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CATCHES OF TUNAS AND TUNA LIKE FISHES, IN THE LONGLINE FISHERY AREAS OFF THE COAST OF BRAZIL

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The fishery of tunas and tuna like fishes in the Atlantic Ocean had a major importance since the year 1956, when started the operations of the Japanese longliners, based on Brazilian ports (Doumenge, 1961 ; Borgstrom, 1964 ; Postel, 1964) .

This fishing activity showed a rapid development, until the beginning of the 60's years. At that time occurred the displacement of the fleet to other bases in the Atlantic Ocean, by economic and political reasons.

The catch data of the Japanese longliners based on Brazilian ports were used in several scientific papers — see Paiva (1961*a*, *b*) , Lima & Wise (1962) , Moraes (1962) , Morais (1963) , Fonsêca & Barros (1963) , Barros & Fonsêca (1965) , and Barros (1965) —, contributing for a better knowledge of the general fishery conditions of tunas and tuna like fishes, in the longline areas off the coast of Brazil.

Based on data presented by Wise & Le Guen (1969) , concerning operations of Japanese longliners in the tuna fishery areas of the Guianas and Bahia, during the years 1956/1963 , was estimated the annual potential catches of tunas, in these areas of special importance for Brazil (Paiva *et al.*, 1971) . The results were the following: *area* of *Guianas* — maximum annual catch = 231,000 tunas, corresponding about to 11,000 metric tons; *area of Bahia* — maximum annual catch = 462,000 tunas, corresponding about to 19,000 metric tons.

Paiva (1974) considered the area between latitudes 20°N and 20°S , and longitudes 20°W and 60°W , under the influence of the future Fishery Port of Fortaleza, concerning to the fishery of tunas and tuna like fishes. It was estimated for this area a catch of 32,900 metric tons of these fishes in 1972 , by longliner fleets belonging to Japan, Korea, Taiwan, Cuba, and Venezuela.

In this paper we try to estimate the annual catches of tunas and tuna like fishes in the longline fishery areas off the coast of Brazil, during the years 1956/1971 . These areas comprise tropical and South temperate waters, in the Western part of the Atlantic Ocean.

LONGLINE FISHERY AREAS

Four longline fishery areas off the coast of Brazil were considered. It was taken in account the clock wise for their numbers I — IV , beginning from the North to the South (figure 1) .

In the delimitation of these areas we had in mind the access from the principal Brazilian ports, trying to have an equal distance for the fishing grounds. The ports directly related to the areas are the following: area I — Belém and Fortaleza; area II — Fortaleza and Recife; area III — Recife, Salvador, and Rio de Janeiro; area IV — Rio de Janeiro, Santos, and Rio Grande.

The areas I — III cover tropical waters of the Atlantic Ocean, between latitudes 15°N

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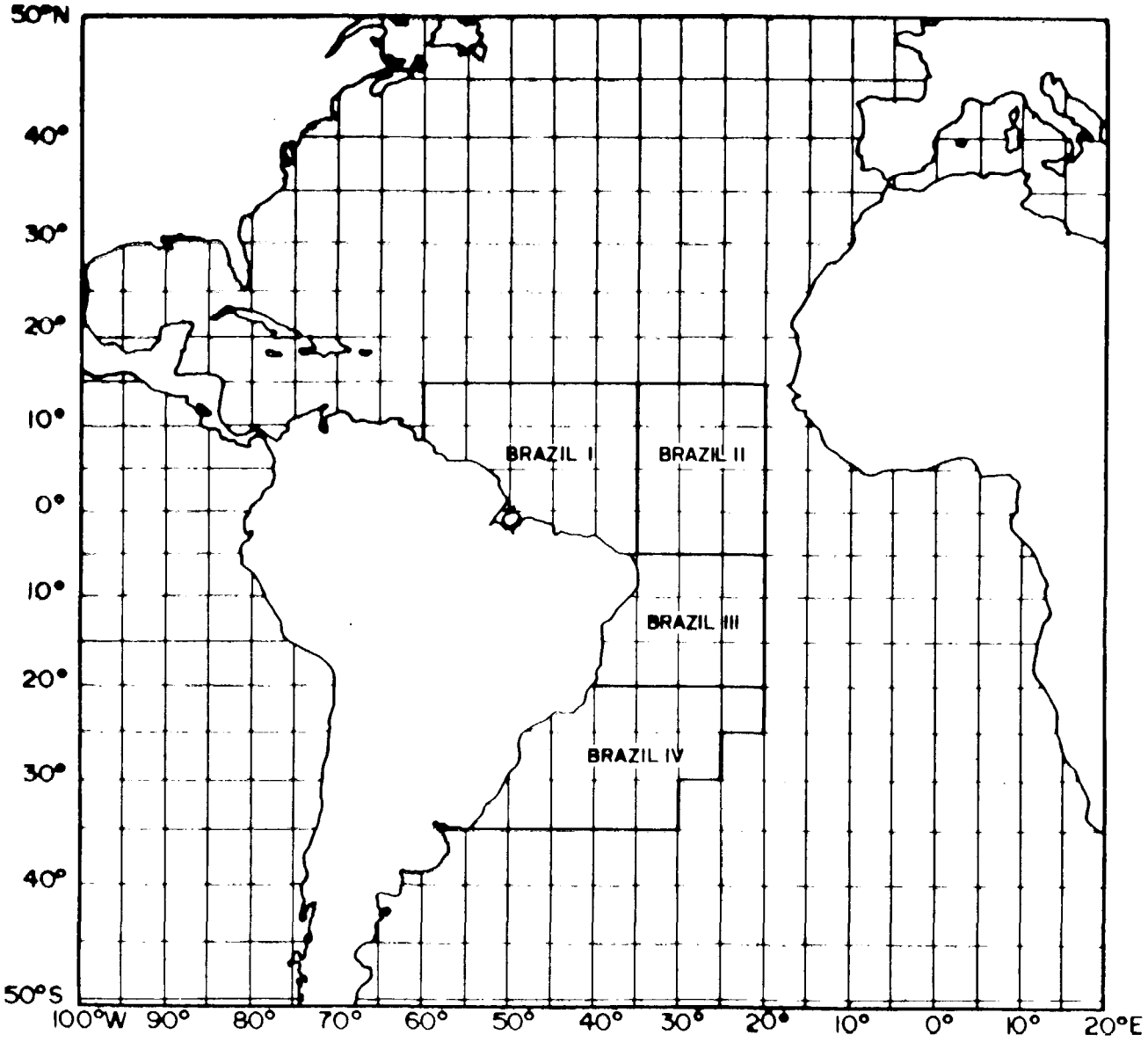

Figure 1 — Longline fishery areas off the coast of Brazil.

and 20°S, and longitudes 20°W and 60°W: the area I is influenced by the North Equatorial and Guianas Currents; the area II, by the North and South Equatorial Currents, the last corresponding to its South limit; the area III, by the South Equatorial and Brazil Currents, the first defining its North limit (Emilsson, 1959; Neumann, 1965).

The area IV comprises temperate waters of the Atlantic Ocean, between latitudes 20°S and 35°S, and from longitudes 20°W, 30°W in direction to the coast of Brazil. It is influenced by Brazil and Malvinas Currents, and limited in the South by the Subtropical Convergence (Emilsson, 1959; Deacon, 1965; Wüst, 1965).

Regarding to the limits of the fishery areas, were considered the following aspects: the longitude 20°W seems to be a divisor between the Eastern and Western parts of the South Atlantic; the longitude 60°W, below the latitude 15°N, defines the entrance of the Caribbean Sea, from the South America; in the Western South Atlantic, the waters situated just below the latitude 35°S are under the influence of La Plata River and Malvinas Current.

For delimitation of the longline fishery areas, some conclusions of Nakamura (1969) were taken in account: different oceanic currents are distinct habitats of tunas and constitute fishery grounds with distinct characteristics too; the limits of tuna fishery grounds are the same ones of the oceanic currents; the tuna migrations can occur in a unique system of oceanic current or between systems; the distribution and migration of

tunas are under the control of the water temperature.

TUNAS AND TUNA LIKE FISHES

According to the International Commission for the Conservation of Atlantic Tunas, the tunas and tuna like fishes belong to the suborder Scombroidei, except the families Trichiuridae and Gempylidae, as well as the genus *Scomber* Linnaeus.

The families and genera that comprise those fishes are the following: Scombridae — *Thunnus* South, *Gymnosarda* Gill, *Euthynnus* Jordan & Gilbert, *Sarda* Cuvier, *Katsuwonus* Kiphinouye, *Auxis* Cuvier, *Acanthocybium* Gill, *Scomberomorus* Lacépède, *Orcynopsis* Gill, *Allothunnus* Serventy, *Gasterochisma* Richardson, and *Rastrelliger* Jordan & Dickerson; Xiphiidae — *Xiphias* Linnaeus, and Istiophoridae — *Istiophorus* Lacépède, *Tetrapturus* Rafinesque, and *Makaira* Lacépède. The tunas are the species of the genus *Thunnus*, while the tuna like fishes belong to the other genera.

