COASTAL AND HIGH-SEAS PELAGIC FISHERY RESOURCES OF THE WESTERN PACIFIC OCEAN

by

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ABSTRACT

This brief review of the coastal and high-seas resources of pelagic fishes in the western Pacific is intended as background material in planning for a symposium to be held in 1972 during the 15th Session of the Indo-Pacific Fisheries Council, and was prepared at the request of the 13th IPFC Session. The area covered in this report includes Japan and Korea in the north and New Zealand, Australia, and the coastal waters of the Indonesian Archipelago in the south. The general features of the fisheries and the hydrography in the western Pacific are discussed. A more detailed review is made of the more important pelagic fishes which include the categories (1) jacks, mullets, etc., (2) herrings, sardines, anchovies, etc., (3) tunas, bonitos, and skipjacks, and (4) mackerels, billfishes, cutlassfishes, etc.

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INTRODUCTION

This brief review of the coastal and high-seas resources of pelagic fishes in the western Pacific was prepared in response to a request made at the 13th Session of the IPFC (Indo-Pacific Fisheries Council) held in Brisbane, Australia, on 14-25 October 1968. The document provides background information needed for the planning of a symposium scheduled to be held in 1972 during the 15th IPFC Session.

Although the IPFC area includes the Indian Ocean, we have focused our attention on the western Pacific and adjacent waters. The recently organized Indian Ocean Fisheries Commission is already undertaking a review of the Indian Ocean fishery resources. The area covered in this report (Fig. 1) includes the waters extending from the Asiatic coast eastward to 180°. For convenience, the northern boundary has been placed along lat. 45°N and includes the coastal waters of Japan and Korea. The southern boundary includes the waters surrounding New Zealand, Australia and the southern part of the Indonesian Archipelago.

In our discussions covering the important coastal and high-seas, pelagic fishery resources of the western Pacific, we have restricted our comments relating to the fisheries of Japan and Korea to those species whose areal distributions extend to southern waters or to fish that have related species in southern waters.

In the following sections we will review briefly the status of fisheries in the western Pacific and the hydrography of the area, and provide details of several of the more important commercial fish species. For the latter, we have followed the general classification outlined in the FAO Yearbook of Catch Statistics (see, for example, FAO, 1969). The pelagic fishes are discussed as follows (1) jacks, mullets, etc., (2) herrings, sardines, anchovies, etc., (3) tunas, bonitos, and skipjacks, and (4) mackerels, billfishes, cutlassfishes, etc. Except for providing figures on total landings, the category of sharks, rays, and chimaeras is not discussed.

SOME GENERAL ASPECTS OF FISHERIES IN THE WESTERN PACIFIC

On the basis of FAO catch statistics (FAO, 1969), the 1968 world catch of fish and other fishery products was 64.0 million metric tons. Table I provides a summary of the catch (based principally on 1968 statistics) for those countries located in the western Pacific. Although precise data are lacking for some of the countries, e.g., Indonesia and mainland China, the estimated total regional catch of 20,849.7 thousand metric tons represents about 33 percent of the total world catch. It should be noted that a substantial part of the catches reported for Japan, Korea and Taiwan come from waters outside of the IPFC area; e.g., approximately 15 percent of the total demersal catch made by Japan was taken in a distant-water trawl fishery.

The growth rates of the fisheries in some of the southeast Asian countries have shown sizeable increases in recent years. Table II which illustrates the growth of the fisheries for a few selected countries, shows increases ranging from 3.5 percent per annum for Japan to a high of 26.0 percent per annum for Thailand. Much of Thailand's growth is attributed to the rapid development of bottom fisheries (Isarankura and Kühlmorgen-Hille, 1967). Even while further expansion of the bottom trawl fishery can be expected, especially in parts of the South China Sea (Menasveta, 1970), the pelagic resources of the coastal and high-seas waters show promise of substantially greater increase in landings, e.g., the present catch from Indonesian waters is estimated to be only 15 percent of the total potential yield (Comitini, 1970). Except for the tunas taken in the high seas by Japan, Korea and Taiwan, much of the pelagic fishes taken in southeast Asian waters come from coastal areas, mainly within 15 miles of land (Comitini, 1970). Shomura and Gulland (in press) in a recent review of the fishery resources of the western central Pacific Ocean estimated the potential yield of pelagic fishes as ranging from 1 to 5 million tons in waters less than 50 m and at 1 million ton in waters from 50 to 200 m.

