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SOUTH CHINA SEA FISHERIES
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THE SOUTH CHINA SEA FISHERIES

tuna resources

UNITED NATIONS DEVELOPMENT PROGRAMME

FOOD AND AGRICULTURE ORGANIZATION
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South China Sea Fisheries Development and Coordinating Programme
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TUNA RESOURCES IN THE SOUTH CHINA SEA

by

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This study, prepared on behalf of the South China Sea Programme, was based on field visits in the region during May and June, 1973.

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

UNITED NATIONS DEVELOPMENT PROGRAMME

Rome, December 1973

THE SOUTH CHINA SEA FISHERIES
DEVELOPMENT AND COORDINATING PROGRAMME

The South China Sea Fisheries Development and Coordinating Programme (Phase I) was formally conceived by the Indo-Pacific Fisheries Council and its activities have been conducted in close collaboration with that body. The Programme is supported by the UNDP and is being carried out by the FAO Department of Fisheries. This paper, as well as others in a series referred to in SCS/DEV/73/1/Rome, forms the basis for the long-term Phase II programme outlined in that document. The Phase I programme was conducted as an identification project to reflect the wishes and needs of the participating countries for collaborative long-term comprehensive fisheries development.

A.G. Woodland
Programme Leader

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SUMMARY

1. The resources reviewed include the tunas, billfishes and tuna-like species in the South China Sea and adjacent waters.

2. An appraisal of these resources is made more difficult by the inadequacy of catch statistics, which are incomplete and do not report catches by species separately. Few effort data are available. The vernacular names given to various species differ from country to country, raising more difficulties with the statistical system. A set of suggested names is given, for possible uniform use.

3. The total catch of these fishes in the area is estimated at 80 000 metric tons. This is an underestimate. The catch of small-sized tunas is about 37 000 tons, of Spanish mackerels 34 000 tons and of larger species almost 10 000 tons. These totals do not include what may be a substantial catch from some segments of the Philippines fisheries.

4. In Thailand bonito and Spanish mackerel are the main species landed. Their landings combined were about 16 000 tons in 1971.

5. In Malaysia little tunas and Spanish mackerels are the principal species. In West Malaysia their combined catch in recent years has been about 11 000 tons, in Sarawak about 1 200 tons and in Sabah 4 300 tons.

6. In Singapore only skipjack and Spanish mackerel are reported, recently only a little over 100 tons a year.

7. Hong Kong has no tuna fishery, and only sporadic catches are made of the smaller species.

8. The Philippines ranks first in tuna production among the countries facing the South China Sea, but information about the fishery is very sparse and statistics are poor. Catches are reported as 13 000 tons for 1971. There is no doubt that this is a considerable underestimate. For example, the "municipal fisheries" (boats smaller than 3 gross tons) are reported to have caught an additional 10 000 tons of yellowfin tuna in 1972.

9. Production in the South China Sea of tunas by Japan was 3 300 tons in 1971, mostly yellowfins and bigeyes. Japanese pole-and-line boats have entered the northeastern part of the region in recent years; their production is not known.

10. Boats from China (Province of Taiwan) have fished in the area for many years, but their catch of tunas there is not known. Their vessels seem to concentrate on the billfishes, judging from the composition of the catch, which is different from that of Japanese vessels.

11. No data are available for tuna catches of Vietnam, Khmer or China (except the Province of Taiwan) although all are assumed to be fishing for tunas in the South China Sea.

12. Limited data from catch per unit of effort statistics of the Japanese fisheries suggest that the stocks of yellowfin and bigeye tunas have been stable in recent years. No opinions can be expressed about the status of the billfish resources, for lack of information. It appears that the populations of the small-sized species are capable of greater exploitation,

with skipjack the most promising. More production can also be expected from Thunnus tonggol and it may be possible to expand the catches of little tuna and frigate mackerel. Spanish mackerel may be fully exploited. All of these conclusions should be checked by cooperative investigations.

13. The following recommendations are made.

(a) Statistics of catch and effort should be expanded and improved as quickly as possible.

(b) Biological studies are required for all the species.

(c) Further stock assessment studies should be conducted; for the large-sized species this should include data from the longline fishery of China (Province of Taiwan).

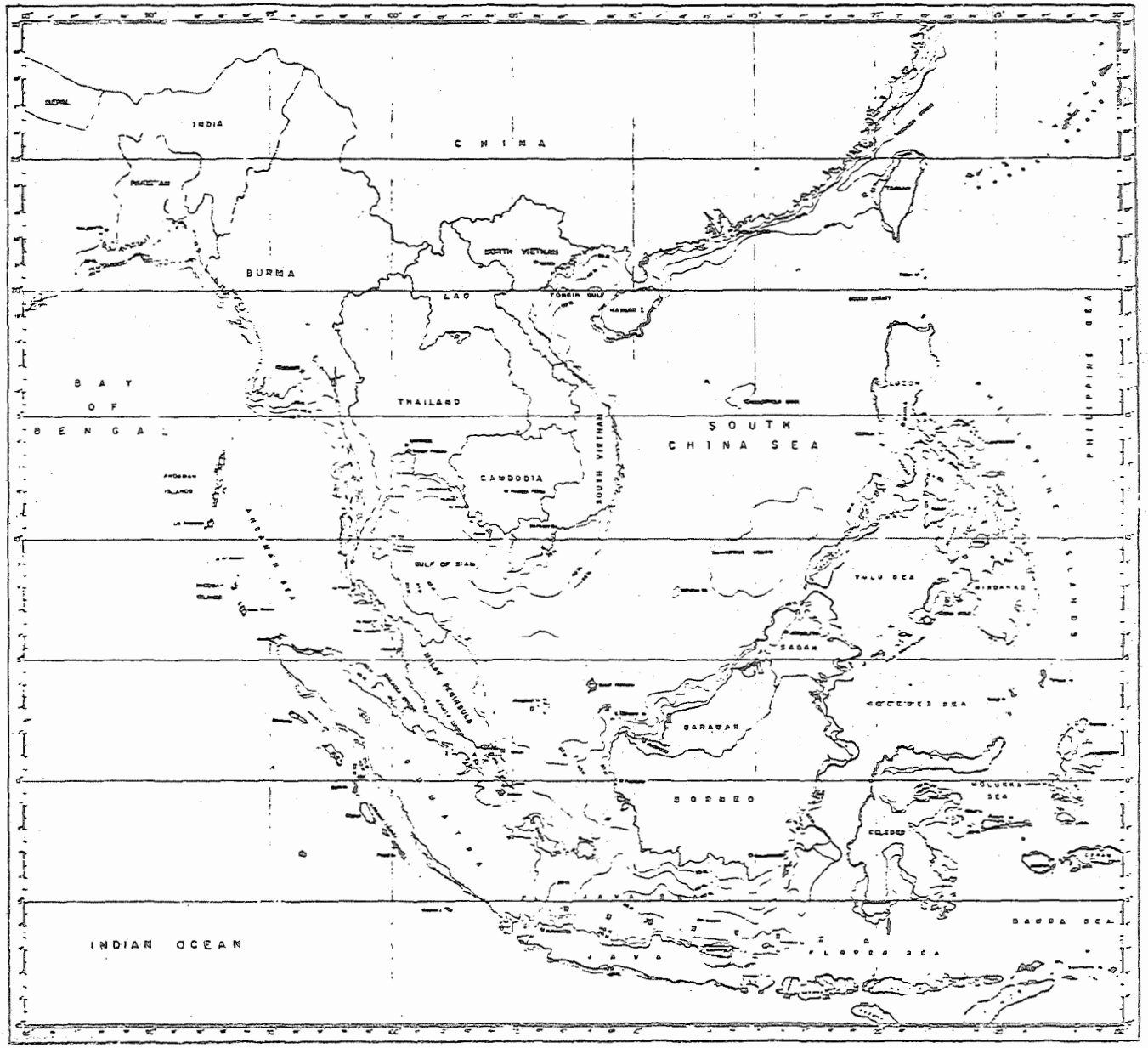
(d) The feasibility of expanding the skipjack fishery should be investigated, using several kinds of gear.

