-69	Log book coverage is only 2-18% of the boats; need data on weight of catch
Venezuela (1)	Yes	1968-70	
Surface Fishery			
Canada	Yes	1967-71	Reported together with American statistics
France	Yes	1969-71	Reported separately for baitboats and seiners; includes Ivory Coast and Senegalese statistics
Dakar bait boats		1955-68	
Pt. Noire (1) bait boats		1964-70	Not broken down into 5° areas
Pt. Noire Purseseiners		1964-70	
Ivory Coast (1)	Yes	1969-71	Reported together w/French statistics
Japan	Yes for purse seiners NO for bait boats	1967-70	Survey system is being established
Portugal	None	1963-70	Data available for BB that fish off Angola; but data not broken down into 5° area; need data
Senegal	Yes	1969-71	Reported together W/French statistics
Spain	None		Need data
U.S.A.	Yes	1967-71	Includes Canadian and Panamanian statistics

(1) = non member countries

Table 15 -

SUMMARY OF AVAILABLE STATISTICS ON SIZE-FREQUENCY OF
OF CATCH OF ATLANTIC YELLOWFIN TUNA FOR THE MAJOR FLEETS

Country	Years	Months	Areas	Comments
Longline Fishery				
Rep. China *	None			Need data
Cuba *	None			Need data
Japan	1955-60 1965-70	(Jan-Dec)	Entire Atlantic 10°x20° areas for 1965-70	Data grouped into tw periods; need data separately per year
Korea	1970	Jul-Oct	5° areas	Very few samples; ne data
Venezuela *	1969-70			Need data
Surface fishery				
Canada	1968-71	Jul-Nov	5° areas and NMFS areas	Reported together wi U.S.A. statistics
France	1965-71	Jan-Dec	ORSTOM areas	Better coverage in some time-area strat needed; includes I. Coast and Senegalese statistics
Ivory Coast *	1965-71	Jan-Dec	ORSTOM areas	Reported together w/ French statistics
Japan (purse seiner only)	1965, 1967-68	Jul-Nov	Pt. Noire 5°x10° areas	Better coverage is needed; e.g., Abidja landings are not sam pled
Portugal(Angela)	None			Need data
Senegal	1965-71	Jan-Dec	ORSTOM	Reported together w/ French statistics
Spain	Kone			Need data
U.S.A.	1968-71	Jul-Nov	NMFS areas	Better coverage in some time-area strat needed; includes Can dian and Panamanian statistics

* = non-member countries

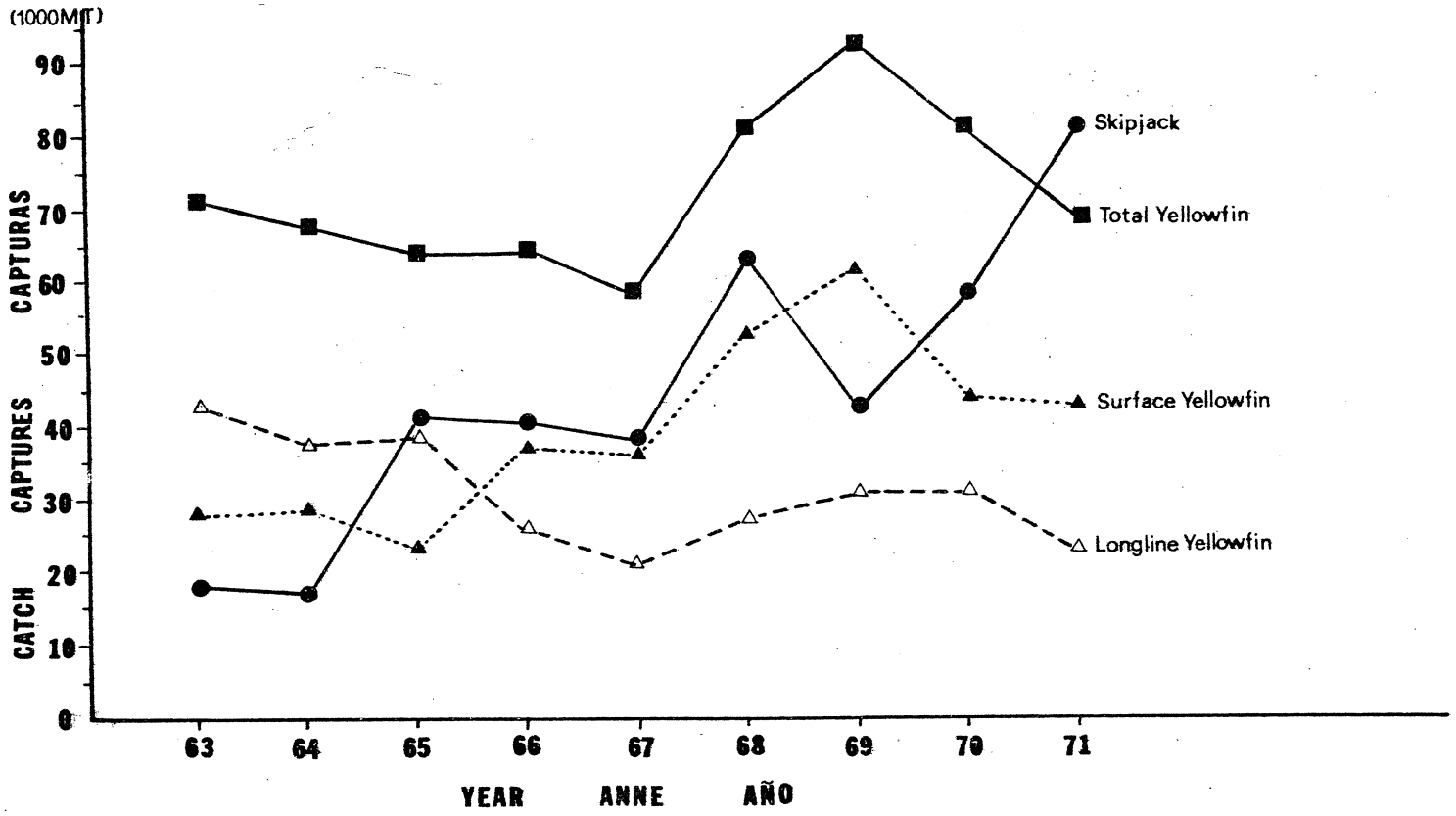

Figure 1.- Catches of yellowfin by surface and longline fisheries in Atlantic, and surface catches of skipjack in Atlantic.