The tunas and tuna like fishes caught by longliners in all fishery areas of the Atlantic Ocean are listed in table I, by their codes and names. They correspond to ten species, one of them represented by two subspecies.

Resumed informations on these fish species, including nomenclature, systematic status, distribution, behavior, and fishery conditions in the Atlantic Ocean are found in Miyake & Hayasi (1972), Broderick (1973), and Saila & Norton (1974). These bibliographic sources are of major importance for a general knowledge on tunas and tuna like fishes of the Atlantic Ocean, that are considered in this paper.

TREATMENT OF THE DATA

The regular publishing of data on the Japanese longline fishery in the Atlantic Ocean, by species caught and months, for each 5-degree square, during the years of 1956/1971, was made by Shiohama *et al.* (1965) and the Fisheries Agency of Japan (1966/1973). The nature of these rough data and their detailed treatment were described repeatedly (Le Gall, 1973*a*, *b*; MS).

Regarding the data used in this study, were calculated the weighted annual abundance indexes for each species of tunas and tuna like fishes, corresponding to every one of the longline fishery areas off the coast of Brazil (tables II to V).

The wheighted annual abundance index (AIWA) is derived from the catch per unit of effort for 100 hooks. Considering a geographical area (a), including a number of 5-degree squares (n), and the months (m) of the year (y), being the catch recorded in number of fishes (C) and the effort in number of hooks (E), the calculation of the weighted annual abundance index is made by the equation

$$AIWA_{ay} = \frac{1}{n \times 12} \sum_{i,m} \frac{C_{aimy}}{E_{aimy}}$$

where i ranges from 1 to n, and m from 1 to 12.

As the data refer only to the catches of the Japanese fleet in the longline fishery areas off the coast of Brazil, it was necessary to find the correcting coefficients for calculation of total longline fishing effort in these areas. The utilized coefficients are in table VI, taken from Shiohama (1973).

Multiplying the data of the Japanese annual fishing effort (Shiohama *et al.*, 1965; Fisheries Agency of Japan, 1966/1973) by the indexes above mentioned, it was possible to estimate the annual longline fishing efforts for each species of tunas and tuna like fishes in the longline fishery areas off the coast of Brazil (tables VII to X).

TABLE I

Codes and names of tunas and tuna like fishes of the Atlantic Ocean, referred in this paper.

Codes	ICCAT names	Scientific names
BFT	Bluefin tuna	*Thunnus thynnus thynnus* (Linnaeus)
	Southern bluefin tuna	*Thunnus thynnus maccoyii* (Castelnau)
YFT	Yellowfin tuna	*Thunnus albacares* (Bonnaterre)
ALB	Albacore	*Thunnus alalunga* (Bonnaterre)
BET	Bigeye tuna	*Thunnus obesus* (Lowe)
SJK	Skipjack	*Katsuwonus pelamis* (Linnaeus)
ASF	Atlantic sailfish	*Istiophorus albicans* (Latreille)
BKM	Black marlin	*Makaira indica* (Cuvier)
ABM	Atlantic blue marlin	*Makaira nigricans* (Lacépède)
AWM	Atlantic white marlin	*Tetrapturus albidus* (Poey)
BSF	Broadbill swordfish	*Xiphias gladius* Linnaeus

ICCAT = International Commission for the Conservation of Atlantic Tunas.

TABLE II

Weighted annual abundance indexes of tunas and tuna like fishes in the area Brazil I, resulted from Japanese longline fishery, during the years 1956/1971.

Years	Weighted annual abundance indexes (fishes/100 hooks) (1)									
	BFT	YFT	ALB	BET	SJK	ASF	BKM	ABM	AWM	BSF
1956	0.004	9.131	0.914	0.233	—	0.140	0.037	0.340	0.061	0.068
1957	0.079	6.635	1.188	0.294	—	0.231	0.010	0.320	0.145	0.014
1958	—	7.529	1.340	0.160	—	—	—	0.139	—	—
1959	0.175	5.312	1.409	0.393	0.034	0.059	0.036	0.148	0.063	0.022
1960	0.064	4.084	1.183	0.401	0.067	0.211	0.047	0.144	0.134	0.013
1961	0.141	2.459	0.930	0.531	—	0.272	0.108	0.152	0.104	0.020
1962	0.129	3.020	0.968	0.577	—	0.177	0.012	0.111	0.102	0.027
1963	0.246	1.750	0.931	0.639	0.024	0.140	0.009	0.083	0.106	0.035
1964	0.095	1.260	0.945	0.545	0.006	0.157	0.074	0.081	0.162	0.041
1965	0.064	1.201	0.573	0.564	0.005	0.315	0.001	0.051	0.205	0.034
1966	0.095	1.160	0.425	0.553	0.035	0.210	0.029	0.051	0.323	0.046
1967	0.038	1.149	0.767	0.617	0.001	0.283	—	0.039	0.143	0.033
1968	0.007	1.187	0.887	0.703	0.008	0.336	—	0.052	0.103	0.035
1969	0.029	1.369	0.474	0.637	0.046	0.213	—	0.048	0.115	0.044
1970	0.003	0.921	0.466	0.306	—	0.262	—	0.042	0.066	0.042
1971	0.001	0.768	0.388	0.519	0.008	0.123	0.010	0.031	0.059	0.037

(1) — derived from CPUE/100 hooks.
Sources: Shiohama *et al.* (1965), and Fisheries Agency of Japan (1966/1973).

TABLE III

Weighted annual abundance indexes of tunas and tuna like fishes in the area Brazil II, resulted from Japanese longline fishery, during the years 1956/1971.

Years	Weighted annual abundance indexes (fishes/100 hooks) (1)									
	BFT	YFT	ALB	BET	SJK	ASF	BKM	ABM	AWM	BSF
1956	—	6.403	1.176	0.072	—	0.138	—	0.145	—	0.018
1957	0.139	6.205	2.169	0.348	—	0.575	0.017	0.267	0.165	0.060
1958	—	7.355	1.099	0.445	—	—	—	0.116	—	—
1959	0.123	6.158	1.047	0.448	—	0.033	0.051	0.137	0.115	0.023
1960	0.280	4.043	1.423	0.411	—	0.128	0.007	0.119	0.084	0.022
1961	0.204	2.407	0.580	0.611	—	0.056	0.009	0.089	0.094	0.063
1962	0.331	1.896	0.506	0.767	—	0.104	0.032	0.114	0.224	0.069
1963	0.177	1.577	0.515	0.848	0.002	0.079	0.023	0.080	0.145	0.060
1964	0.133	1.297	0.499	0.586	0.013	0.080	—	0.053	0.131	0.059
1965	0.040	0.963	0.422	0.702	0.003	0.108	0.002	0.035	0.110	0.070
1966	0.021	0.937	0.331	0.646	0.009	0.071	0.003	0.032	0.118	0.084
1967	0.019	1.551	0.265	0.643	—	0.135	0.005	0.039	0.099	0.066
1968	0.005	1.276	0.262	0.639	0.015	0.196	—	0.034	0.098	0.067
1969	0.028	1.315	0.274	0.274	0.012	0.111	—	0.046	0.114	0.078
1970	0.009	0.796	0.147	0.713	—	0.082	0.001	0.040	0.062	0.103
1971	0.000	0.574	0.085	0.739	0.003	0.062	—	0.024	0.035	0.061

(1) — derived from CPUE/100 hooks.
Sources: Shiohama *et al.* (1965), and Fisheries Agency of Japan (1966/1973).

Through the weighted annual abundance indexes and the corresponding fishing efforts, were estimated the number of tunas and tuna like fishes caught in the longline fishery areas off the coast of Brazil, during the years 1956/1971 (tables XI to XVI).

Contrary to the data of the Japanese longline fishery, limited to the catches in number of fishes, the Taiwanese longline fishery data are related to catches in number and weight of fishes (Taiwan Fisheries Bureau, 1968/1972).

Computer treatment of these Taiwanese data leads to some estimates of mean weights of tunas and tuna like fishes caught in the longline fishery areas off the coast of Brazil (table XV). Complementary informations on this subjet were found in Fox (1971).

The estimates of the annual catches in weight were made through the products between the number of fishes caught and the corresponding mean weight, for each species and areas considered (tables XVI to XIX).

The values of potential production of the fishery areas off the coast of Brazil, including those of the major species caught, were drawn from graphic analyses. It was not possible to use the logistic model of Schaefer (1954),

because the catches and areas do not correspond to the whole populations of the considered species in the Atlantic Ocean.

CATCHES BY SPECIES

Bluefin tuna/Southern bluefin tuna

The catches of this species in the longline fishery areas off the coast of Brazil are low, with major importance in the area III. The maximum catches in the considered years were the following: area I — 535 metric tons in 1963, area II — 1,518 metric tons in 1962, area III — 3,503 metric tons in 1962, and area IV — 102 metric tons in 1964 (tables XVI to XIX).

In relative values, the mean participations of this species, in the total catches, were the following: area I — 1.3%, area II — 2.1%, area III — 10.5%, and area IV — 0.7% (tables XVI to XIX; figure 2).

It is possible to conclude that the best longline area for the fishing of this species off the coast of Brazil is situated between latitudes 5°S — 20°S, influenced by the South Equatorial and Brazil Currents.