(e) Fishing for other small-sized tunas should be investigated, since these fisheries seem capable of expansion.

(f) Combined skipjack and pole-and-line fishing should be developed.

(g) Demand for tuna should be encouraged, for example by improvements in processing.

THE SOUTH CHINA SEA AND
ADJACENT WATERS



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1. INTRODUCTION

The objectives of this paper are (a) to extract and update the available information on the resources of tunas and tuna-like species, and on the status of related fisheries in the overall area of the South China Sea and adjacent waters covered by the South China Sea Fisheries Development and Coordinating Programme, and (b) to evaluate the above material and prepare a review on these resources and fisheries, indicating in particular any development potential and management requirements, taking into account other relevant international efforts on this subject.

The species concerned are tunas (Thunninae), billfishes (Istiophoridae and Xiphiidae), and tuna-like species (Scomberomorinae) in the South China Sea and adjacent waters.

Most of the information reported here has been obtained during a one-month field survey in the area, including attendance at the technical seminar on South China Sea fisheries resources organized by Southeast Asian Fisheries Development Centre (SEAFDEC), and at the Third Cooperative Study on Kuroshio Symposium, both of which were held at Bangkok in May 1973.

2. PROBLEMS WITH STATISTICAL DATA

Nomenclature

For stock assessment the basic data are the catch statistics by species. However, tuna catch statistics of the countries of the South China Sea region are not reported by species, except in a few cases; most of the catches are recorded for groups of similar species. A still more confusing problem is presented by the various scientific and vernacular names given the species in different parts of the region, which raise difficulties in statistical compilation.

The list in Table 1 is the author's suggestion of uniform names, to lessen the present complexity. The table is not intended to be used for taxonomic purposes. Further revisions of the list should be made, to assist in obtaining more accurate scientific information on these species and better landing statistics.

Some of the information in the text is from the statistical books of the countries included in the survey, and from papers by Jones and Silas (1962) and Herre and Umali (1948).

Catch and effort evaluation

The catch of tunas reported from most sources seems to be underestimated. For example, some of the catches of coastal species made by artisanal fisheries are consumed by local people and probably are not reported.

Another problem is the manner of compilation of the statistics, where catches of several species may be combined. In the Philippines, for example, catch statistics have been compiled under two categories, "commercial fishery" and "municipal fishery", the latter conducted by vessels smaller than three tons. The catch statistics of the municipal fishery are reported for all species combined; this catch is said to include substantial amounts of tunas.

Difficulty is also encountered in evaluating the effort expended in catching tuna. The main problems are (a) few effort data are reported, even the numbers of vessels, and (b) the tuna catch is mostly sporadic or is a by-product of other fisheries, with few specialized tuna fisheries.

Table 1

Proposed common names of tuna and tuna-like species in the South China Sea

Scientific name	English name	Japanese name	Common local name
Large-sized tuna species			
Thunnus thynnus	Bluefin tuna	Kuromaguro	
Thunnus alalunga	Albacore	Binnaga	Tambakol (P), Albakora (P) — Tulingan (P)
Thunnus obesus	Bigeye tuna	Mebachi	
Thunnus albacares	Yellowfin tuna	Kihada	Albakora (P) — Tulingan (P)
Small-sized tuna species			
Thunnus tonggol	Northern bluefin tuna	Koshinaga	Pla O (T), Ikan kayu (W.M.)
Euthynnus pelamis	Skipjack	Katsuo	Gulyasan (P)
Euthynnus affinis	Little tuna or long-tail tuna	Yaito	Pla O (T), Ikan kayu (W.M.), Aya/tongkol (W.M.), Tongkol (Sara.), Sakulan (Sabah) Katchorita (P), Tunungan (P)
Other tuna-like species			
Auxis spp.	Frigate mackerel	Soda-gatsuo	Pla O (T), Tunungan (P), Tongkol (Sara.)
Scomberomorus spp.	Spanish or king mackerel	Sawara	Pla In-See (T), Tangigi (P), Tenggiri (Sara., Sabah, W.M., Sing.)
Billfishes			
Istiophorus platypterus	Sailfish	Basho-kajiki	
Tetrapturus audax	Striped marlin	Ma-kajiki	
Makaira mazara	Blue marlin	Kuro-kajiki	
Makaira indica	Black marlin	Shiro-kajiki	
Xiphias gladius	Swordfish	Me-kajiki	

Notes: 1. "Bonito" is commonly used for tuna-like species, except the Spanish mackerel
2. T = Thailand, P = Philippines, W.M. = West Malaysia, Sara. = Sarawak, Sing. = Singapore

3. UTILIZATION

Total catch

Reflecting their distribution, tunas and tuna-like species in this region may be grouped into two major types, coastal and pelagic. The coastal resources are small-sized tunas and Spanish mackerels; they are caught in coastal areas of the South China Sea. The pelagic resources are large-sized tunas and billfishes; they are caught in the eastern half of the area, including the central deep waters of the South China Sea.