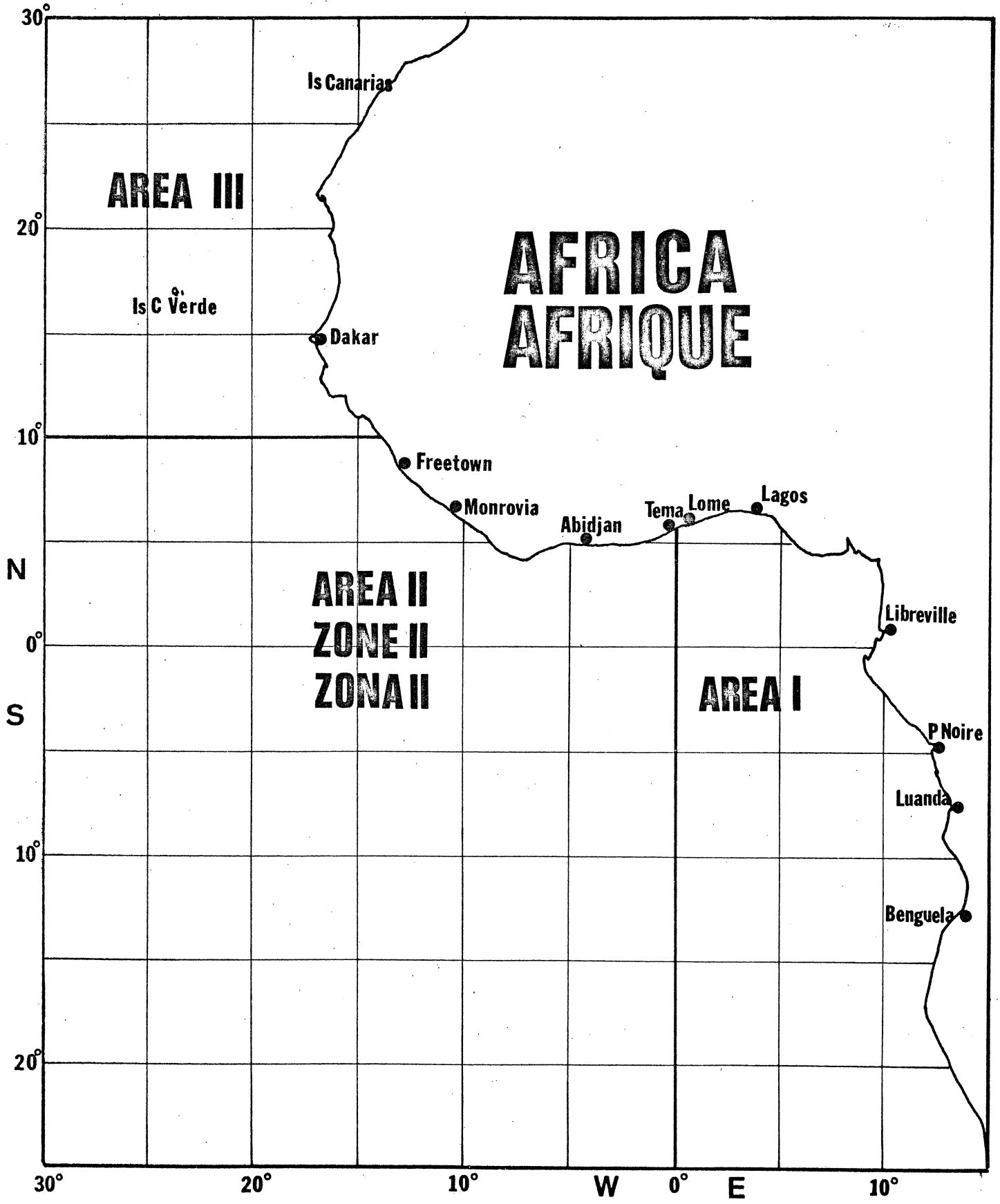

Figure 2.- Eastern Tropical Atlantic showing three areas used in study.