TABLE IV

Weighted annual abundance indexes of tunas and tuna like fishes in the area Brazil III, resulted from Japanese longline fishery, during the years 1956/1971.

Years	Weighted annual abundance indexes (fishes/100 hooks) (1)									
	BFT	YFT	ALB	BET	SJK	ASF	BKM	ABM	AWM	BSF
1956	—	0.318	1.318	0.045	—	—	—	0.090	—	0.181
1957	—	3.910	2.555	0.205	—	—	—	0.470	—	0.026
1958	.	1.262	7.656	0.104	—	—	—	0.993	—	—
1959	0.316	0.603	8.955	0.129	—	0.208	0.017	0.564	0.312	0.025
1960	0.105	0.971	6.305	0.163	—	0.184	0.003	0.408	0.395	0.019
1961	0.084	0.563	4.572	0.278	—	0.310	0.122	0.658	0.525	0.035
1962	0.262	0.539	3.082	0.211	—	0.354	0.023	0.472	0.476	0.040
1963	0.479	0.327	2.870	0.157	0.060	0.235	0.002	0.291	0.428	0.053
1964	0.169	0.315	2.543	0.219	0.012	0.355	0.001	0.161	0.393	0.041
1965	0.044	0.276	2.415	0.289	0.038	0.286	0.009	0.134	0.408	0.049
1966	0.058	0.180	2.236	0.189	0.004	0.439	0.001	0.092	0.324	0.053
1967	0.003	0.194	2.686	0.261	—	0.584	—	0.083	0.271	0.060
1968	0.003	0.199	2.844	0.091	—	0.641	—	0.100	0.420	0.030
1969	0.002	0.172	2.265	0.150	—	0.447	—	0.121	0.362	0.033
1970	0.071	0.092	1.782	0.066	—	0.175	—	0.059	0.287	0.072
1971	—	0.192	3.051	0.121	—	0.572	—	0.043	0.210	0.046

(1) — derived from CPUE/100 hooks.
Sources: Shiohama *et al.* (1965), and Fisheries Agency of Japan (1966/1973).

TABLE V

Weighted annual abundance indexes of tunas and tuna like fishes in the area Brazil IV, resulted from Japanese longline fishery, during the years 1956/1971.

Years	Weighted annual abundance indexes (fishes/100 hooks) (1)									
	BFT	YFT	ALB	BET	SJK	ASF	BKM	ABM	AWM	BSF
1956	—	—	—	—	—	—	—	—	—	—
1957	—	—	—	—	—	—	—	—	—	—
1958	—	—	—	—	—	—	—	—	—	—
1959	0.028	0.187	2.737	0.037	—	—	—	1.020	0.704	0.030
1960	—	0.442	1.326	0.211	—	—	—	—	—	—
1961	0.013	0.129	3.955	1.361	—	—	—	0.234	—	0.086
1962	0.011	0.697	4.059	0.087	—	0.025	0.012	0.310	0.277	0.032
1963	0.064	0.138	5.092	0.009	—	0.180	—	0.600	0.177	0.120
1964	0.021	0.175	3.359	0.189	0.004	0.386	0.000	0.161	0.754	0.061
1965	0.022	0.116	2.929	0.251	0.042	0.186	—	0.072	0.504	0.045
1966	0.025	0.151	3.157	0.238	0.007	0.319	—	0.054	0.410	0.045
1967	0.014	0.057	3.254	0.359	0.000	0.893	0.000	0.062	1.111	0.046
1968	0.003	0.168	3.706	0.184	—	0.313	0.002	0.037	0.568	0.194
1969	0.006	0.285	2.016	0.459	0.184	0.119	0.000	0.019	0.304	0.420
1970	0.009	0.148	1.378	0.146	0.021	0.326	—	0.025	0.317	0.197
1971	0.018	0.096	1.820	0.406	0.033	0.071	—	0.091	0.220	0.181

(1) — derived from CPUE/100 hooks.
Sources: Shiohama *et al.* (1965), and Fisheries Agency of Japan (1966/1973).

TABLE VI

Correcting coefficients for calculation of total longline fishing effort from Japanese fishing effort in the South Atlantic Ocean (case of fishery mainly focused on albacore), during the years 1956/1971.

Years	Coefficients	Years	Coefficients
1956	1.000	1964	1.076
1957	1.000	1965	1.060
1958	1.000	1966	1.267
1959	1.567	1967	3.792
1960	1.207	1968	2.294
1961	1.168	1969	5.127
1962	1.043	1970	4.203
1963	1.099	1971	8.417 (1)

(1) — preliminary value.
Source: Shiohama (1973).

Yellowfin tuna

The yellowfin tuna catches in the longline fishery areas off the coast of Brazil are great in the areas I and II, and of lower importance in the other areas. The maximum catches in the considered years were the following: area I — 11,856 metric tons in 1959, area II — 20,943 metric tons in 1959, area III — 1,861 metric tons in 1960, and area IV — 596 metric tons in 1968 (tables XVI to XIX).

In relative values, the mean participations of the species, in the total catches, were the following: area I — 56.0%, area II — 54.1%, area III — 10.3%, and area IV — 3.7% (tables XVI to XIX; figure 2).

TABLE VII

Annual estimated longline fishing efforts for tunas and tuna like fishes in the area Brazil I, during the years 1956/1971.

Years	Annual longline fishing efforts (100 hooks)									
	BFT	YFT	ALB	BET	SJK	ASF	BKM	ABM	AWM	BSF
1956	234	1,050	1,089	1,089	—	174	364	1,089	260	326
1957	4,639	6,787	6,764	6,720	—	6,154	3,606	6,787	5,281	4,962
1958	—	31,312	31,208	30,570	—	--	—	26,762	—	—
1959	25,351	54,438	54,268	50,200	992	20,818	4,162	50,023	20,584	29,560
1960	17,572	43,495	43,413	42,603	4,431	29,929	779	38,373	31,278	35,958
1961	7,436	11,587	11,498	11,365	—	94,861	54	11,320	8,279	8,455
1962	46,912	68,554	68,382	68,554	—	67,648	2,120	68,277	67,251	66,593
1963	43,506	62,162	62,125	62,162	13,763	56,249	6,453	60,635	60,592	60,383
1964	77,067	127,918	127,918	127,918	36,188	115,410	15,871	127,648	125,271	126,525
1965	83,243	123,591	122,877	123,480	20,978	122,341	11,857	122,932	122,513	121,705
1966	10,065	39,534	39,242	39,534	4,770	36,837	8,597	38,929	388,837	37,933
1967	8,077	75,047	75,047	75,047	2,074	72,416	—	73,220	70,774	73,091
1968	11,663	49,826	49,826	49,826	5,948	48,814	—	49,743	49,603	48,670
1969	18,196	137,081	135,378	137,081	2,963	135,968	—	135,404	135,271	135,496
1970	10,861	71,211	70,884	71,211	—	69,997	—	69,976	69,324	69,669
1971	13,694	283,569	282,559	283,375	26,219	275,379	3,544	283,375	278,897	279,899

TABLE VIII

Annual estimated longline fishing efforts for tunas and tuna like fishes in the area Brazil II, during the years 1956/1971.

Years	Annual longline fishing efforts (100 hooks)									
	BFT	YFT	ALB	BET	SJK	ASF	BKM	ABM	AWM	BSF
1956	—	198	198	198	—	159	—	198	—	159
1957	2,977	5,666	5,511	5,649	—	3,005	1,414	5,529	3,930	5,231
1958	—	20,303	20,243	19,328	—	—	—	18,299	—	—
1959	42,243	75,757	72,337	74,610	—	40,802	9,562	73,025	58,128	72,643
1960	38,280	57,576	46,238	57,576	—	43,215	9,602	55,920	49,266	46,757
1961	32,610	47,146	43,186	46,666	—	43,750	3,208	46,649	45,227	45,787
1962	89,941	101,040	100,011	100,997	—	95,250	18,560	97,773	99,858	100,919
1963	97,636	106,694	101,034	106,657	31,764	101,834	36,494	106,536	106,273	106,388
1964	118,657	144,903	142,936	144,903	48,450	137,712	—	144,506	143,853	144,251
1965	136,443	159,322	157,609	159,310	73,266	159,000	32,850	158,996	159,097	159,158
1966	50,546	81,474	70,256	81,521	19,342	79,799	10,050	81,183	80,518	81,478
1967	127,089	236,173	230,041	236,173	—	233,583	39,217	235,528	235,923	235,893
1968	24,401	85,011	80,659	85,011	3,462	84,511	—	84,853	84,254	84,786
1969	31,577	1,872	18,381	183,808	2,922	186,520	—	186,177	186,141	187,048
1970	25,974	124,598	117,949	124,598	—	124,068	11,474	123,904	123,656	124,598
1971	63,994	361,864	339,668	361,864	109,387	307,524	—	335,518	335,182	361,620

TABLE IX

Annual estimated longline fishing efforts for tunas and tuna like fishes in the area Brazil III, during the years 1956/1971.