Within the coastal area itself, there is wide diversity in the degree of fishing intensity and in the fishing gear and techniques used. In some areas, such as off Thailand (Isarankura and Kühlmorgen-Hille, 1967) fishing is intensive, but in other areas such as off New Zealand, Australia and Indonesia, fishing intensity is relatively light. Furthermore, fishing is generally confined to waters within visual distance of shore. While a number of factors contribute to this lack of an expansion offshore, the lack of suitable fishing crafts and the inability of many fishermen to navigate are two of the more important.

Of interest is the fact that a predominant part of the pelagic fish catch is consumed fresh, dried, or processed into various fish pastes. This is even true of the clupeoids, which in other parts of the world are either canned or reduced to fish meal.

HYDROGRAPHY

In the western North Pacific, the dominant feature in the current system is the Kuroshio. Upstream of the Kuroshio, the North Equatorial Current moves westerly north of about lat. 5°N. To the east of the Philippines, the North Equatorial Current separates into two branches. The northern branch moves northward along the Philippine Islands and Taiwan, where it becomes the Kuroshio. The southern branch forms the eastward flowing Equatorial Countercurrent. After passing Taiwan, the Kuroshio flows in a northeasterly direction through the Ryukyu Islands. At the northern sector of the Ryukyu chain, the Kuroshio sends off a branch northward as the Tsushima Current, which provides warm equatorial waters to the Sea of Japan and to parts of the East China Sea and the Yellow Sea. The main core of the Kuroshio flows along the east coast of Japan, and under average conditions, turns eastward at about lat. 35°N and becomes known as the Kuroshio Extension Current.

For much of the tropical and southwestern Pacific areas, the current pattern is dominated by the monsoons. Wyrtki (1961) provides an excellent review of the general circulatory pattern prevailing in the southwest Pacific. At the height of the northern monsoon in February the high pressure system is fully developed over the Asiatic Continent. The prevailing winds are northeasterly north of the Equator and northerly at the Equator. In the southern latitudes, between the Equator and lat. 10°S, the winds are northwesterly, but south of lat. 19°S they are southeasterly. The flow of the surface ocean currents shows a similar pattern to the winds. Figure 2 shows the general flow of the surface currents in February.

At the height of the southern monsoon in August, the South Equatorial Current is fully developed. Pacific water moves into southeast Asia south of Mindanao and south of Halmahera Island (Fig. 3). The current flow is northwesterly along the northern coast of New Guinea and forms the principal source for the Equatorial Countercurrent.

JACKS, MULLETS, ETC.

This group includes a wide variety of species ranging from estuarine species such as the mullets (family Mugillidae) to the truly pelagic species such as the dolphin (family Coryphaenidae) and the saury (*Cololabis saira*).

The regional catch of fish in this category in 1963 was estimated at 1,003.7 thousand metric tons (Table III), which represents about 51 percent of the total world catch of 1,960.0 thousand metric tons. The actual landings of this group would be significantly larger than listed, since statistics are not available from a number of the major countries which undoubtedly utilize fish in this group, e.g., mainland China, Indonesia. Furthermore, since species such as scads and mullets can be taken by simple fishing gear, the amount caught and not reported by the many subsistence fisheries located throughout the area could be substantial.

Principal Species

Jack Mackerel

Trachurus japonicus (Japan, Korea)
Trachurus declivis (Australia)

Round Scad

Decapterus macrosoma (Philippines)
Decapterus russelli (Philippines)

Saury

Cololabis saira (Japan, Korea)

Landings by Country

Table IV shows the 1968 landings of the principal species listed above. The jack mackerel (*T. japonicus*) landings in Japan reached a post World War II peak of 595.7 thousand metric tons in 1960 (Japan, Ministry of Agriculture and Forestry, 1963). The most dramatic increase occurred in 1952 when the total landings increased from 92.6 thousand metric tons in 1951 to 206.3 thousand metric tons. Other species of jack mackerel are caught also throughout the area but the catches are not large.