The estimated production is tabulated by countries in Table 2. The total amount of all species combined is about 80 000 tons. This amount is probably underestimated, as discussed above, particularly since it probably omits the catch by artisanal fisheries of the coastal species.

The catch of small-sized tuna species, mainly little tuna and frigate mackerel, amounted to more than 37 000 tons, caught by various fishing methods. Spanish mackerels, about 34 000 tons, were harvested by almost all nations. The main fishing gear for this coastal resource is a drift gillnet. The production of the pelagic resources totalled nearly 10 000 tons, mainly harvested by Japan, China (Province of Taiwan) and the Philippines. The main fishing method by Japan and Taiwan Province is the longline with which they catch deep-swimming tuna and billfish. It should be noted that substantial amounts of yellowfin tuna caught by hand-lining in the coastal waters of the southern Philippines are not included in Table 2.

Judging from the price of fish in the Southeast Asian countries, Spanish mackerels are highly esteemed in all areas. Other tunas and billfishes are less in demand. Yellowfin tuna and Thunnus tonggol are exported.

Table 2

Estimated catch of tuna and tuna-like fishes in the South China Sea area by countries, 1970 or 1971

Countries	Bigeye tuna	Yellow-fin tuna	Bill-fish	Skip-jack	Little tuna and frigate mackerel	Spanish mackerel	Main source of data
Hong Kong	-[a]	-	-	-	-	1 849	Fisheries Research Station, 1971
Japan	962	2 132	204	n.a.[b]	-	-	Annual Report, Tuna Longline, 1971
Philippines	-	3 775[c]	-	226	4 246	5 143	Fisheries Statistics, 1971
Sabah	-	-	-	-	2 600	1 700[d]	Annual Report, 1971
Sarawak	-	-	-	-	4 414	6 292	Annual Report, 1971
Singapore	-	-	-	-	-	73	Primary Production Department, 1971
China (Province of Taiwan)[e]	2 800		2 000	604	14 985	2 541	Fisheries Yearbook, 1970
Thailand	-	-	-	-	6 548[f]	9 201	Department of Fisheries, 1971
West Malaysia	-	-	-	-	4 295[f]	6 988	Annual Fisheries Statistics, 1971

a/ - = none or negligible
b/ n.a. = not available
c/ Substantial amounts of yellowfin tuna were reportedly caught by municipal fisheries conducted by fishing craft smaller than three tons; these are not included here.
d/ Other types of scombroids are included here.
e/ Tuna and billfish production was obtained by prorating proportions from older data, and other species production probably includes the catch from the coastal area of Taiwan Province.
f/ Thunnus tonggol production is included here.

Fishing activities by country

Thailand

Bonito and Spanish mackerel are the main species caught commercially. Catches of these species combined were 16 070 metric tons in 1971, about 1.9% of the total fish production. Catch statistics for these species are available only for 1971, as a result of a recent change in the statistical system.

Bonito These fish are much less in demand and lower in price than Spanish mackerel. At least three species are reported together, Thunnus tonggol, Euthynnus affinis and Auxis spp. All three were seen in the Bangkok fish market in May 1973. Locally they are called "Pla O". More than ten baskets of T. tonggol were unloaded at the market in that morning. This species is distributed on both coasts, and to the south.

Production of bonito in 1971 was 6 548 metric tons of which 5 090 metric tons (78%) were caught by Thai and Chinese purse seine fisheries. Fishing is done mostly at night. Catches were mostly in the Gulf of Thailand and on the west coast of the country. Best catches were made in the latter half of the year.

Spanish mackerel This fish is high priced and is one of the most important commercial species. Under this group three species are included, Scomberomorus commerson (the most abundant), S. guttatus and S. lineolatus (the least important) (Tongyai 1971). The production in 1971 was 9 201 metric tons. The historical total catch records are not available, but records of fish auctioned at the Bangkok fish market in recent years are 1 623 metric tons in 1970, 1 434 metric tons in 1971 and 1 696 metric tons in 1972. This suggests a stable catch. Examination of catch statistics in 1971 suggests that conditions are similar to those described by Tongyai in 1970. They indicate that 83.8% of the total catch was made by drift gillnets, and 11.4% by longlines and handlines. Monthly catches showed that better landings were made during the first half of the year.

Other species In the Bangkok fish market in May 1973, one medium-sized black marlin was seen. Sailfish and black marlin can reportedly be caught by the hanging longline in two localities, near Chang and Samui in the Pangan Islands. Exploratory tuna longline fishing by R/V Fisheries Research No. 2, Department of Fisheries, Thailand, was conducted in the area inside 6-16°N and 109-119°E, in April and May, 1968. Twenty-seven sets, in each of which 160 baskets were used, produced 4 711 kg (125 in number) of yellowfin tuna, with sporadic catches of bigeye tuna, albacore, blue marlin, black marlin and other miscellaneous fishes.

Malaysia

Because of differences in statistical units used in Malaysia, descriptions are given separately for West Malaysia, Sarawak and Sabah.

West Malaysia

Historical catch records for little tunas and Spanish mackerels are shown in Table 3. Since 1958 the catch of Spanish mackerel (Tenggiri) has been almost stable. That of the little tunas (Aya/tongkol) increased until 1967, when it levelled off. Recent catches of these species account for about 3.5% of the total marine production.

Little tunas (Aya/tongkol) At least three species are included in this category, Euthynnus affinis, Thunnus tonggol and Auxis spp. The production of Aya/tongkol in 1971 was 4 295 metric tons. The catch statistics by gear, area and month in 1970 indicate that (1) more than half of the catch are from lines and the rest from seine nets and drift gillnets, (2) Penang on the west coast and Trengganu on the east coast are the main landing ports, and (3) best catches are made in the later half of the year. Fishing by lines includes hand-lining, trolling and perhaps small-scale longlining. It is said that the main catching method on the east coast is trolling, whereas on the west coast trolling is much less productive.

Table 3

Catch of little tunas and Spanish mackerel in West Malaysia, 1958-1971 (in metric tons)

Year	Little tunas	Spanish mackerel
1958	1 147	7 042
1959	789	4 642
1960	1 712	4 890
1961	1 917	5 125
1962	2 246	6 308
1963	3 355	5 039
1964	2 633	5 425
1965	3 114	6 829
1966	4 455	7 634
1967	5 578	6 161
1968	4 465	6 860
1969	3 430	5 856
1970	4 703	6 982
1971	4 295	6 998

The main fishing ground for Thunnus tonggol is on the west coast between Kedah and Pangkor; the principal fishing method is purse seining at night. Ovaries of T. tonggol examined in a cannery at Penang were fully well developed in fish 50 cm long. T. tonggol has been sold to a cannery in Penang. The cannery also purchased some little tuna: about 800 metric tons in both 1971 and 1972. The smaller sized fish (less than 1 kg) are consumed by local people.