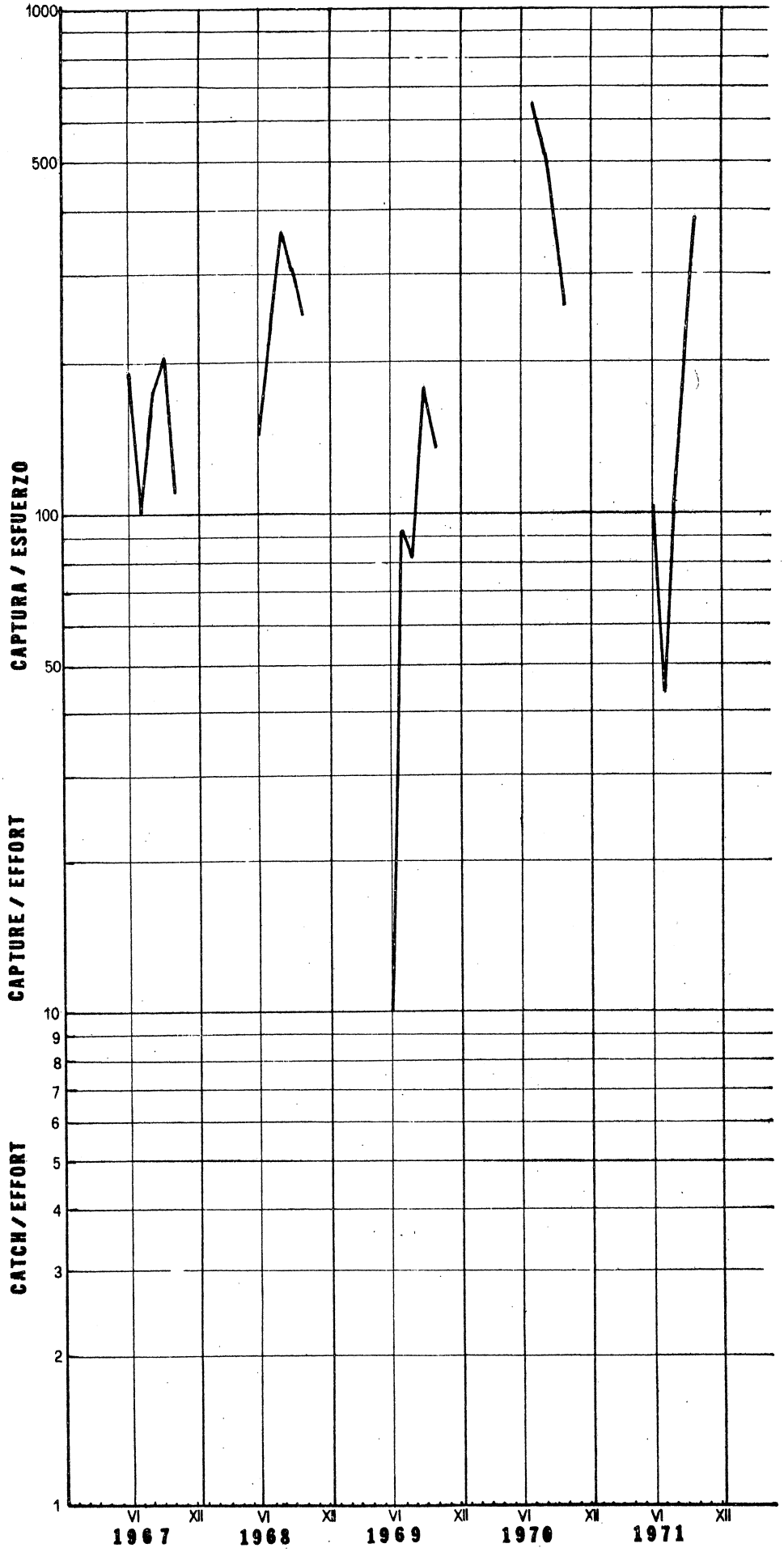

Figure 3 - Catch per unit effort (number of fish/day) of incoming year class (Class I = FL less than 90 cm or LD less than 27 cm) of yellowfin by baitboats in Pointe-Noire Region.

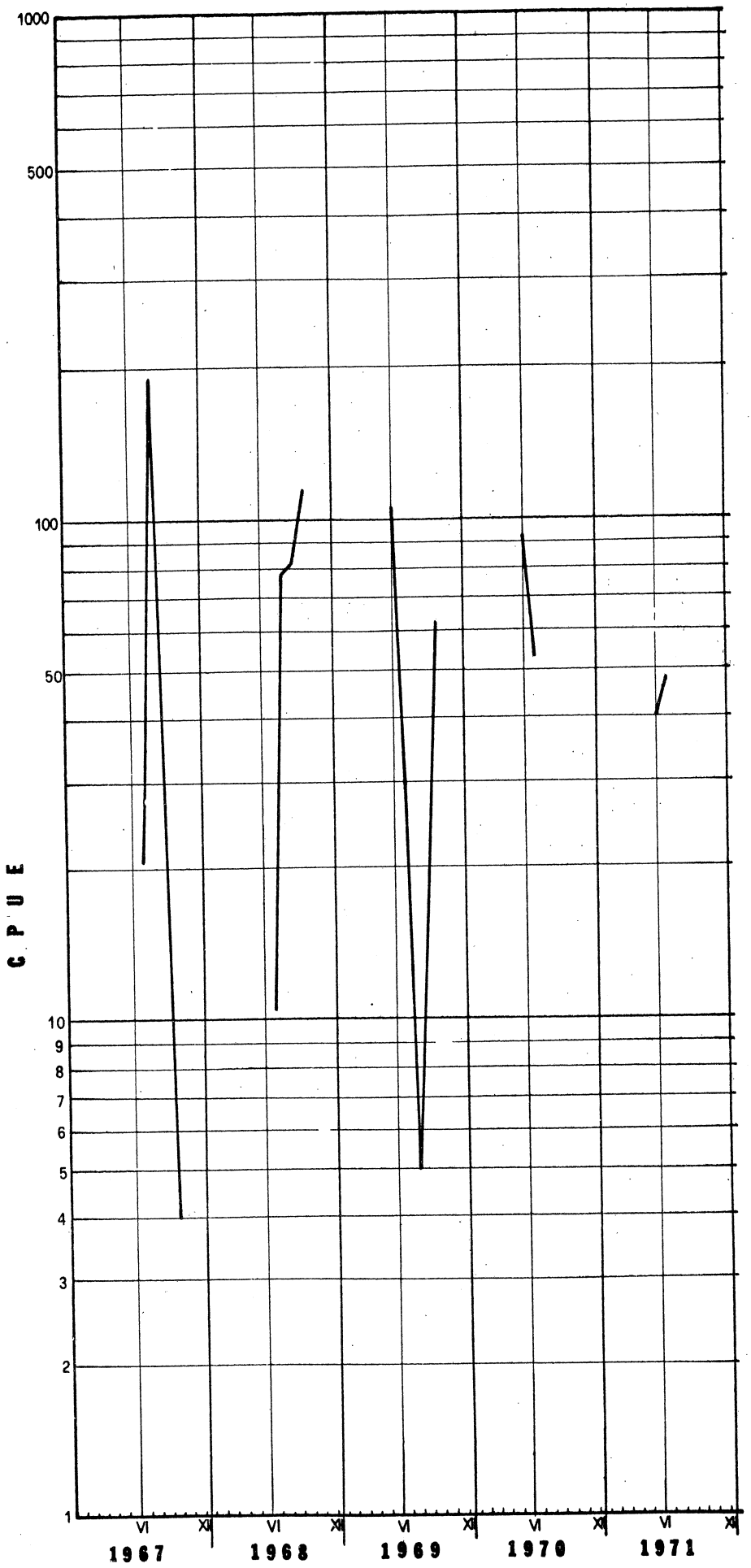

Figure 4 - Catch per unit effort (in number of fish/day) of incoming year class (Class I = FL less than 90 cm or LD less than 27 cm) of yellowfin by average purse seiners in Pointe-Noire Region.