Years	Annual longline fishing efforts (100 hooks)									
	BFT	YFT	ALB	BET	SJK	ASF	BKM	ABM	AWM	BSF
1956	—	22	22	22	—	—	—	22	—	22
1957	—	412	412	329	—	—	—	398	—	329
1958	—	3,521	3,521	3,521	—	—	—	3.521	—	—
1959	21,297	28,559	28,634	58,810	—	19,542	12,263	28,637	22,012	24,100
1960	34,230	41,662	41,633	41,405	—	32,949	6,035	41,434	37,685	41,229
1961	27,783	39 874	39,064	39.874	—	36,699	8,992	39,846	38,139	38,696
1962	81,534	89,109	89,148	89,074	—	87,335	12,913	89,109	88,835	88,450
1963	38,965	51,606	51,766	51,638	18,216	50,192	8,255	51,446	51,617	51,408
1964	60,363	92,419	92,457	92.156	52,492	90,096	16,810	92,282	92,028	91,259
1965	32,748	49,605	49,591	49,694	17,006	48,830	7,877	49,111	49,236	49,263
1966	19,766	78,268	78,359	78,128	27,844	77,801	14,451	78,066	77,936	78,240
1967	12,343	54,901	55,310	54,351	—	52 690	—	55,177	55,310	54,066
1968	626	25,929	25,929	37,232	—	24,966	—	25,489	25,929	25,181
1969	3,594	16,786	16,786	16,427	—	14,428	—	16,786	16,786	16,371
1970	496	24,609	24,609	21,956	—	24,247	—	24,428	24,609	23,549
1971	—	4,756	20,032	6,102	—	6,858	—	5,614	6,153	6,641

TABLE X

Annual estimated longline fishing efforts for tunas and tuna like fishes in the area Brazil IV, during the years 1956/1971.

Years	Annual longline fishing efforts (100 hooks)									
	BFT	YFT	ALB	BET	SJK	ASF	BKM	ABM	AWM	BSF
1956	—	—	—	—	—	—	—	—	—	—
1957	—	—	—	—	—	—	—	—	—	—
1958	—	—	—	—	—	—	—	—	—	—
1959	108	268	268	160	—	—	—	268	160	108
1960	—	63	63	63	—	—	—	—	—	—
1961	269	901	979	979	—	—	—	922	—	965
1962	7,000	8,132	8,132	8,132	—	6,524	6,524	8,132	8,132	7,858
1963	5,452	19,635	19,635	19,138	—	19,213	—	19,635	19,560	19,635
1964	29,473	44,599	44,677	44,171	18,690	43,938	3,558	44,300	44,352	44,597
1965	2,448	3,616	37,166	36,513	2,314	33 201	—	35,847	35,987	36,686
1966	12,821	18,052	24,694	24,467	10,396	23,267	—	20,923	22,717	24,177
1967	31,777	68,749	58,920	58,806	5,544	57,343	14,322	57,756	54,753	58,920
1968	39,117	74,232	76,509	76,427	—	72,981	6,604	73,830	71,869	75,842
1969	99,946	20,316	205,577	197,754	34,939	114,517	17 837	185,551	176,881	203,978
1970	27,446	75,755	77,579	75,709	28,122	50,091	—	60,994	68,110	76,507
1971	10,698	8,661	27,279	25,958	1,002	15,311	—	3,510	18,029	25,613

We conclude that the best longline areas for the fishing of this species off the coast of Brazil are situated between latitudes 15°N — 5°S, influenced by the Equatorial Currents, and the Guianas Current.

Albacore

The albacore catches in the longline fishery areas off the coast of Brazil are great in the areas III and IV, and of lower importance in the other areas. The maximum catches in the considered years were the following: area I — 2,780 metric tons in 1964, area II — 1,742 metric tons in 1959, area III — 6,869 metric tons in 1962, and area IV — 9,532 metric tons in 1969 (tables XVI to XIX).

In relative values, the mean participations of this species, in the total catches, were the following: area I — 12.6%, area II — 6.5%, area III — 49.8%, and area IV — 50.5% (tables XVI to XIX; figure 2).

We conclude that the best longline areas for the fishing of this species off the coast of Brazil are situated between latitudes 5°S — 35°S, mainly influenced by Brazil Current.

Bigeye tuna

The bigeye tuna catches in the longline fishery areas off the coast of Brazil have regular importance in the areas I and II, and lower signification in the other areas. The maximum catches in the considered years

TABLE XI

Total annual estimated catches of tunas and tuna like fishes in the area Brazil I, carried on by longliners during the years 1956/1971.

Years	Number of fishes caught									
	BFT	YFT	ALB	BET	SJK	ASF	BKM	ABM	AWM	BSF
1956	1	9,586	995	254	—	24	13	370	16	22
1957	366	45,032	8,036	1,976	—	1,422	36	2,172	766	69
1958	—	235,748	41,819	4,891	—	—	—	3,720	—	—
1959	4,436	289,175	76,464	19,729	34	1,223	150	7,403	1,297	650
1960	1,125	177,634	51,358	17,084	297	6,315	37	5,526	4,191	467
1961	1,048	28,492	10,693	6,305	—	25,802	6	1,721	861	169
1962	6,052	207,033	66,194	39,556	—	11,974	25	7,579	6,860	1,798
1963	10,702	108,783	57,838	39,722	330	7,875	58	5,033	6,423	2,113
1964	7,321	161,177	120,883	69,715	217	18,119	1,174	10,339	20,294	5,188
1965	5,328	148,433	70,409	69,643	105	38,537	12	6,270	25,115	4,138
1966	956	45,859	16,678	21,862	167	7,736	249	1,985	125,594	1,745
1967	307	86,229	57,561	46,304	2	20,494	—	2,856	10,121	2,412
1968	82	59,143	44,196	35,028	48	16,402	—	2,587	5,109	1,703
1969	528	187,664	64,169	87,321	136	28,961	—	6,499	15,556	5,962
1970	33	65,585	33,032	21,791	—	18,339	—	2,939	4,575	2,926
1971	14	217,781	109,633	147,072	210	33,872	35	8,785	16,455	10,136

TABLE XII

Total annual estimated catches of tunas and tuna like fishes in the area Brazil II, carried on by longliners during the years 1956/1971.

Years	Number of fishes caught									
	BFT	YFT	ALB	BET	SJK	ASF	BKM	ABM	AWM	BSF
1956	—	1,268	233	14	—	22	—	28	—	3
1957	414	35,158	11,953	1,966	—	1,728	24,038	1,476	648	314
1958	—	149,328	22,237	8,601	—	—	—	2,123	—	—
1959	5,196	465,390	75,737	33,425	—	1,346	488	10,004	6,685	1,671
1960	1,072	232,780	65,797	23,664	—	5,532	67	6,654	4,138	1,029
1961	6,652	113,480	25,048	28,513	—	2,450	29	4,152	4,251	2,885
1962	29,770	191,572	50,606	77,465	—	9,906	594	11,146	22,368	6,963
1963	17,282	168,256	52,033	90,445	64	8,045	839	8,523	15,410	6,383
1964	15,781	187,939	71,325	84,913	630	11,017	—	7,659	18,845	8,511
1965	5,456	153,427	66,511	111,834	220	17,172	66	5,565	17,501	11,141
1966	1,061	76,341	23,255	52,663	174	5,665	30	2,598	9,501	6,844
1967	2,415	366,304	60,961	151,859	—	31,534	196	9,186	23,356	15,569
1968	122	108,474	21,133	54,322	52	16,564	—	2,885	8,257	5,681
1969	884	2,462	5,036	50,363	35	20,703	—	8,561	21,220	14,590
1970	234	99,180	17,339	88,838	—	10,174	11	4,956	7,667	12,834
1971	42 (1)	207,710	28,872	267,417	328	19,066	—	8,052	11,731	22,059

(1) — product between the number of fishes caught by Japanese longliners and the correcting coefficient for calculation of total longline fishing effort.

were the following: area I — 6,471 metric tons in 1971, area II — 13,371 metric tons in 1971, area III — 908 metric tons in 1964, and area IV — 4,811 metric tons in 1969 tables XVI to XIX).

In relative values, the mean participations of the species, in the total catches, were the following: area I — 18.2%, area II — 26.5%, area III — 5.5%, and area IV — 13.2% (tables XVI to XIX; figure 2).

We can conclude that the best longline area for the fishing of this species off the coast of Brazil is situated between latitudes 15°N — 5°S, and longitudes 20°W — 35°W, influenced by the Equatorial Currents.

Skipjack

The skipjack catches in the longline fishery areas off the coast of Brazil are very low, with a little importance in the area IV. The maximum catches in the considered years were the following: area I — 6 metric tons in 1963, area II — 11 metric tons in 1964, area III — 19 metric tons in 1963, and area IV — 266 metric tons in 1969 (tables XVI to XIX).

In relative values, the mean participations of this species, in the total catches, corresponded to 0.4% in the area IV, and to 0.0% in the other areas (tables XVI to XIX; figure 2).

TABLE XIII

Total annual estimated catches of tunas and tuna like fishes in the area Brazil III, carried on by longliners during the years 1956/1971.