The fishery for round scads (*D. macrosoma* and *D. russelli*) has developed into the most important fishery in the Philippines where the bulk of the western Pacific catches are landed. In 1956 the total catch was estimated to be 19.0 thousand metric tons; there has been a rapid increase in landings since 1965 and in recent years the annual catch has exceeded 150.0 thousand metric tons. The maximum catch to date was the 206.8 thousand metric tons landed in 1967.

The landings of saury (*C. saira*) have undergone considerable fluctuations. Japan, the leading producer of saury, increased its catches in the 1950's and recorded a high of 575.1 thousand metric tons in 1958 (Japan, Ministry of Agriculture and Forestry, 1963). Since then there has been a general decline in catches, and in 1969 Japan's total saury catch was about 51.0 thousand metric tons (Japan, Ministry of Agriculture and Forestry, 1970).

Method of Fishing

The principal gear used to catch jack mackerel is the purse seine; however, hand lines are also used throughout the area. In the round scad fishery in the Philippines a specialized bag net method of fishing, developed in the post World War II years, is used (Tiews, Ronquillo and Caces-Borja, 1970). In recent years purse seining also become more popular. The purse seine nets used are 250-270 fathoms long, 45 fathoms deep, and are hauled in by power blocks. The development of this gear was chiefly responsible for the dramatic increase in landings of this species. Fishing is done at night with the aid of lights to attract the fish.

The saury fishery also utilizes a net and light system as the principal method of capture. This method, called the "stick-held dip net", depends on the strong phototaxic response of saury. Drift nets are used also to catch saury in commercial quantities.

Biology and Stock Assessment

Jack mackerel are found throughout the IPFC and quite a bit of the life history of this species is known. On the Pacific side *T. japonicus* is known to move northward from the southern waters to the north end of Honshu Island. These fish remain in the Honshu area until November when they begin the return movement to the south. In the Sea of Japan this species is known to move from south of Kyushu Island to near the northern end of Honshu Island. Spawning occurs from March to July (Fukataki, 1960).

Unlike the stocks of jack mackerel in northern waters, which are fished commercially, the stocks of jack mackerel in the Southern Hemisphere are virtually untouched. The southern species, *T. declivis*, occur on the Continental Shelf of Southern Australia, from Shark Bay, Western Australia to Newcastle, New South Wales, and around the coastal waters of Tasmania and New Zealand (Fraser and Hynd, 1967). The potential yield of this species has been estimated by CSIRO to be of the order of 100.0 thousand metric tons (Gulland, in press). Information of the life history and biology of *T. declivis* is fragmentary.

The distribution of round scad (*Decepterus spp.*) is probably similar to that of the jack mackerel. In the Philippines the round scad fishery depends upon two species, *D. macrosoma* and *D. russelli.*

Although studies of the round scad in Philippine waters have been made recently (Tiews, Ronquillo and Caces-Borja, 1970; Ronquillo, 1970), much of the biology and population dynamics of the two principal species are still unknown. The fishery is centered in the Sulu Sea area and is based mainly on

2-year-old fish (Ronquillo, 1970). While estimates of the size of the resource are not available, an expansion of this fishery in the Philippines is believed possible (Tiews, Ronquillo and Caces-Borja, 1970).

A considerable amount of information is available on the biology of the saury in the North Pacific. The appearance of saury in abundance off Japan varies with locality; off Hokkaido from August-October and off Honshu from September-December. The saury moves shoreward and southward with the onset of winter.

Presently a fishery does not exist for saury in the Southern Hemisphere; but information being accumulated indicate that a sizable resource may exist in the South Pacific (information provided by A. Suda).

HERRINGS, SARDINES, ANCHOVIES, ETC.

The clupeoids and related species form the most important (by weight) group of fishes taken commercially in the world. In 1968 the world catch of clupeoids was 20,460.0 thousand metric tons, constituting about 32 percent of the world's total fish catch.