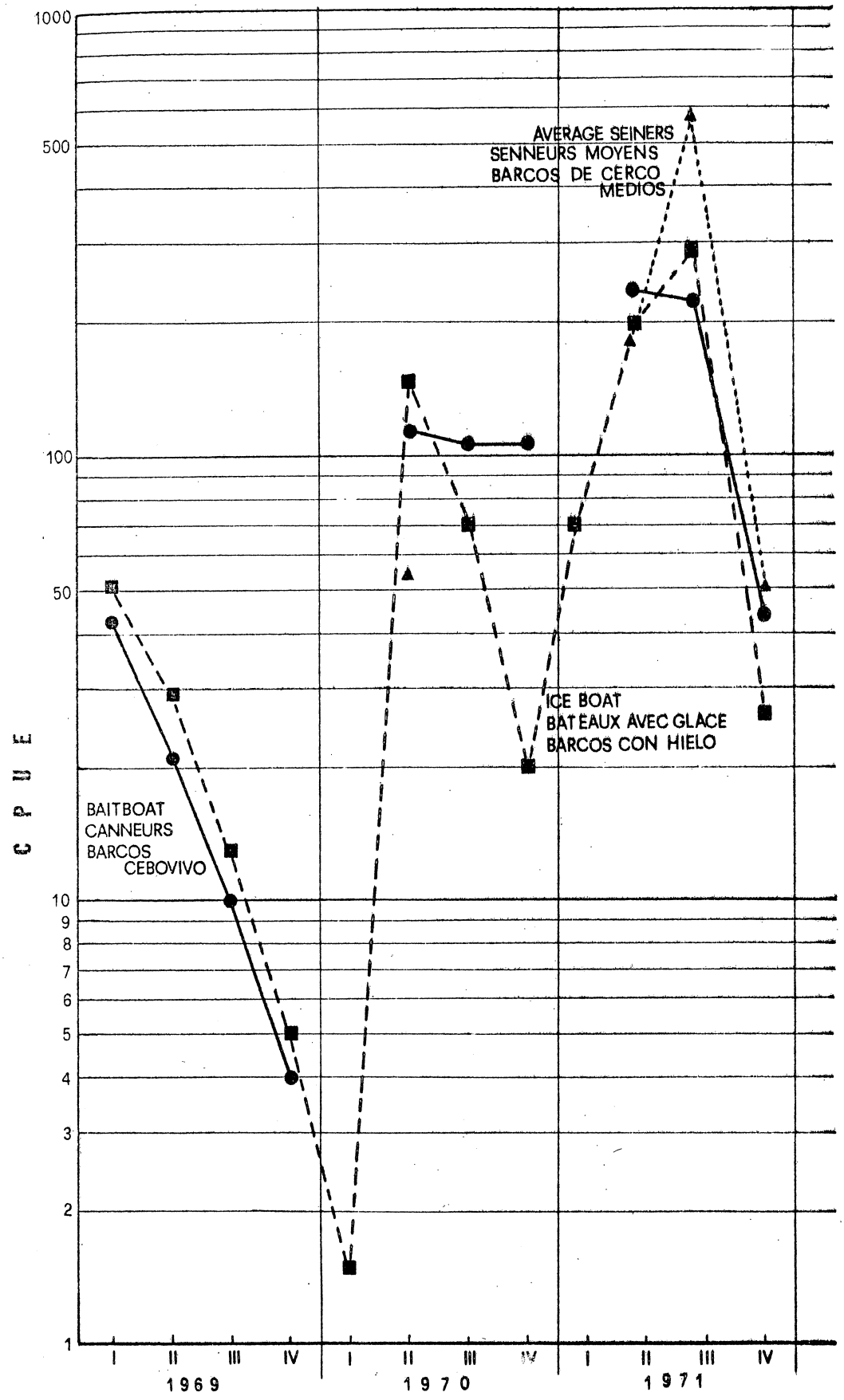

Figure 5.- Catch per unit effort (in number of fish per day) of incomig (Class I=FL less than 90 cm. or DI less than 27 cm.) year class of yellowfin by FIS vessels in Dakar region.

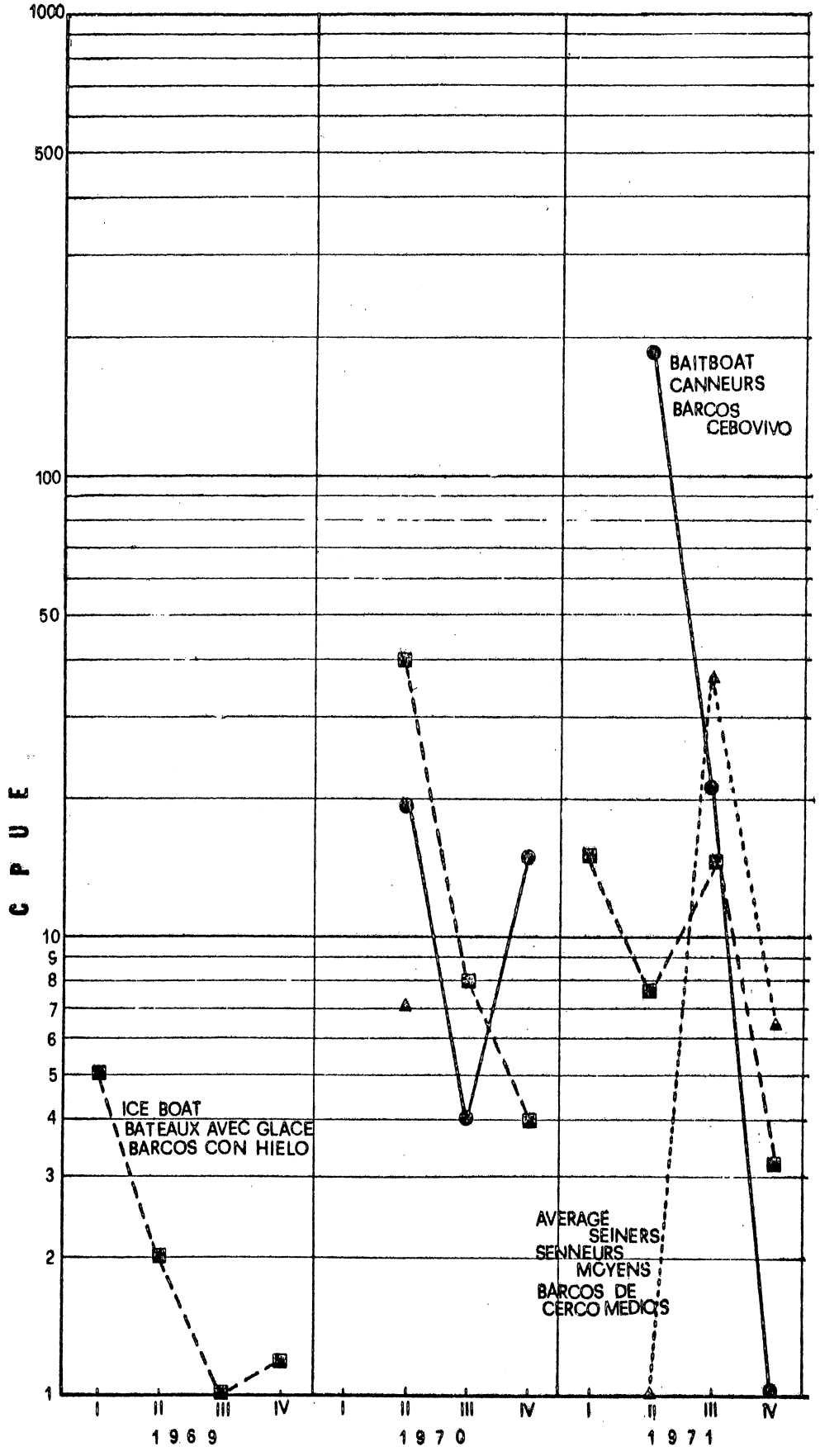

Figure 6.- Catch per unit effort (in number of fish per day) of small yellowfin (LD, less than 17 cm. or FL less than 50 cm.) by FIS vessels in Dakar region.