Years	Number of fishes caught									
	BFT	YFT	ALB	BET	SJK	ASF	BKM	ABM	AWM	BSF
1956	—	7	29	1	—	—	—	2	—	4
1957	—	1,611	1,053	67	—	—	—	187	—	6
1958	—	4,444	26,957	366	—	—	—	3,496	—	—
1959	6,730	17,221	256,417	7,586	—	4,065	208	16,151	6,868	603
1960	3,594	40,454	262,496	6,749	—	6,063	18	16,905	14,886	783
1961	2,334	22,449	178,600	11,085	—	11,377	1,097	26,219	20,023	1,354
1962	21,362	48,030	274,754	18,795	—	31,094	297	42,059	42,285	3,538
1963	18,664	16,941	148,568	8,107	1,093	11,795	17	14,971	22,092	2,725
1964	10,201	29,112	235,118	20,182	630	31,984	17	14,857	36,167	3,742
1965	1,441	13,691	119,762	14,362	646	13,965	71	6,581	20,088	2,414
1966	1,146	14,088	175,211	14,766	111	34,155	14	7,182	25,251	4,147
1967	37	10,651	148,563	14,186	—	30,771	—	4,580	14,989	3,244
1968	2	5,160	73,742	3,388	—	16,003	—	2,549	10,890	755
1969	7	2,887	38,020	2,464	—	6,454	—	2,031	6,077	540
1970	35	2,264	43,853	1,449	—	4,243	—	1,441	7,063	1,696
1971	—	913	61,118	738	—	3,928	—	241	1,292	305

TABLE XIV

Total annual estimated catches of tunas and tuna like fishes in the area Brazil IV, carried on by longliners during the years 1956/1971.

Years	Number of fishes caught									
	BFT	YFT	ALB	BET	SJK	ASF	BKM	ABM	AWM	BSF
1956	—	—	—	—	—	—	—	—	—	—
1957	—	—	—	—	—	—	—	—	—	—
1958	—	—	—	—	—	—	—	—	—	—
1959	3	50	734	6	—	—	—	273	113	3
1960	—	28	84	13	—	—	—	—	—	—
1961	3	116	3,872	1,332	—	—	—	216	—	83
1962	77	5,668	33,008	707	—	163	8	2,521	2,253	251
1963	349	2,710	99,981	172	—	3,458	—	1,178	3,462	2,356
1964	619	7,805	150,070	8,348	75	16,960	2 (1)	7,132	33,441	2,720
1965	54	419	108,713	9,165	97	6,175	—	2,581	16,137	1,651
1966	321	2,726	77,959	5,823	73	7,422	—	3,222	9,314	1,088
1967	445	3,919	191,726	21,111	6 (1)	51,654	11 (1)	3,581	60,831	2,710
1968	117	12,471	283,542	14,063	—	22,843	13	2,731	40,822	14,713
1969	600	5,790	414,443	90,769	15,629	13,628	10 (1)	3,525	54,380	85,671
1970	247	11,212	106,904	11,054	591	16,330	—	1,525	21,591	15,072
1971	193	831	49,648	10,539	33	1,087	—	319	3,966	4,636

(1) — product between the number of fishes caught by Japanese longliners and the correcting coefficient for calculation of total longline fishing effort.

TABLE XV

Annual mean weight of tunas and tuna like fishes caught by longliners, in the areas off the coast of Brazil.

Areas	Annual mean weight (kg)									
	BFT	YFT	ALB	BET	SJK	ASF	BKM	ABM	AWM	BSF
Brazil I	50	41	23	44	17 (1)	15	80 (2)	98	22	39
Brazil II	51	45	23	50	17 (1)	16	80	98	22	45
Brazil III	164 (1)	46	25	45	17 (1)	21	55	75	27	46
Brazil IV	164 (1)	48	23	53	17 (1)	22	102	80	27	76

(1) — mean weight considering the whole Atlantic Ocean longline catches, based on data of the Federations of Japan Tuna Fisheries Cooperatives Associations and Japan Tuna Fisheries Federation [*in* Fox (1971)] ;
(2) — the same mean weight of the area Brazil II.
Source: Taiwan Fisheries Bureau (1968/1972) .

We can conclude that the best longline area for the fishing of this species off the coast of Brazil is situated between latitudes 20°S — 35°S, mainly influenced by Brazil Current.

Atlantic sailfish

The Atlantic sailfish catches in the longline fishery areas off the coast of Brazil are very low, with some importance in the areas III and IV. The maximum catches in the considered years were the following: area I — 578 metric tons in 1965, area II — 505 metric tons in 1967, area III — 825 metric tons in 1971, and area IV — 1,136 metric tons in 1967 (tables XVI to XIX).

In relative values, the mean participations of this species, in the total catches, were the following: area I — 2.4%, area II — 1.2%, area III — 4.9%, and area IV — 4.3% (tables XVI to XIX; figure 2).

It is possible to conclude that the best longline areas for the fishing of this species off the coast Brazil are situated between lati-

TABLE XVI

Annual estimated weight of tunas and tuna like fishes caught by longliners in the area Brazil I, during the years 1956/1971.

Years	Catches in metric tons										
	BFT	YFT	ALB	BET	SJK	ASF	BKM	ABM	AWM	BSF	total
1956	0	393	23	11	—	0	1	36	0	1	465
1957	18	1,846	185	87	—	21	3	213	17	3	2,393
1958	—	9,666	962	215	—	—	—	365	—	—	11,208
1959	222	11,856	1,759	868	1	18	12	725	29	25	15,515
1960	56	7,283	1,181	752	5	95	2	542	92	18	10,026
1961	52	1,168	246	277	—	387	0	169	19	7	2,325
1962	303	8,488	1,522	1,740	—	180	2	743	151	70	13,199
1963	535	4,460	1,330	1,748	6	118	5	493	141	82	8,918
1964	366	6,608	2,780	3,067	4	272	94	1,013	446	202	14,852
1965	266	6,086	1,619	3,064	2	578	1	614	553	161	12,944
1966	48	1,880	384	962	3	116	20	195	2,763	68	6,439
1967	15	3,535	1,324	2,037	0	307	—	280	223	94	7,815
1968	4	2,425	1,017	1,541	1	246	—	254	112	66	5,666
1969	26	7,694	1,476	3,842	3	434	—	637	342	233	14,687
1970	2	2,689	760	959	—	275	—	288	101	114	5,188
1971	1	8,929	2,522	6,471	4	508	3	861	362	395	20,056
Means t	120	5,313	1,193	1,728	2	222	9	464	334	96	9,481
Means %	1.3	56.0	12.6	18.2	0.0	2.4	0.1	4.9	3.5	1.0	100.0

TABLE XVII

Annual estimated weight of tunas and tuna like fishes caught by longliners in the area Brazil II, during the years 1956/1971.

Years	Catches in metric tons										
	BFT	YFT	ALB	BET	SJK	ASF	BKM	ABM	AWM	BSF	total
1956	—	57	5	1	—	0	—	3	—	0	66
1957	21	1,582	275	98	—	28	1,923	145	14	14	4,100
1958	—	6,720	511	430	—	—	—	208	—	—	7 869
1959	265	20,943	1,742	1,671	—	22	39	980	147	75	25,884
1960	55	10,475	1,513	1,183	—	89	5	652	91	46	14,109
1961	339	5,107	576	1,426	—	39	2	407	94	130	8,120
1962	1,518	8,621	1,164	3,873	—	158	48	1,092	492	313	17,279
1963	881	7,572	1,197	4,522	1	139	67	835	339	287	15,830
1964	805	8,457	1.640	4,246	11	176	—	751	415	383	16,884
1965	278	6,904	1,530	5.592	4	275	5	545	385	501	16,019
1966	54	3,435	535	2.633	3	91	2	255	209	308	7,525
1967	123	16,484	1,402	7.593	—	505	16	900	514	701	28,238
1968	6	4,881	486	2,716	1	265	—	283	182	256	9,076
1969	45	111	116	2,518	1	331	—	839	467	657	5,085
1970	12	4,463	399	4,442	—	163	1	486	169	578	10,713
1971	2	9,347	664	13,371	6	305	—	789	258	993	25,735
Means t	275	7,197	860	3,519	2	161	132	573	236	328	13,283
Means %	2.1	54.1	6.5	26.5	0.0	1.2	1.0	4.3	1.8	2.5	100.0

TABLE XVIII

Annual estimated weight of tunas and tuna like fishes caught by longliners in the area Brazil III, during the years 1956/1971.