Spanish mackerel (Tenggiri) Two species, Scomberomorus commerson and S. guttatus are included. Production in 1971 was 6 998 metric tons. About 80% of the catch was from drift gillnets and others from lines. The main landing ports are scattered on both sides of the coast. The fishing methods are assumed to be the same as those of Thailand, described by Tongyai in 1970.

Other species The annual catch of swordfish is less than 10 tons. Auxis spp. are said to be less abundant on the west coast.

Sarawak

Tuna and Spanish mackerel are the two major components of the catch in this state. Combined catches were 1 077 metric tons in 1970 and 1 216 metric tons in 1971, about 10% of the total fish production.

Tuna The species included in this group are uncertain. Euthynnus spp., the name used in the statistics, may be the main component. The local name tongkol includes other small-sized coastal tuna species. Production was 483 metric tons in 1970 and 372 metric tons in 1971, and was made exclusively by gillnet fishing. Landings are highest on the southern coast of Sarawak. The size of the fish is said to be about 2 feet throughout the year.

Spanish mackerel (Tenggiri) Three species of Scomberomorus are grouped. Production was 736 metric tons in 1970 and 705 metric tons in 1971. Most of the catch has been made in southern Sarawak coastal waters, more than 90% by gillnetting. The drift gillnet is the principal gear, and others are encircling and bottom gillnets. Three hundred gillnet fishing craft, based at Kuching since 1965, have been operating; the boats are about 30-36 feet long, and have two men on board. There are in addition many smaller gillnetters. For the drift gillnet Spanish mackerel fishery, the peak fishing season is from May through September, although the boats operate throughout the year.

Other species Three Thunnus tonggol, about 50-60 cm in length, were seen in Kuching fish market in early June 1973.

Sabah

There are two categories in the statistics, "Tuna" and "Mackerels", and no further breakdown is available. These two groups of fish must include several species. The production for both groups combined was 4 300 tons in 1971, which accounted for about 15% of the total fish production.

Tuna (Tunas, bonito and skipjacks) The catch of this group has been as follows:

(In thousands of tons)

1968	1969	1970	1971
0.7	0.7	0.8	2.6

It is said that little tuna (Euthynnus affinis) is found on both east and west coasts of Sabah. Skipjack and yellowfin tuna were fished in the Celebes Sea off the south east coast of Sabah (Sabah, Annual Report, 1969). No information on the fishing method is available.

According to the Annual Report for 1969, the pre-war tuna fishing base on Pulau Si-Amil (east coast of Sabah) was revived by a Japanese fishing company. During the years 1960-1962 the landings of bonito or skipjack on the island were as follows:

1960	1961	1962	
1 700	2 075	1 733	(in tons).

From another source of information a more detailed account of activities was given:

(a) Fishing grounds were in the Celebes and Sulu Seas.

(b) Five pole-and-line boats were engaged in the fishery at its peak, with purse seine operation beginning in the first half of 1961.

(c) The catch was mainly of skipjack, with about 5-10% of yellowfin tuna.

(d) The size of skipjack was from 2 to 6 kg, averaging 3-4 kg.

(e) Bait fishes were mainly anchovies and sardines, caught by night-light fishing.

Mackerels (Mackerels, billfishes, etc.) Catches of this group were 1 700 tons in both 1970 and 1971. The catch consisted mainly of Spanish mackerel; about five species of Scomberomorus are included, probably being dominated by S. commerson and S. guttatus. Spanish mackerel are caught in all coastal areas by trolling, gillnetting and fish traps.

Other species In the Annual Report for 1970, tuna longline fishing trials in the Celebes Sea were reported, mainly for yellowfin tuna; they were discontinued because of the poor catch.

At Kota Kinabalu fish market in early June 1973 one specimem of sailfish was recognized.

Monthly catch and effort data of a commercial company stationed at Tawau catching skipjack by pole-and-line fishing, is tabulated for the years 1927 through 1930 in Table 4.

Table 4

Pre-war catches of the pole-and-line fishery based at Tawau, eastern coast of Sabah, by month, 1927-1930
(in metric tons)

Month	1927		1928		1929		1930	
	Skipjack	Yellowfin tuna	Skipjack	Yellowfin tuna	Skipjack	Yellowfin tuna	Skipjack	Yellowfin tuna
Jan	-	-	12.1	14.2	16.3	8.4	48.6	24.6
Feb	1.3	2.7	41.5	17.8	21.4	30.2	37.9	31.2
Mar	4.1	2.8	15.0	9.2	19.8	24.3	51.9	47.7
Apr	5.5	15.3	21.2	34.3	21.0	17.2	129.0	35.1
May	3.6	10.1	25.3	44.6	46.6	45.2	39.8	14.7
June	9.4	13.6	21.0	19.0	23.9	27.8	31.1	21.1
July	2.4	0.2	10.4	15.7	28.1	28.4	16.7	11.1
Aug	4.7	4.5	9.6	14.3	13.7	31.0	35.9	34.4
Sept	4.3	6.9	61.2	24.8	52.0	40.1	48.7	19.3
Oct	9.2	3.5	30.7	20.2	37.6	28.3	55.4	27.5
Nov	26.8	10.8	22.4	25.8	51.6	55.4	58.5	21.7
Dec	17.2	10.0	18.6	13.9	27.3	24.3	19.5	31.1
Total	88.5	80.4	285.3	253.8	359.4	360.6	573.1	314.8

Source: Japan 1933

Singapore

In Singapore, only skipjack and Spanish mackerel were indicated in the statistics, and recent landings in tons were as follows:

	1970	1971	1972
Spanish mackerel	243	73	87
Skipjack	816	28	35

Spanish mackerel may include at least two species of Scomberomorus. It is said to be caught mainly by drift gillnet. The skipjack recorded in the statistics was of fish transhipped.

Hong Kong

There is no tuna fishery in Hong Kong; and probably only sporadic catches of Euthynnus spp. and Auxis spp. are made.