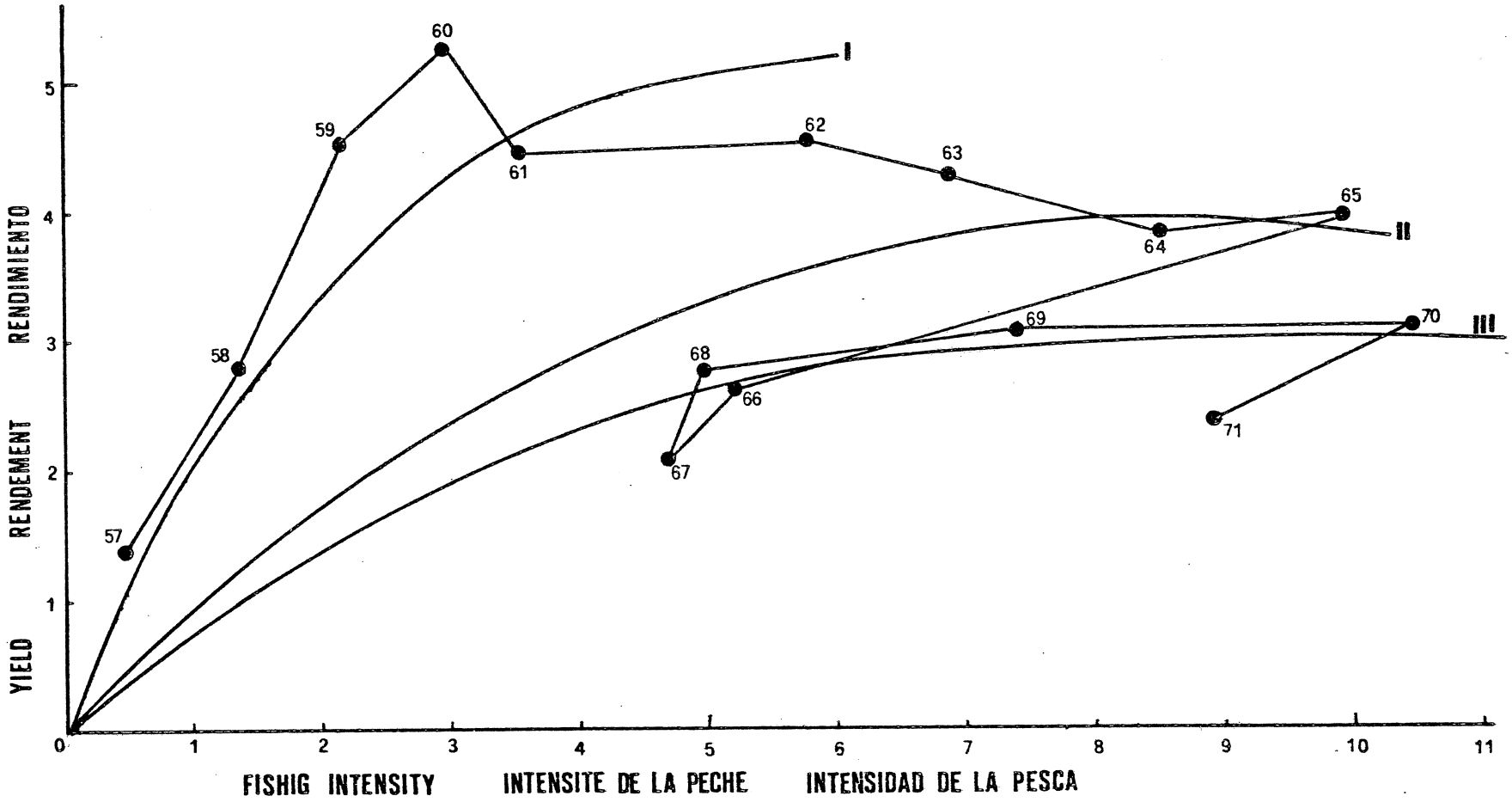

Figure 7.- Yellowfin yield (in 10,000 metric tons) and fishing intensity (in 10 hooks per 5º x 5º square) in entire Atlantic longline fishery.