Principal Species

Sardines

Sardinops melanosticta (Japan, Korea)
Sardinops neopilchardus (Australia)
Sardinella perforata (Philippines)
Sardinella fimbriata (Philippines)
Sardinella sirm (Philippines)
Sardinella longiceps (Philippines)
Clupea (Harengula) longiceps (Indonesia)
Other species and genera elsewhere

Anchovies

Engraulis japonicus (Japan)
Other species and genera elsewhere

Landings by Country

Table III provides estimates of the marine clupeoid landed in 1968 by countries in the western Pacific area. The total catch of 767.5 thousand metric tons represents about 4 percent of the world's total catch of this group. Only a small fraction of the catch was made in southern waters; Japan was the largest producer with 527.0 thousand metric tons. In the Philippines the sardines and the anchovies are the second and third most important fishes taken commercially.

Method of Fishing

The fishing gear used for catching marine clupeoids varies from the simple dip net to sophisticated purse seines fished from powered vessels (Li, 1960; von Brandt, 1960). In Japan the enveloping nets account for about 58 percent of the total sardine catch, whereas the gill nets take an additional 29 percent (von Brandt, 1960). In the Philippines approximately 90 percent of the total marine clupeiod catch is made with bag nets.

Biology and Stock Assessment

The distribution of the various species of marine clupeoids follows the pattern of other organisms; the number of species increases from the higher to lower latitudes (Longhurst, MS*). Published records show the diversity of species within this group. Thirty-three species of clupeoids have been reported from Taiwan waters, (Yuan, 1970) whereas Ronquillo (1960) reported nine species of *Sardinella* in Philippine waters.

One of the most important aspects of marine clupeoids is the tremendous fluctuations in landings that a number of species has undergone in different parts of the world (e.g., California and Japan, Longhurst MS*). The landings of sardines, principally *S. melanosticta,* has declined dramatically in Japan. From 1925 to 1938 the average annual landing of sardines in Japan was 1,550.0 thousand metric tons (Tokai Regional Fisheries Research Laboratory, 1960); since 1945 the total annual landings have been at very

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* Longhurst, A. (MS). The clupeoid resources of the tropical seas. National Marine Fisheries Service, Fishery-Oceanography Center, La Jolla, California.

low levels, varying from 200.0 to 500.0 thousand metric tons. The decline has been attributed not to over-fishing, but to environmental changes that had led to reduced recruitment (Nakai, 1960). Interestingly, during the period of abundance the major proportion of the catch came from the Pacific east of Japan. In the period of low catches the major center of abundance was in the Sea of Japan.

The virtual collapse of the sardine fishery in Japan stimulated considerable research in this species. Consequently, of the commercially important fish species taken in Japan the biology of the sardine is probably the best known and documented.

S. melanosticta is reported to move northward in the spring from south of Kyushu Island and southward in autumn along both coasts of Japan and also off Korea. The fishing season varies with locality; off southern Kyushu Island the season extends from December to March while off central Honshu the season is from March to early June. Spawning occurs in the Sea of Japan and extends from January to May.

The biology of the anchovy (*E. japonicus*) found off Japan is better known than the other species of anchovies found elsewhere in the western Pacific. *E. japonicus* occurs in Japanese coastal waters all year round. Spawning is reported to take place at the edge of the Continental Shelf. Lim and Lee (1970) reported that 96 percent of all fish eggs and 77 percent of all fish larvae taken in plankton net tows in Korean waters were of *E. Japonicus*. South of Japan anchovy species of the genus *Stolephorus* appears to be the most important (Tiews, Ronquillo and Santos, 1970).

Since marine clupeoids occupy the lower end of the food web, their occurrence in large numbers is related to areas of upwelling, e.g., the tremendous anchovy resource in waters off Peru is associated with intense upwelling there. Because the waters in the northern sector have been intensively surveyed, it is unlikely that new resources of marine clupeoids will be uncovered there. The same cannot be said about the southern sectors because the areas of upwelling have not been adequately surveyed with respect to both the intensity and extent of upwelling and the presence of clupeoids. Areas deserving attention include the Banda Sea (Wyrtki, 1961), the coasts of Indonesia, Sarawak, and Makassar (Shomura and Gulland, in press) where some upwelling occurs.