Years	Catches in metric tons										
	BFT	YFT	ALB	BET	SJK	ASF	BKM	ABM	AWM	BSF	total
1956	—	0	1	0	—	—	—	0	—	0	1
1957	—	74	26	3	—	—	—	14	—	0	117
1958	—	204	674	16	—	—	—	262	—	—	1,156
1959	1,104	792	6,410	341	—	85	11	1,211	185	28	10,167
1960	589	1,861	6,562	304	—	127	1	1,268	402	36	11,150
1961	383	1,033	4,465	499	—	239	60	1,966	541	62	9,248
1962	3,503	2,209	6,869	846	—	653	16	3,154	1,142	163	18,555
1963	3,061	779	3,714	365	19	248	1	1,123	596	125	10,031
1964	1,673	1,339	5,878	908	11	672	1	1,114	976	172	12,744
1965	236	630	2,994	646	11	293	4	494	542	111	5,961
1966	237	648	4,380	664	2	717	1	539	682	191	8,061
1967	6	490	3,714	638	—	646	—	344	405	149	6,392
1968	0	237	1,844	152	—	336	—	191	294	35	3,089
1969	1	133	950	111	—	136	—	152	164	25	1,672
1970	6	104	1,096	65	—	89	—	108	191	78	1,737
1971	—	42	1,528	33	—	825	—	18	35	14	2,495
Means t	675	661	3,194	349	3	317	6	747	385	74	6,411
Means %	10.5	10.3	49.8	5.5	0.0	4.9	0.1	11.7	6.0	1.2	100.0

TABLE XIX

Annual estimated weight of tunas and tuna like fishes caught by longliners in the area Brazil IV, during the years 1956/1971.

Years	Catches in metric tons										
	BFT	YFT	ALB	BET	SJK	ASF	BKM	ABM	AWM	BSF	total
1956	—	—	—	—	—	—	—	—	—	—	—
1957	—	—	—	—	—	—	—	—	—	—	—
1958	—	—	—	—	—	—	—	—	—	—	—
1959	0	2	17	0	—	—	—	22	3	0	44
1960	—	1	2	1	—	—	—	—	—	—	4
1961	0	6	89	71	—	—	—	17	—	6	189
1962	13	272	759	37	—	4	1	202	61	19	1,368
1963	57	130	2,300	9	—	76	—	94	93	177	2,936
1964	102	375	3,452	442	1	373	0	571	903	204	6,423
1965	9	20	2,500	486	2	136	—	206	490	124	3,973
1966	53	131	1,793	309	1	163	—	258	251	82	3,041
1967	73	188	4,410	1,119	0	1,136	1	286	1,642	203	9,058
1968	19	596	6,521	745	—	503	1	218	1,102	1,103	10,808
1969	98	278	9,532	4,811	266	230	1	282	1,468	6,425	23,391
1970	41	538	2,459	586	10	359	—	122	583	1,130	5,828
1971	32	40	1,142	559	1	24	—	26	107	348	2,279
Means t	38	198	2,691	706	22	231	0	177	516	755	5,334
Means %	0.7	3.7	50.5	13.2	0.4	4.3	0.0	3.2	9.8	14.2	100.0

tudes 5°S — 35°S, mainly influenced by Brazil Current.

Black marlin

The black marlin catches in the longline fishery areas off the coast of Brazil are very low, with major importance in the area II. The maximum catches in the considered years were the following: area I — 94 metric tons in 1964, area II — 1,923 metric tons in 1957, area III — 60 metric tons in 1961, and area IV — 1 metric ton in several years (tables XVI to XIX).

In relative values, the mean participations of this species, in the total catches, were the following: area I — 0.1%, area II — 1.0%, area III — 0.1%, and area IV — 0.0% (tables XVI to XIX; figure 2).

It is possible to conclude that the best longline area for the fishing of this species off

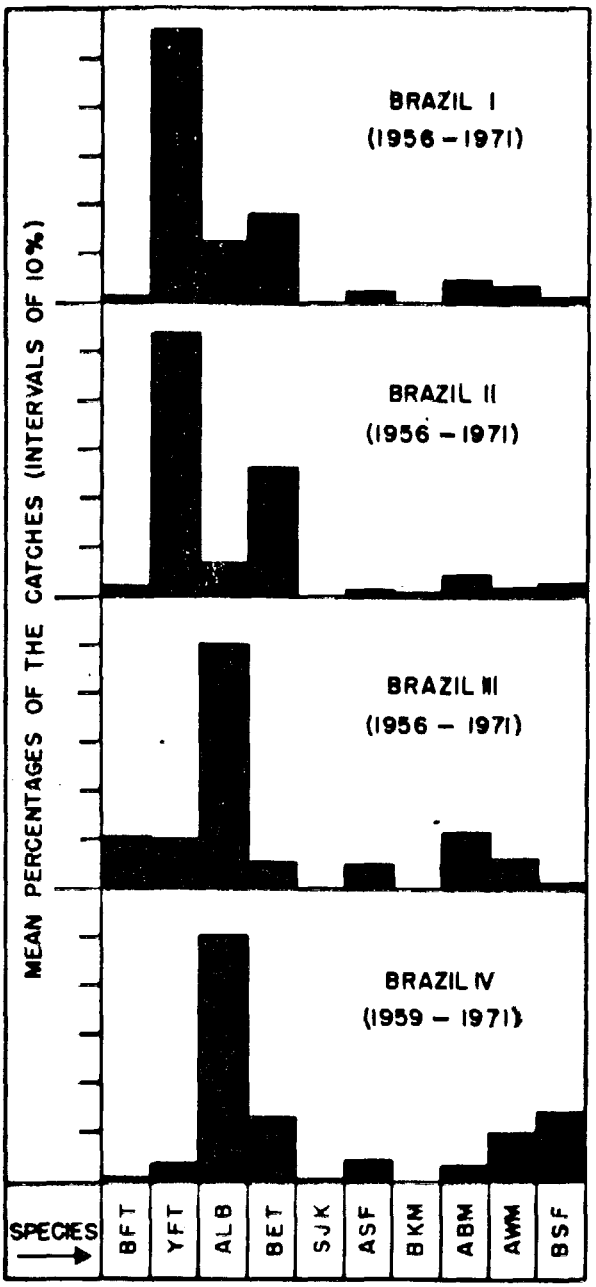

Figure 2 - Mean percentages of the catches by species of tunas and tuna like fishes, in the longline fishery areas off the coast of Brazil.

the coast of Brazil is situated between latitudes 15°N — 5°S, and longitudes 20°W — 35°W, influenced by the Equatorial Currents.

Atlantic blue marlin

The Atlantic blue marlin catches in the longline fishery areas off the coast of Brazil are low, with major importance in the area III. The maximum catches of this species in the considered years were the following: area I — 1,013 metric tons in 1964, area II — 1,092 metric tons in 1962, area III — 3,154 metric tons in 1962, and area IV — 571 metric tons in 1964 (tables XVI to XIX).

In relative values, the mean participations of this species, in the total catches, were the following: area I — 4.9%, area II — 4.3%, area III — 11.7%, and area IV — 3.2% (tables XVI to XIX; figure 2).

We can conclude that the best longline area for the fishing of this species off the coast of Brazil is situated between latitudes 5°S — 20°S, influenced by the South Equatorial and Brazil Currents.

Atlantic white marlin

The Atlantic white marlin catches in the longline fishery areas off the coast of Brazil are low, with major importance in the area IV. The maximum catches in the considered years were the following: area I — 2,763 metric tons in 1966, area II — 514 metric tons in 1967, area III — 1,142 metric tons in 1962, and area IV — 1,642 metric tons in 1967 (tables XVI to XIX).

In relative values, the mean participations of this species, in the total catches, were the following: area I — 3.5%, area II — 1.8%, area III — 6.0%, and area IV — 9.8% (tables XVI to XIX; figure 2).

It is possible to conclude that the best longline area for the fishing of this species off the coast of Brazil is situated between latitudes 20°S — 35°S, mainly influenced by Brazil Current.

Broadbill swordfish

The broadbill swordfish catches in the longline fishery areas off the coast of Brazil are low, with major importance in the area IV. The maximum catches in the considered years were the following: area I — 395 metric tons in 1971, area II — 993 metric tons in 1971, area III — 191 metric tons in 1966, and area IV — 6,425 metric tons in 1969 (tables XVI to XIX).

In relative values, the mean participations of this species, in the total catches, were the following: area I — 1.0%, area II — 2.5%, area III — 1.2%, and area IV — 14.2% (tables XVI to XIX; figure 2).

We can conclude that the best longline area for the fishing of this species off the coast of Brazil is situated between latitudes 20°S — 35°S, mainly influenced by Brazil Current.