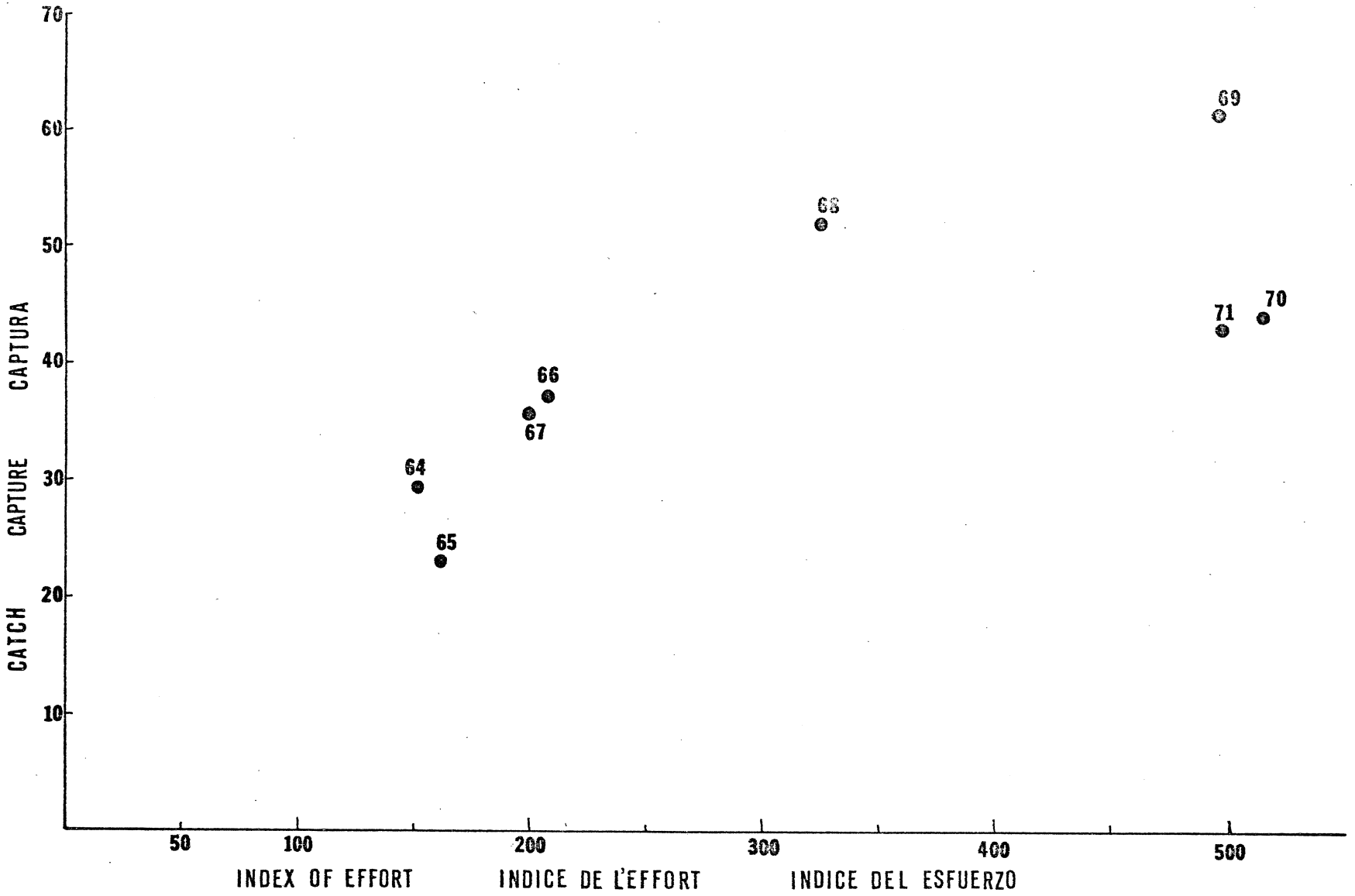

Figure 8.- Catch (in 1,000 metric tons) of yellowfin by surface fishery, and index of surface efforts in Atlantic.

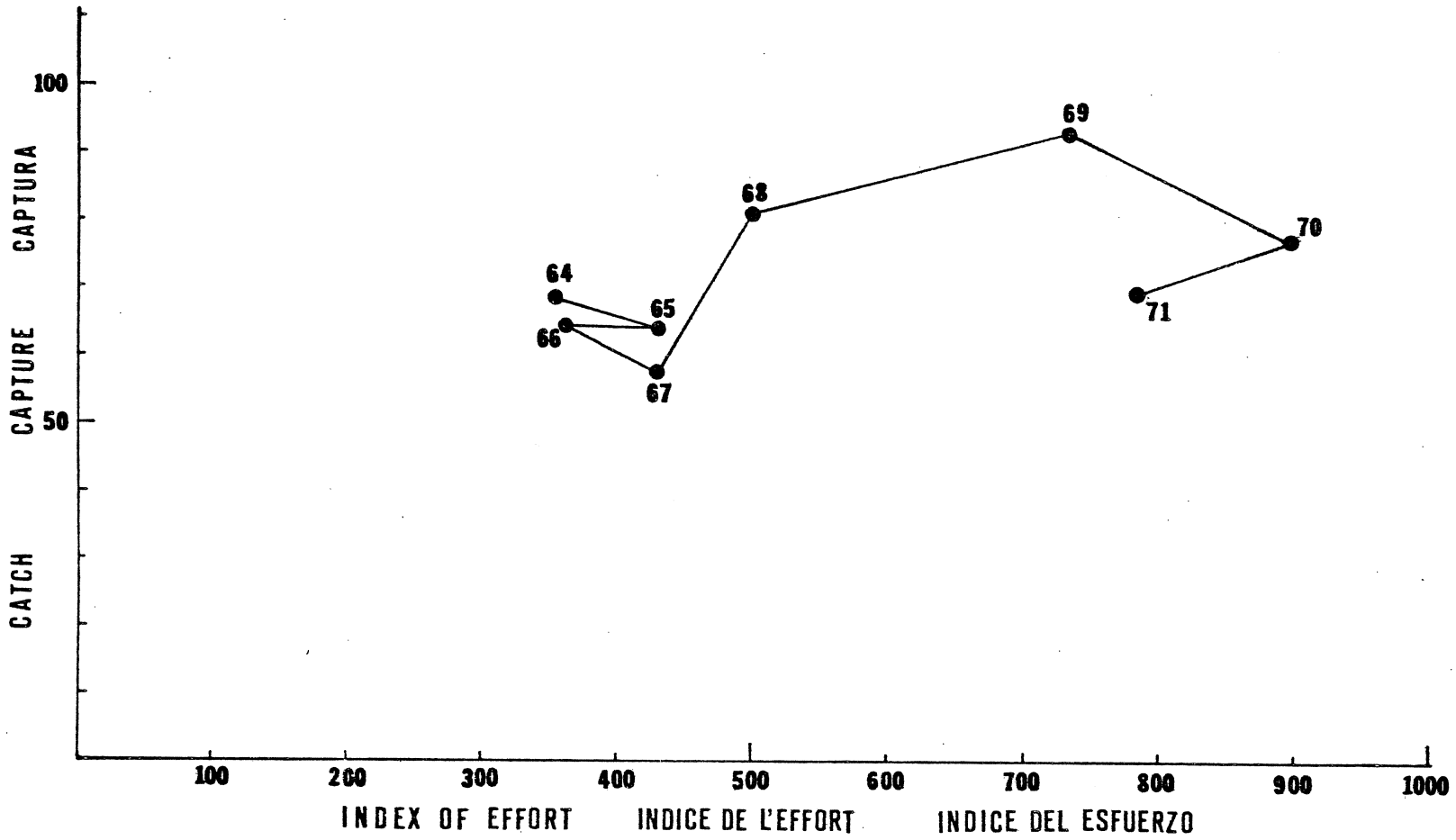

Figure 9.- Total catch of yellowfin in Atlantic and index of effort. Index of effort calculated by dividing catch by surface index of abundance.