The potential yield of marine clupeoids along the coast of Australia has been estimated to exceed 100.0 thousand metric tons Gulland (in press). Blackburn (1960) reported aerial sightings of 10,000 schools of *S. neopilchardus* in 1 day off the south coast of western Australia. Considering that the Australian catch of clupeoids in 1968 was 0.8 thousand metric ton, the resource can certainly be judged as underutilized.

TUNAS, BONITOS AND SKIPJACKS

Among the pelagic fishes the tunas represent the most difficult group in terms of pinpointing location of capture. The fisheries for tunas are truly distant-water fisheries and many nations fish great distances from their home ports for the various species of tuna.

Principal Species

Thunnus alalunga (albacore, widespread distribution)
Thunnus albacares (yellowfish tuna, widespread distribution)
Thunnus maccoyii (southern bluefin tuna, Australia and New Zealand)
Thunnus obesus (bigeye tuna, widespread distribution)
Thunnus thynnus (bluefin tuna, Japan, Korea, Taiwan)
Katsuwonus pelamis (skipjack tuna, widespread distribution)

Landings by Country

Table III lists the 1968 catch of tunas, bonitos, and skipjacks for the countries located in the western Pacific. Since the tuna fisheries of Japan, Korea and Taiwan range throughout the world's oceans, an estimate has been made of the total catch from the area south of lat. 30°N (Table V).

Method of Fishing

The method of fishing for tunas varies with the locality and the species sought. In northern latitudes the albacore and skipjack tuna are taken primarily by the pole-and-line technique using live bait (Van Campen, 1960; Isa, 1970). Albacore are taken also on longline gear. Bluefin tuna in northern waters are taken on longline gear and in set nets in Japanese coastal waters. In tropical waters the longline is the principal gear used to catch yellowfin tuna and bigeye tuna. Other gear such as trolling and hand line are used for catching tunas in the subsistence fisheries throughout the area.

The pole-and-line method using live bait is presently the principal method of fishing for skipjack tuna in the western Pacific; however, Japan and the United States are testing the feasibility of using purse seine to catch skipjack tuna in commercial quantities (Miller, 1970).

In the higher latitudes of the Southern Hemisphere, especially around New Zealand and Australia, the longline gear is used to take southern bluefin tuna. Attempts to catch this species there in commercial quantities with the pole-and-line technique were unsuccessful (Hynd and Vaux, 1963).

Biology and Stock Assessment

A wealth of information on the biology of various species of tunas of the western Pacific is available in the literature (see for example, papers presented at the FAO World Tuna Conference (Rosa, 1963-64) and the State of Hawaii Governor's Conference (Manar, 1966). Perhaps the most important areas which need further attention are stock identification and stock assessment. Regarding stock identification, tagging experiments have demonstrated the transpacific movements of bluefin tuna and albacore (Clemens and Flittner, 1969, Clemens, 1961, Otsu, 1960; Otsu and Uchida, 1963) and the movement of skipjack tuna in Trust Territory waters (Otsu, 1970), but more intensive work is needed, especially in waters within the East Indies Archipelago.

Regarding stock assessment studies, Rothschild and Uchida (1968) indicated that an increase in effort of the longline fishery for albacore, yellowfin tuna, and bigeye tuna would not result in any substantial increase in catch. Precise estimates of the potential increase in the yield of skipjack tuna are not available; however, some evidence suggests that the increase in the central Pacific may be substantial (Rothschild, 1966; Silliman, 1966). For the western Pacific, Gulland (in press) estimated the potential yield of skipjack tuna to be in the order of 250.0 thousand metric tons.

There has been considerable concern in recent years regarding the stock size of the southern bluefin tuna in waters around Australia and New Zealand. The longline fishing vessels of Japan, which landed from 10 to 20 tons of southern bluefin tuna per day 7 or 8 years ago are presently averaging less than 1 ton per day (Suisan Keisai Shinbun, 1970).