Spanish mackerel Five species are included. Among them, Scomberomorus commerson and S. guttatus are the most important. Recent yearly catches of Spanish mackerel were obtained at the Fisheries Research Station, Aberdeen (in tons):

1968	1969	1970	1971	1972
1 505	1 500	1 712	1 849	1 954

Bigger catches are made during the winter months than other times of the year. Although there is no specific Spanish mackerel fishery, these fish are caught in inshore waters, mainly by gillnetters about 40 feet long. The smaller fish are caught by trawling.

Other species Fishing for tuna (Euthynnus affinis) was done by a kind of seining on an experimental basis during the summer months of 1967 and 1968 (Williamson 1970).

It is said that Thunnus tonggol appears near Hong Kong in summer.

Philippines

The catch statistics for the Philippines are shown in Table 5. The production in 1971 was a little over 13 000 tons, accounting for 3.5% of the total commercial fishery production. The main fishing gears are the bagnet, purse seine, and otter trawl; there is a tendency for the catches to be better in the first half of the year. However, the above statistics need further examination, especially to clarify catches by gears that are not possible to identify here.

Since the above statistics do not show the catch by species, or report any catches by fishing vessels smaller than 3 tons (the "municipal fishery") the actual amount caught by Philippine boats must be much more than indicated. For example, the yellowfin catch by the municipal fisheries is estimated to have been more than 10 000 tons in 1972. These fish were caught mostly by handlining, in small bancas operating near the coasts of the southern Philippines.

The Philippines ranks first in the tuna production among the countries facing the South China Sea. However, the following description of their fishery is very brief due to the inability to collect more information.

Tuna The "Tuna" reported consists mainly of yellowfin, probably with the sporadic inclusion of bigeye. Production was 3 775 metric tons in 1971. As mentioned the yellowfin tuna catch is becoming larger. Although the statistics indicate that the main gears for this group are the bagnet and purse seine, it is said that they are also taken by surface trolling, trap net and handlining; the last one of these has been used extensively in recent years. The handline fishing grounds are located in several regions, mainly in the southern Philippines facing the Sulu Sea.

Catch for 1939 on the pre-war pole-and-line skipjack fishery at Zamboanga is tabulated in Table 6. The fishing vessels used were two 40 tonners and two 22 tonners. The average size of skipjack and yellowfin tuna was almost the same, from 3 to 3.5 kg throughout the year.

In early June 1973 at the Navotas fish market, a yellowfin tuna, 45-100 cm in length was seen; it was said to have been caught by purse seine. A large skipjack, more than 50 cm in length, caught by night-time purse seining, was seen at the same time.

Experimental purse seining and pole-and-line fishings for tuna species have been conducted by the UNDP/FAO project.

A tuna longline experiment was done in 1957-1960, mainly in the Sulu Sea. Yellowfin dominated the catch, but no details are available (Yearbook of Philippine Fisheries, 1962).

Bonito This group must include Euthynnus affinis, Auxis spp. and perhaps other small-sized tunas. The catch, 4 246 metric tons in 1971, was made principally by bagnets and purse seines.

Some individuals of little tuna and frigate mackerel were seen at the Navotas fish market in June 1973.

Spanish mackerel It is not known how many species are included in this category. Production was 5 148 metric tons in 1971; the main gear was reported to be the otter trawl, but it is not easily understood how that could be so.

Spanish mackerel, similar to Scomberomorus commerson, were seen in the Navotas fish market during the visit in June 1973.

Table 5

Catches of tuna and tuna-like species in the Philippines

A. Catch by species, by gear and by month, 1971
(in metric tons)

	Albacore	Bonito	Spanish mackerel	Skipjack	Swordfish	Tuna
Gear						
Bagnet	4.4	1 460.0	40.6	1.3	-	1 212.4
Beach seine	-	187.4	-	-	-	214.9
Gillnet	-	172.0	0.8	-	-	135.9
Hook and line	12.7	55.0	124.2	-	27.1	61.1
Muro-Ami	-	-	-	-	-	285.9
Purse seine	20.0	2 305.9	338.1	219.8	-	1 664.6
Otter trawl	-	-	4 572.4	4.4	-	-
Round haul seine	-	65.5	66.4	-	-	-
Longline	-	-	-	-	-	200.0
Month						
January	-	123.0	131.5	-	-	301.7
February	20.8	496.4	1 376.1	-	-	897.4
March	-	734.5	1 603.7	-	8.1	106.0
April	12.7	754.7	28.3	204.3	4.6	238.7
May	3.6	42.3	1 579.8	4.8	-	1 176.2
June	-	919.7	103.8	-	-	115.9
July	-	156.7	15.2	-	1.6	110.4
August	-	168.9	-	-	-	144.8
September	-	112.2	21.6	4.4	-	493.7
October	-	168.8	34.0	-	-	87.0
November	-	210.5	117.2	4.0	-	94.0
December	-	358.0	131.2	8.0	12.8	9.0

B. Catch by species, 1967 to 1971
(in metric tons)

	Albacore	Bonito	Spanish mackerel	Skipjack	Swordfish	Tuna
1967	183.2	7 245.1	2 206.6	230.0	-	3 803.8
1968	696.2	13 281.9	5 046.6	1 041.1	134.4	6 019.7
1969	133.8	12 391.8	268.8	2 316.4	62.6	2 522.6
1970	206.8	7 247.0	3 596.8	122.4	5.0	1 685.2
1971	37.1	4 245.8	5 142.8	225.5	27.1	3 774.8

From Fisheries Statistics of the Philippines, 1971

Table 6

Pre-war catches of the pole-and-line fishery based at Zamboanga, Mindanao Island, by month, 1937 (in metric tons)

Month	Skipjack	Yellowfin tuna
January	160.5	12.0
February	160.5	10.7
March	132.1	16.7
April	235.1	29.8
May	224.5	30.1
June	131.8	22.9
July	69.8	19.5
August	23.9	22.5
September	42.7	39.4
October	26.5	14.9
November	33.0	39.3
December	16.1	6.8
Total	1 256.4	264.5

Source: Takehisa 1940

Japan

The tuna longline fishery has been harvesting deep-swimming tunas and billfishes in the South China Sea for many years. Pre-war activities were on a smaller scale than now. Production in 1971 was estimated to be about 3 300 metric tons, and was characterized by a preponderance of yellowfin and bigeye tunas in the catch. Catches of bluefin tuna and albacore are sporadic. Historical catch data prepared from the series "Annual report of effort and catch statistics by area on Japanese tuna longline fishery, 1963-1971", are shown by species in Table 7. The recent fishing grounds of this fishery are in the central portion of the South China Sea, as shown in Figure 1. The size of longlines operating in this region ranges from 40 to 100 tons.