CATCHES BY AREAS

Area I

The longline fishery of tunas and tuna like fishes in this area is very important. In the considered years, the maximum catch corresponded to 20,056 metric tons in 1971,

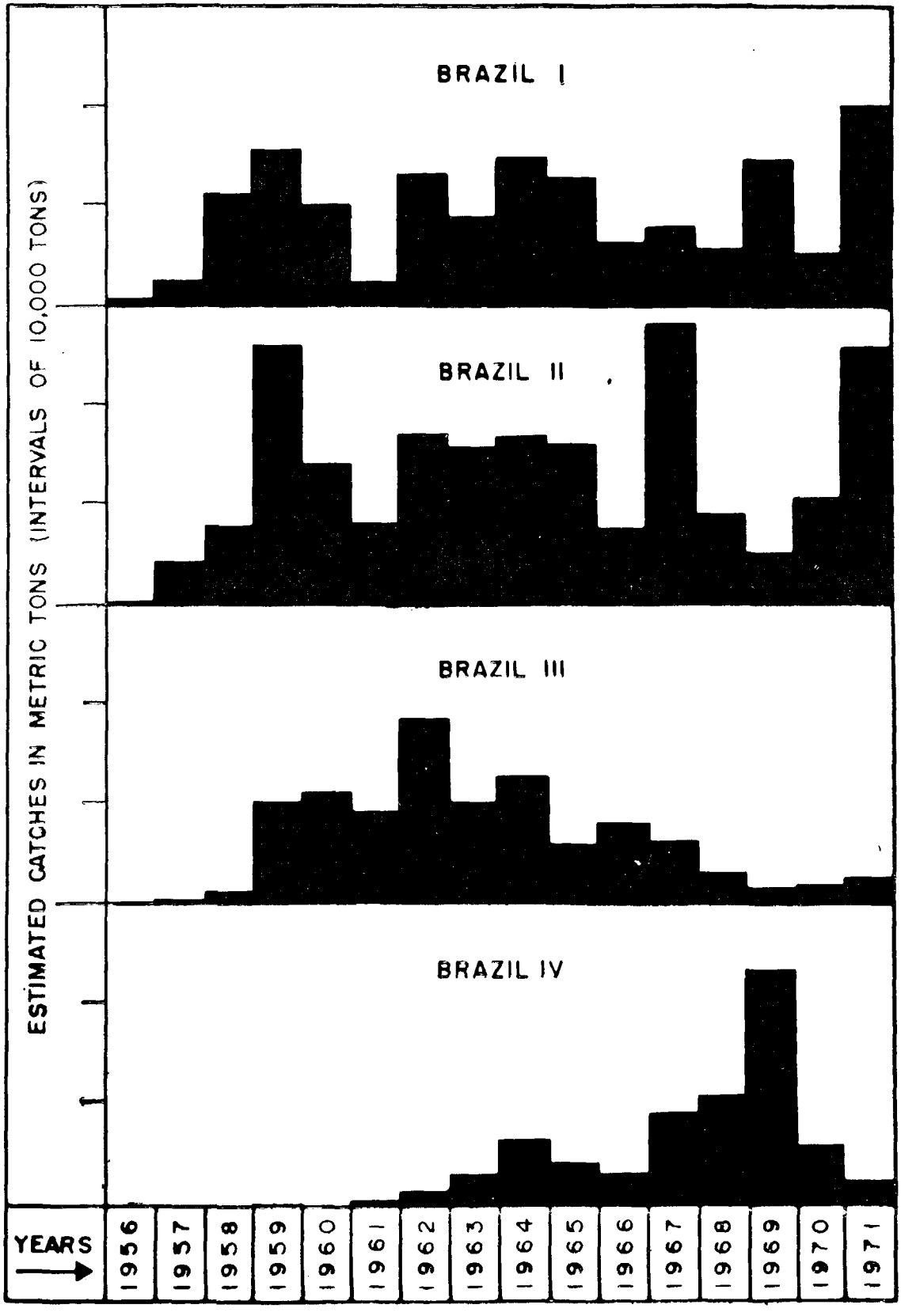

Figure 3 — Estimated catches of tunas and tuna like fishes in the longline fishery areas off the coast of Brazil, during the years 1956/1971.

TABLE XX

Estimated catches of tunas and tuna like fishes in the longline fishery areas off the coast of Brazil, during the years 1956/1971.

Years		Catches in metric tons										
		BFT	YFT	ALB	BET	SJK	ASF	BKM	ABM	AWM	BSF	total
1956		0	450	29	12	—	—	—	39	0	1	532
1957		39	3.502	486	188	—	49	1.926	372	31	17	6.610
1958		—	16.590	2.147	661	—		—	835	—	—	20.233
1959		1.591	33.593	9.928	2.880	1	125	62	2.938	364	128	51.610
1960		700	19.620	9.258	2.240	5	269	8	2.462	585	100	35.289
1961		774	7.314	5.376	2.273	—	553	62	2.559	654	205	19.882
1962		5.337	19.590	10.314	6.496	—	581	67	5.191	1.846	565	50.401
1963		4.534	12.941	8.541	6.644	26	976	73	2.544	1.169	671	37.715
1964		2.946	16.779	13.750	8.663	27	1.069	55	3.449	2.740	961	50.903
1965		789	19.040	8.643	9.788	19	1.661	7	1.859	1.970	897	38.897
1966		348	6.094	7.092	4.568	9	663	26	1.247	3.905	649	25.066
1967		217	18.697	18.850	11.387	0	2.665	17	1.810	2.784	1.247	51.503
1968		29	8.139	9.868	5.154	2	1.660	1	946	1.690	1.460	28.639
1969		170	8.216	12.074	11.282	270	1.131	1	1.910	2.441	7.340	44.835
1970		61	7.794	4.714	6.052	10	886	1	1.204	1.044	1.900	23.466
1971		35	18.358	5.856	20.434	11	1.662	3	1.694	762	1.750	50.565
Means	t	1.108	13.369	7.938	6.302	29	931	147	1.961	1.471	1.253	34.509
	%	3.2	38.7	23.0	18.3	0.1	2.7	0.4	5.7	4.3	3.6	100.0

and the annual mean was 9,481 metric tons (table XVI ; figure 3) .

We may conclude that the potencial production of this longline area is about 15,000 metric tons year of tunas and tuna like fishes.

Area II

The longline fishery of tunas and tuna like fishes in this area is very important. In the considered years, the maximum catch corresponded to 28,238 metric tons in 1967 , and the annual mean was 13,283 metric tons (table XVII ; figure 3) .

We may conclude that the potencial production of this longline area is about 15,000 metric tons year of tunas and tuna like fishes.

Area III

The longline fishery of tunas and tuna like fishes in this area has a regular importance. In the considered years, the maximum catch corresponded to 18,555 metric tons in 1962 , and the annual mean was 6,411 metric tons (table XVIII ; figure 3) .

We may conclude that the potential production of this longline area is about 10,000 metric tons/year of tunas and tuna like fishes.

Area IV

The longline fishery of tunas and tuna like fishes in this area has a regular importance. In the considered years, the maximum catch corresponded to 23,391 metric tons in 1969 , and the annual mean was 5,334 metric tons (table XIX ; figure 3) .

We may conclude that the potencial production of this longline area is about 10,000 metric tons year of tunas and tuna like fishes.

TOTAL CATCHES

The total catches by species of tunas and tuna like fishes, in the longline fishery areas off the coast of Brazil, during the years 1956 1971 (table XX ; figure 4), present the following important data: bluefin tuna Southern bluefin tuna — maximum catch of 5,337 metric tons in 1962 , and the mean annual catch of 1,108 metric tons represents 3.2% of the mean total catch; yellowfin tuna — maximum catch of 33,593 metric tons in 1959 , and the mean annual catch of 13,369 metric tons represents 38.7% of the mean total catch; albacore — maximum catch of 18,850 metric tons in 1967 , and the mean annual catch of 7,938 metric tons represents 23.0% of the mean total catch; bigeye tuna — maximum catch of 20,434 metric tons in 1971 , and the mean annual catch of 6,302 metric tons represents 18.3% of the mean total catch; skipjack — maximum catch of 270 metric tons in 1969 , and the mean annual catch of 29 metric tons represents 0.1% of the mean total catch; Atlantic sailfish — maximum catch of 2,665 metric tons in 1967 , and the mean annual catch of 931 metric tons represents 2.7% of the mean total catch; black marlin — maximum catch of 1,926 metric tons in 1957 , and the mean annual catch of 147 metric tons represents 0.4% of the mean total catch; Atlantic blue marlin — maximum catch of