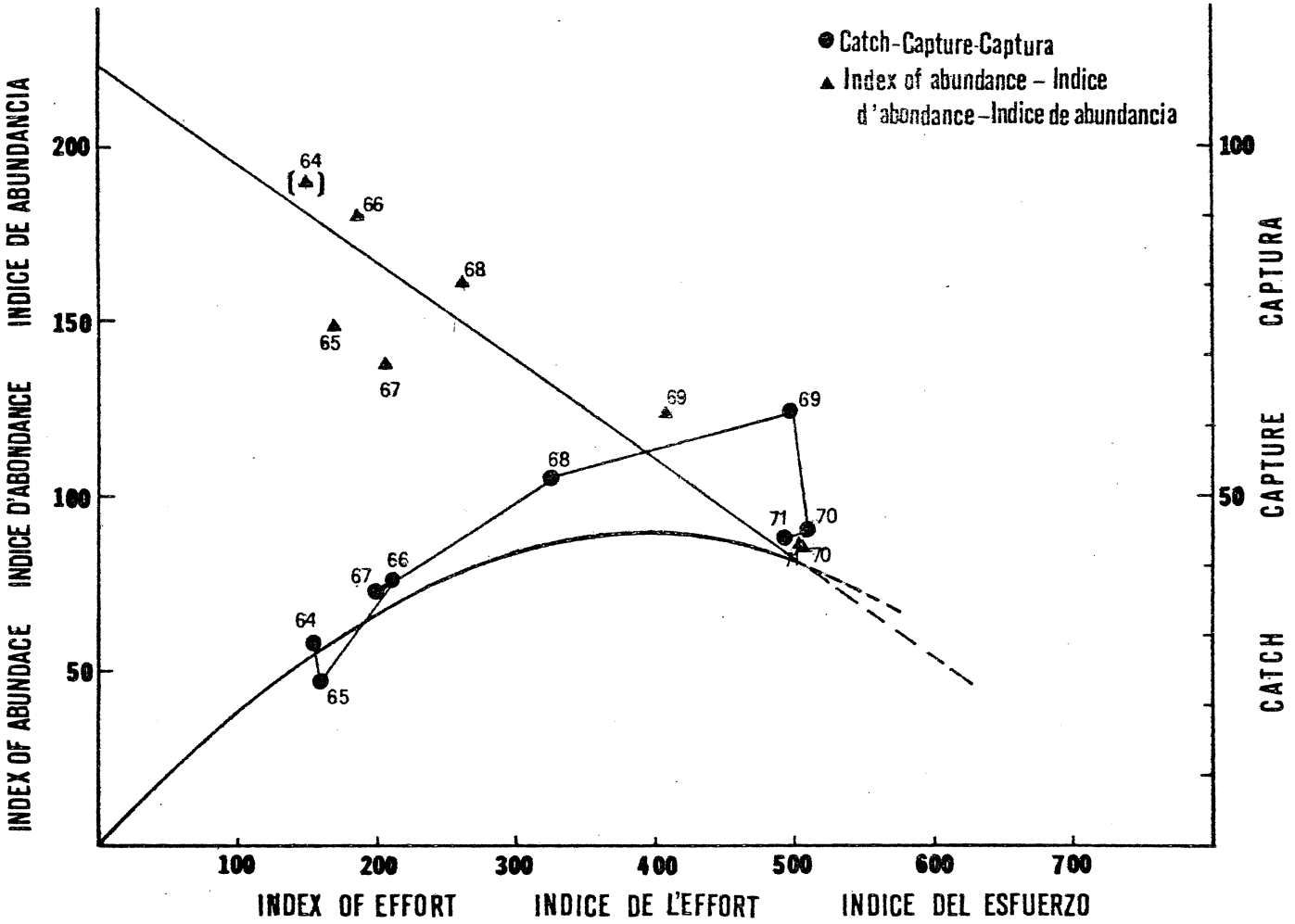

Figure 10.- Surface catch (in 1,000 tons) of yellowfin, surface index of abundance of yellowfin and 2-year average index of effort in Atlantic.