It is reported that some of the Japanese pole-and-line fishing fleet have recently entered into the north-eastern part of this region. The fishing season is during the winter months. The catch is mainly skipjack, but the amount is not available.

China (Province of Taiwan)

The total production of the tuna and tuna-like species in the South China Sea was apparently more than 20 000 tons from all countries in 1970, if the catch from the coastal fisheries of China (Province of Taiwan) is included (Formosa 1970). It was, however, not possible to identify accurately the part of the Taiwanese catch from the South China Sea.

Tunas and billfishes The main fishing ground of small longliners based at the Province of Taiwan has been in the South China Sea and adjacent waters. This fishery has operated for many years, even from pre-war times. In 1940 longline vessels based at Kaohsiung numbered about 300, and they unloaded 12 700 tons of tunas and billfishes. The longline fishery was renewed soon after the war (Nakamura 1966).

Table 7

Catches and fishing effort of the Japanese longline fishery in the South China Sea, 1963-1971

Catch by species (in metric tons)[a/]

Year	Hooks (in '000)	Bigeye	Yellowfin	Swordfish	Striped marlin	Blue marlin	Black marlin	Sailfish
1963	2 543	361	1 541	63	29	59	48	1
1964	1 128	152	633	32	10	32	23	2
1965	2 771	476	1 873	55	18	95	57	6
1966	2 256	525	1 444	47	9	63	46	9
1967	7 545	1 747	4 821	146	56	237	105	20
1968	5 149	946	2 531	82	29	126	79	9
1969	6 016	1 395	3 186	99	26	87	81	8
1970	2 553	724	1 543	52	10	51	56	3
1971	3 596	963	2 132	53	17	65	63	4
Average weight of the fish (in kg)		39	34	47	48	101	78	26

[a/] Weight was estimated from the number of fish reported caught multiplied by the average weight by species, obtained from recent data.

The inshore tuna longline fishery fleet shows a rising catch (from "Chugoku Suisan" a monthly periodical):

(in '000 tons)

1964	1965	1966	1967	1968	1969	1970	1971	1972
15.9	16.3	19.0	19.5	24.5	25.9	27.6	29.8	32.1

The above catches include tunas, billfishes and sharks, and catches from outside the South China Sea.

The 1966 longline catch from the South China Sea in numbers was 47 000 tunas, 20 000 billfishes and 40 000 sharks. This species composition was remarkably different from that of the Japanese longline catch in the same area, in which tunas consisted of more than 90% of the total. Even within the tunas and billfishes the species composition is different: there was a preponderance of yellowfin among the tunas, and of black marlin, sailfish and swordfish among the billfishes in Taiwan Province longline catch. It is assumed that the Taiwan Province longline fishing operation stresses the capture of billfishes rather than tunas. In addition, the gear and fishing grounds (Figure 1) may be somewhat different from those of the Japanese longline fleet.

Bonito Under this group, frigate mackerel and little tuna are included. The area breakdown of catch is not possible. Total production in 1970 was about 15 500 metric tons. Frigate mackerel (778 tons in 1970) was caught by troll line, purse seines, gillnets and set nets. The species of the other "bonito" caught are not known. They were captured mainly by purse seines.

Skipjack The catch of the inshore fishery in 1970 was 604 tons, 227 tons of which was taken by pole-and-line fishing. It is not certain if the catch was only from the South China Sea.

Spanish mackerel The catch of the inshore fisheries in 1970 was 2 541 tons, which was made principally by gillnet.