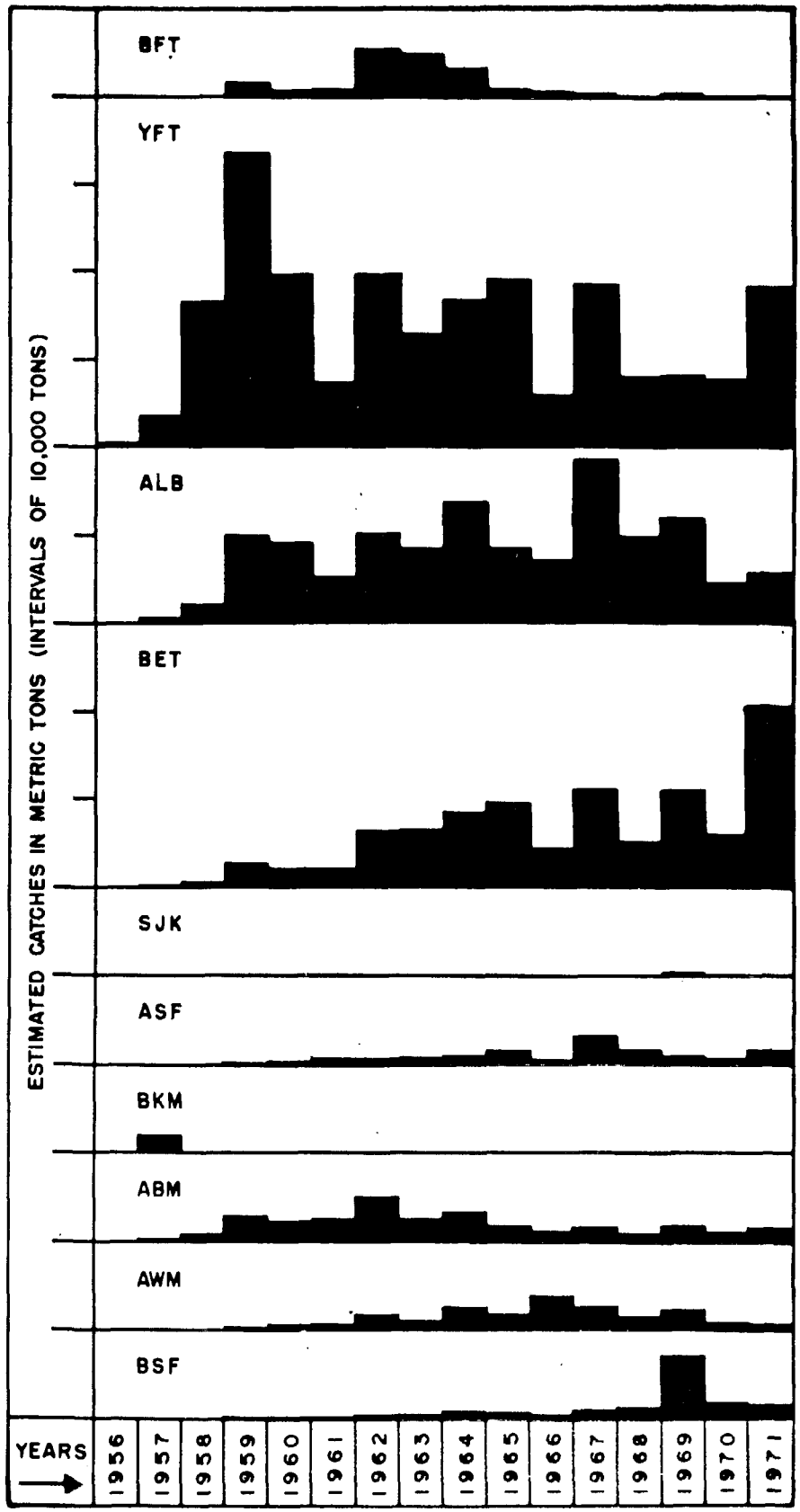

Figure 4 — Estimated total catches by species of tunas and tuna like fishes, in the longline fishery areas off the coast of Brazil, during the years 1956/1971 .

5,191 metric tons in 1962, and the mean annual catch of 1,961 metric tons represents 5.7% of the mean total catch; Atlantic white marlin — maximum catch of 3,905 metric tons in 1966, and the mean annual catch of 1,471 metric tons represents 4.3% of the mean total catch; broadbill swordfish — maximum catch of 7,340 metric tons in 1969, and the mean annual catch of 1,253 metric tons represents 3.6% of the mean total catch.

The most important species caught by the longliner fleets in their fishery areas off the coast of Brazil are the yellowfin tuna, albacore, and bigeye tuna; these species comprise 80.0% of the mean annual total catch (table XX ; figure 4) .

We may conclude that the potential productions of the major species in the longline fishery areas off the coast of Brazil are about 20,000 metric tons/year of yellowfin tuna, 10,000 metric tons/year of albacore, and 10,000 metric tons/year of bigeye tuna.

The estimated potential productions of these species in all longline fishery areas of the Atlantic Ocean are the following: yellowfin tuna — 40,000 metric tons/year, albacore — 40,000 metric tons/year, and bigeye tuna — 25,000 metric tons/year (Gulland, 1970 ; Broderick, 1973) .

A simple comparison of the above data on potential productions gives a clear idea about the importance of the longline fishery areas of tunas and tuna like fishes off the coast of Brazil.

During the years 1960/1971 the maximum annual catch of tunas and tuna like fishes in the Atlantic Ocean was obtained in 1971, corresponding to 382.9 x 10^3 metric tons; the catches by longliners in all fishery areas of this ocean reached the maximum in 1965, being equal to 148.1 x 10^3 metric tons; the maximum catch in the longline fishery areas off the coast of Brazil was 51.5 x 10^3 metric tons in 1967 (table XXI ; figure 5) .

The mean annual productions of tunas and tuna like fishes in the period of 1960/1971 were the following: total catch in the Atlantic Ocean — 309.0 x 10^3 metric tons; total catch by longliners in all fishery areas of this ocean — 108.7 x 10^3 metric tons; total catch in the longline fishery areas off the coast of Brazil — 38.1 x 10^3 metric tons; the mean catch of tunas and tuna like fishes in the longline fishery areas off the coast of Brazil represents 36.1% of the mean catch by longliners in all fishery areas of the Atlantic Ocean (table XXI ; figure 5) .

We may conclude that the potential production of tunas and tuna like fishes in the longline fishery areas off the coast of Brazil is about 50 x 10^3 metric tons/year.

TABLE XXI

Catches of tunas tuna like fishes in the Atlantic Ocean, compared with those made by longliners in their fishery areas, during the years 1960/1971 .

Years	Total catches (10^3 mt)	Catches by longliners			
		all areas		areas off Brazil (1)	
		10^3 mt	%	10^3 mt	%
1960	281.7	77.7	100.0	35.3	45.4
1961	269.8	83.3	100.0	19.9	23.9
1962	299.3	110.3	100.0	50.4	45.7
1963	285.1	124.6	100.0	37.7	30.3
1964	299.2	135.2	100.0	50.9	37.6
1965	331.8	148.1	100.0	38.9	26.3
1966	290.7	102.0	100.0	25.1	24.6
1967	283.2	73.7	100.0	51.5	69.9
1968	318.9	94.1	100.0	28.6	30.4
1969	326.1	111.1	100.0	44.8	40.3
1970	340.4	117.8	100.0	23.5	19.9
1971	382.9	127.0	100.0	50.6	39.8
Means	309.0	108.7	100.0	38.1	36.1

(1) — estimated values; mt = metric ton.
Source: International Comission for the Conservation of Atlantic Tunas (1972/1974).

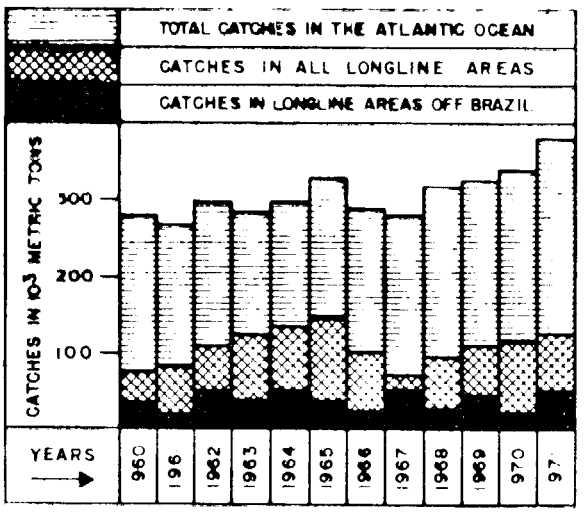

Figure 5 — Total catches of tunas and tuna like fishes in the Atlantic Ocean and in its longline areas, including those off the coast of Brazil, during the years 1960/1971 .

Taking in account the species bluefin tuna, Southern bluefin tuna, yellowfin tuna, albacore, and skipjack together, their maximum annual potential catch in the Atlantic Ocean was estimated by Fullenbaum (1970) in 205 x 10^3 metric tons, while Gulland (1970) suppose to be between 450 — 550 x 10^3 metric tons.

GENERAL CONCLUSIONS

1 — The yellowfin tuna is the predominant species in the catches from the longline

fishery areas off the coast of Brazil, influenced by the Equatorial Currents.

2 — The albacore is the predominant species in the catches from the longline fishery areas off the coast of Brazil, mainly influenced by Brazil Current.

3 — The best catches of the Atlantic sailfish in the longline fishery off the coast of Brazil are made in those areas mainly influenced by Brazil Current.

4 — The best longline area for the catch of bigeye tuna and black marlin off the coast of Brazil is situated between the latitudes 15°N — 5°S and longitudes 20°W — 35°W, influenced by the Equatorial Currents.

5 — The best longline area for the catch of bluefin tuna/Southern bluefin tuna and Atlantic blue marlin off the coast of Brazil is situated between the latitudes 5°S — 20°S, mainly influenced by Brazil Current.

6 — The best longline area for the catch of skipjack, Atlantic white marlin, and broadbill swordfish off the coast of Brazil is situated between the latitudes 20°S — 35°S, mainly influenced by Brazil Current.

7 — The best longline fishery areas of tunas and tuna like fishes off the coast of Brazil are those influenced by the Equatorial Currents.

8 — The most important species caught by longliners in the fishery areas off the coast of Brazil are the yellowfin tuna, albacore, and bigeye tuna; these species comprise 80.0% of the mean annual total catch of the same areas.

9 — The potential productions of the major species in the longline fishery areas off the coast of Brazil are about 20 x 10^3 metric tons/year of yellowfin tuna, 10 x 10^3 metric tons/year of albacore, and 10 x 10^3 metric tons/year of bigeye tuna.

10 — The potential production of tunas and tuna like fishes in the longline fishery areas off the coast of Brazil is about 50 x 10^3 metric tons/year.

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