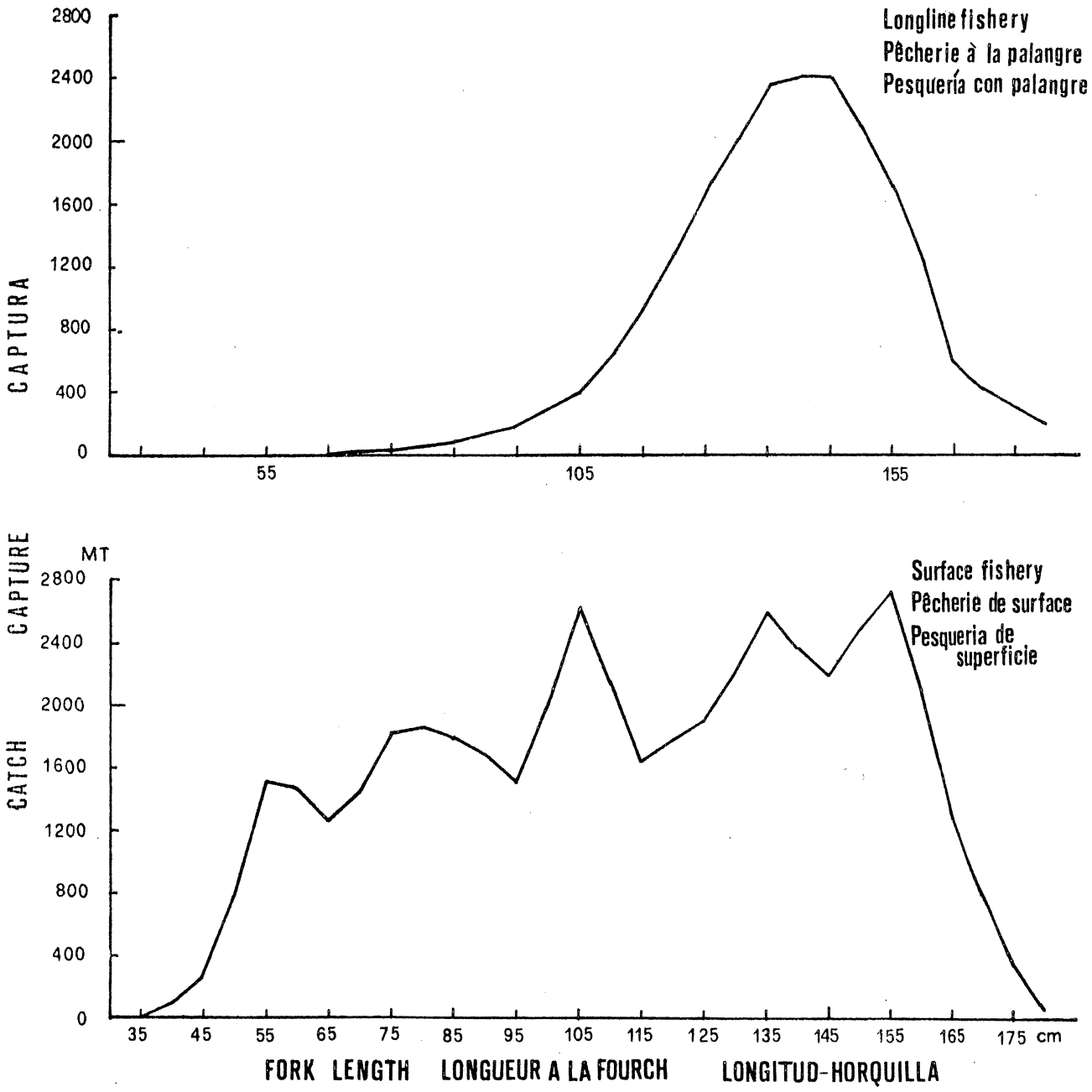

Figure 11.- Yellowfin catch (in metric tons), by size of fish, for surface and longline fisheries, 1970. Size distribution based on average of available size composition data from 1967 to 1971.

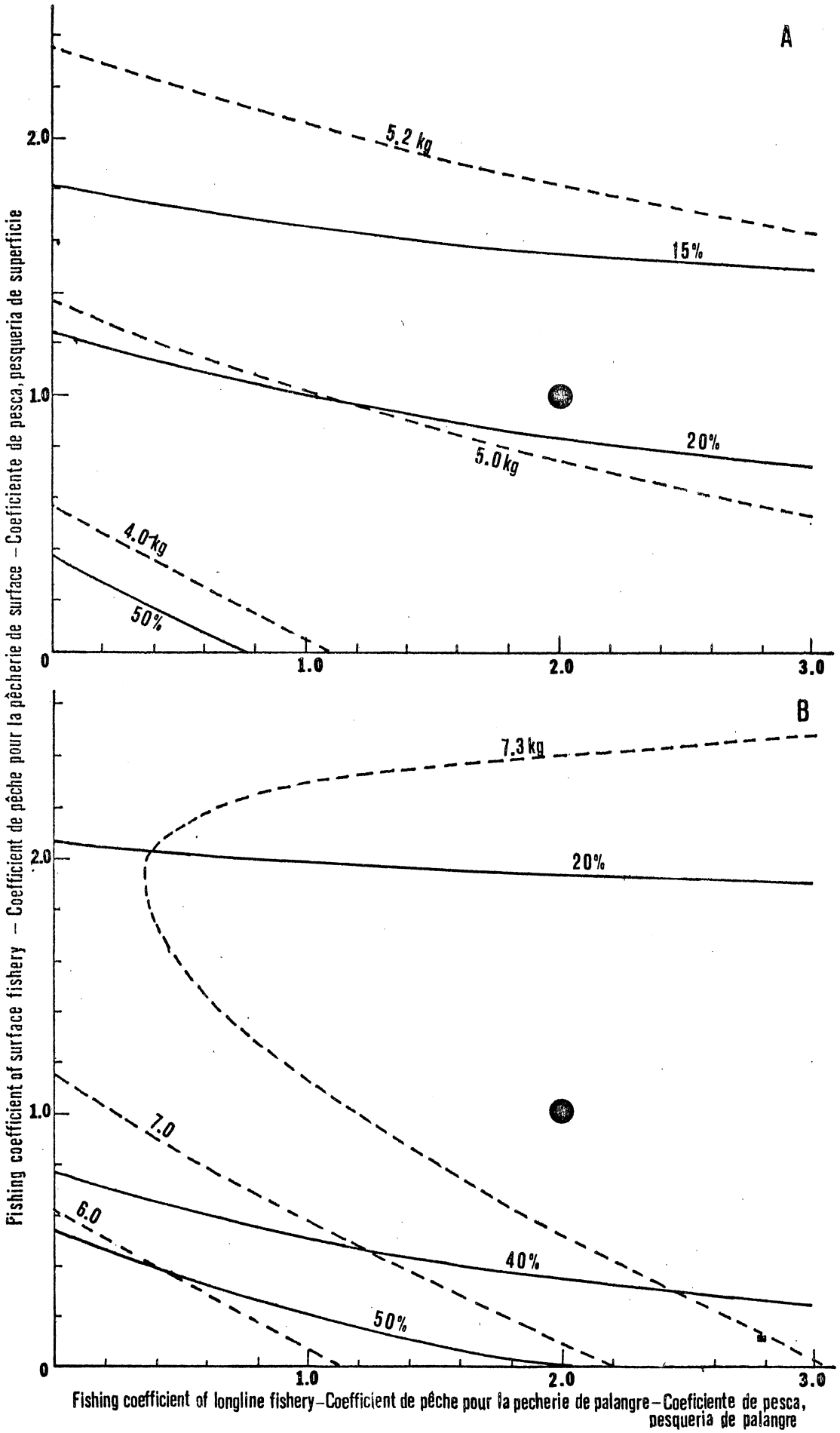

Figure 12 - (see explanation on next page)

Figure 12.-

Yield-per-recruit in Kg. (dotted line) and relative stock fecundity in percent (solid line) of yellowfin tuna taken by two types of fisheries: one aïming at 2 to 5-age fish (surface fishery), and the other, 3-8-age fish (longline fishery).

Solid circles in figure represent present level of fishing intensity.

Curves are based on the following assumptions:

(1) Natural mortality coefficient: 0.8.
(2) growth coefficients:

	L (cm)	K (per year)	to (year)	w (Kg.)
Figure A	190	0.3	0.00	122
Figure B	169	0.6	0.86	99

(3) and fecundity indices of individual fish as:

Age	A)	B)
1	0.04	0.02
2	0.29	0.48
3	1.00	1.00
4	2.32	1.38
5	3.37	1.63
6	4.06	1.77
7	4.57	1.87
8	5.01	1.91

Figure A) is based on parameters from longline samples and
Figure B) is based on parameters from baitboat samples

ANNEX 1

SPECIAL WORKING GROUP ON STOCK ASSESSMENT OF ATLANTIC YELLOWFIN TUNA

Abidjan, June 12-16, 1972

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