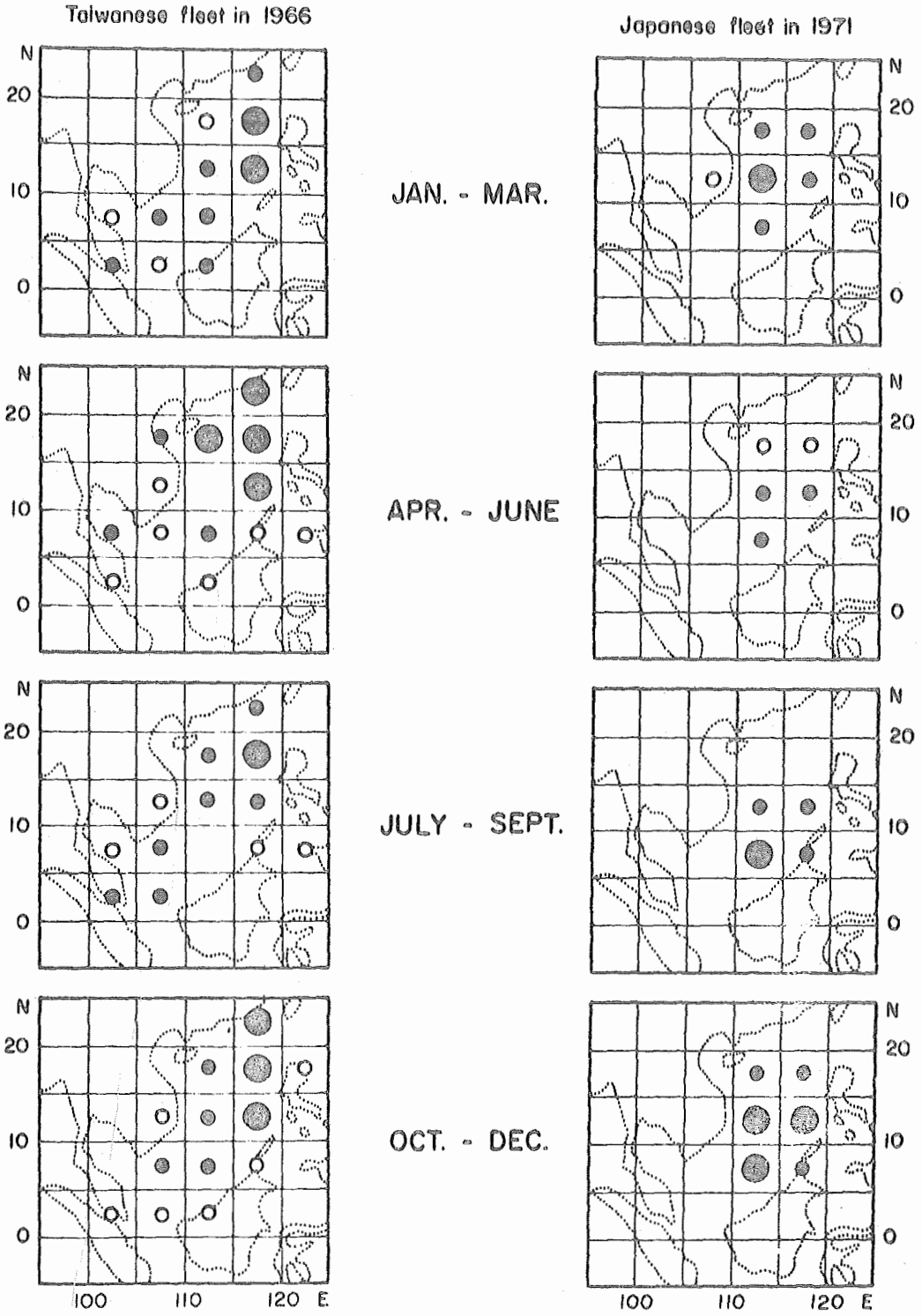

Fig. 1 China (Provinoe of Taiwan) and Japan tuna longline aotivities. The relative amount of effort is expressed by circles, the highest effort shown by large shaded circles, followed by smaller shaded circles and open circles.

Other countries

For Vietnam, Khmer and China (except for the Province of Taiwan), all of which face the South China Sea, no statistics for tuna catches were available. But it is assumed that they have been harvesting some quantities of coastal tunas and tuna-like species.

For Vietnam it is reported that small tunas are caught by gillnet from February through June. In a report by Schoettler in 1960 he showed a catch of Spanish mackerel and small tuna-like species by local fishermen.

4. STOCK ASSESSMENT

At the 15th Session of the Indo-Pacific Fisheries Council it was noted that in the IPFC area most of the stocks of the larger tunas are heavily exploited, but that there is considerable potential for expansion of the surface fisheries for the small tunas (IPFC 1972). This view also applies to the tuna and tuna-like resources in the South China Sea region.

Further attention should be given to stock assessment of the tuna resources in the South China Sea. But in addition to the lack of sufficient and accurate catch and effort statistics there is a shortage of fundamental information on the stock structure, the most important element. In this section an attempt is made to produce a very rough appraisal of the situation on the basis of the limited data available.

Large-sized tuna species

Yellowfin and bigeye tunas are caught in substantial quantities in the South China Sea. The main fishing gears are longlines for deep-swimming fish of both species and handlines for the coastal migrating yellowfin in the southern Philippine waters. The yellowfin stock in the region was suggested by Kikawa in 1973 to have a close relationship with that distributed to the east and south. On the other hand, referring to the frequent occurrence of larvae around the Philippines (Yabe et al. 1963) and the capture of young yellowfin of average weight 3-5 kg with skipjack in the pole-and-line fishery, it is surmized that the yellowfin stock in the South China Sea is independent to some extent. Further study on this is needed. For the bigeye tuna, little information on stock structure is available.

In Figure 2 are shown the annual changes of catch rates in catch per unit of effort for yellowfin and bigeye caught by Japanese longlines in the South China Sea, on a quarterly basis. For both species the catch per unit of effort (catch in number per 100 hooks) seems to have been stable since 1963. The relation of catch to effort of the Japanese longline data, Figure 3, does not indicate a substantial effect of fishing on the abundance, except for a small decline in catch per unit of effort for yellowfin tuna in 1968, which might be caused partly by the rapid increase in catch and effort in 1967. Without the data on catch and effort from the longline fishery of Taiwan Province it is difficult to pursue the analysis further.

The yellowfin catch of the Philippines has been increasing. Handline catches of yellowfin in the coastal area of the southern Philippines are not reported in national statistics, but they are said to be increasing rapidly. Attention should be paid to the relationship of the fishing effort by longlines for deep-swimming yellowfin and by coastal fisheries.

Billfishes

These resources have been taken exclusively by tuna longline fishery as a by-product, although the Taiwan Province fleet seems to catch billfishes by preference. It is not possible to make any further comment on these resources now.

Small-sized tuna species

Except for skipjack, these are coastal species. The shortage of pertinent data has restricted the analysis, but it appears that these resources have not been fully utilized.

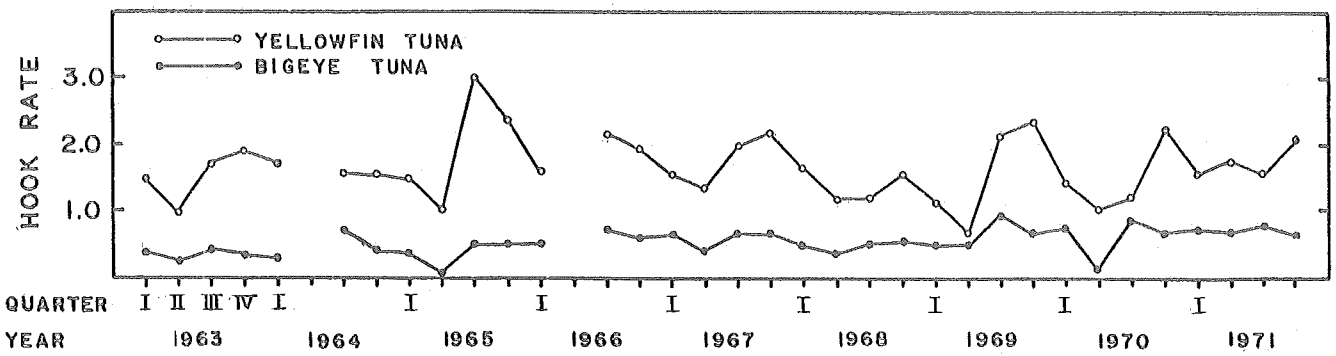

Fig.2 The quarterly and annual changes in hook rates of yellowfin and bigeye tunas caught by Japanese longline fishery in the South China Sea, 1963-1971.

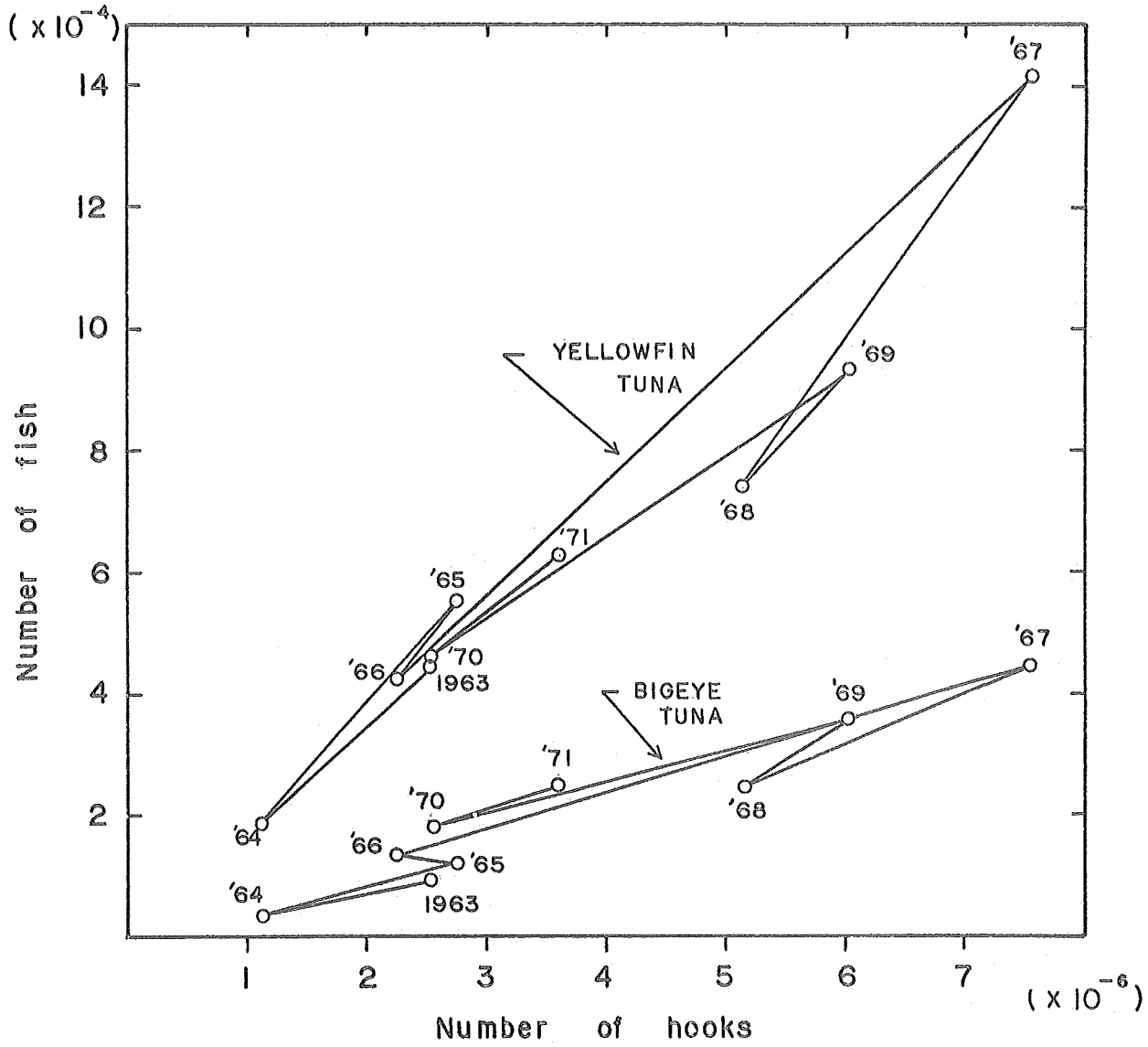

Fig. 3 The relationships between catch in number and effort in number of hooks of Japanese longline caught yellowfin and bigeye tunas in the South China Sea, 1963-1971.

Skipjack

This species is fundamentally oceanic and has been appraised as the most promising resource for future fishery development in the IPFC area. In the South China Sea there has been no substantial skipjack fishery. Only recently the Japanese pole-and-line fleet has initiated fishing in the northeastern part of the Sea. It is the author's opinion that oceanic area of the South China Sea will be productive for skipjack. An examination of activities of the pre-war skipjack fishing in the area, such as indicated in Tables 5 and 6, will give some idea of possible future exploitation.

Thunnus tonggol

In the present survey it appeared that the general area of catch of this species is in coastal areas of the western half of the South China Sea. Very rough estimate of the recent catch would be less than 5 000 tons. Production seems to be increasing and it is expected that it could be expanded still more.

Little tuna and frigate mackerel

These resources have been taken locally by various gears in almost every coastal area of the region. The combined catch of two species is believed to be 30 000 tons or less, and it may be possible to expand this catch.

Spanish mackerel

This species group is caught by coastal fisheries in the whole area, and is important for domestic consumption. The combined catch of several species is more than 30 000 tons. Production is thus fairly high, and there may not be much possibility for further exploitation. This resource should be studied much further on the species level, to discover if the stock is fully or over-utilized.

5. RECOMMENDATIONS

It is the author's opinion that future exploitation of tuna stocks in the South China Sea is highly feasible, except for the large-sized tuna species and Spanish mackerel. Cooperative work on exploratory fishing should be organized among the countries as well as by international bodies. After the expansion of the fishery, analytical study should be followed as soon as possible by management, in order not to deplete the stocks.

The following are specifically recommended:

(1) Statistics on catch and effort of the tuna fisheries should be organized and made accurate as soon as possible. It is necessary that landings should be recorded by species, and effort by gear. Although these are the minimum requirements and are essential for rational utilization and management of the stock, few data meet with these requirements in the region. The nomenclature of the species should be standardized, both vernacular and scientific names.

(2) For some species almost no information is available on the structure of the stock and only a little is known for others. Biological studies on the stocks are needed by the existing research bodies. As a minimum, information on size and maturity should be collected at the landing places.

(3) In the eastern half of the region large-sized tuna species have been caught in substantial numbers by deep tuna longlines. Further stock assessment should take into consideration data on the Taiwan Province longline fishery, and the interaction between deep and coastal longline fisheries.

(4) The feasibility of an expansion of the skipjack fishery is promising. Pole-and-line fishing may be one of the feasible fishing methods. A survey of available live bait species should be conducted. It may not be necessary that the boats in this fishery be large. The experience of pre-war pole-and-line fishing will be helpful for future planning.

(5) It appears that fishing for small-sized coastal tuna species could be expanded. It would be worthwhile to study these stocks further, and to conduct exploratory fishing to examine this possibility. If expansion proves to be justified conversion and improvement of the present boats could be considered.

(6) Seasonal changes in abundance of various stocks in certain areas are expected, so that boats should be capable of more than one kind of fishing. Such combinations as skipjack and pole-and-line fishing with coastal small-sized tuna fishing should be taken into consideration.

(7) Considering the low level of local consumption of tuna in the region, it may be necessary to encourage more demand, for example by improvements in processing.

* * *

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