MACKERELS, BILLFISHES, CUTLASSFISHES, ETC.

Among the several groups of species listed in this general category, the mackerels, principally species of the genera *Scomber*, *Rastrelliger* and *Scomberomorus* are the most important in terms of landings and value. Table III provides a summary of the total catch of this group by country for 1968.

Principal Species

Scomber japonicus (Japan, Korea, Taiwan)
Scomber tapeinocephalus (Japan, Korea, Taiwan)
Rastrelliger neglectus (widespread throughout southeast Asia)
Rastrelliger kanagurta (widespread through southeast Asia

Landings by Country

Table VI lists by country the 1968 catch of the various species of mackerel. Of the two species of *Scomber* (*S. japonicus* and *S. tapeinocephalus*) present in northern latitudes, *S. japonicus* is by far the predominant species in the commercial catch of Japan and *S. tapeinocephalus* in the catch of Taiwan (Yuan, 1970). Pathansali (1967) reported that up to 50 percent of the catch listed as *Rastrelliger* in Malaysia may be that of a *Scomber* species. An unidentified species of *Scomber* also is reported to be present in commercial catches in the Philippines.

The major fisheries for *Rastrelliger* in the western Pacific are in Thailand and Malaysia.

Method of Fishing

The purse seine is the principal commercial gear for catching *Scomber* and *Rastrelliger*. Other commonly used gear include hand line, gill net, lift net with light seine, beach seine, and fish corral (Yuan, 1970).

Biology and Stock Assessment

Although some problems in systematics still remain, e.g., *Scomber* vs. *Pneumatophorus* as the generic term and identification problems in Malaysia (Pathansali, 1967), a considerable amount of information is available on the biology of this group, especially for those species occurring off Japan and Korea. Tagging studies in the Sea of Japan show a northward migration of *S. japonicus* in summer and a southward movement in late fall (Machinaka, 1960). With regard to the population structure Kawasaki (1969) suggests that there are three populations of *S. japonicus* in the seas around Japan.

The fishery for mackerel (*Scomber spp.*) in Japan has shown a phenomenal growth in recent years. From an average annual landing of 242.9 thousand metric tons for the period 1951-55 (Japan, Ministry of Agriculture and Forestry, 1963), the catch has increased to 1,015.0 thousand metric tons in 1968. This marked increase in landings by the Japanease fishery has been attributed to an increase in abundance, rather than being entirely due to expansion of fishing area and increase in fishing effort. Scientists believe that there has been a shift in the spawning grounds of the mackerel, as a result of major changes in environmental conditions. It is believed that changes in the environment have led to better survival of the young, thus resulting in an increase in population.

Thailand has carried out over the past several years a concerned study of the *Rastrelliger* group. A recent study of the catch and effort data obtained from the commercial fishery in Thailand has led to a preliminary assessment of the stock size (Kurogane et al MS*). On the basis of this study, it is believed that the Thailand fishery for *Rastrelliger* is presently operating at an optimal level. It was estimated that a two fold increase in fishing intensity now would result in an increase in yield of only 20 percent accompanied by a decrease in catch per unit of effort of 40 percent.

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TABLE I

Annual fish landings by western Pacific countries

Country	Year	Fresh water and diadromous fishes	Marine		Unsorted and unidentified	Others	Total
			Demersal[1]	Pelagic[2]			
				Thousand metric tons			
Australia	1968	0.7	18.6	26.8	1.6	55.0	102.7
China (mainland)	1960[3]	4,000.0			(1,800.0)		5,800.0
China (Taiwan)	1968	37.6	92.5	255.1	81.2	60.9	527.3
Hong Kong	1968	30.1	30.3	19.6	17.7	3.4	101.1
Indonesia	1969[4]	447.0			(762.4)		1,209.4
Japan	1968	230.4	2,540.0	2,897.8	776.4	2,225.2	8,669.8
Korea (North)	1957[3]						291.0
Korea (Republic)	1968	6.2	155.1	208.1	141.7	330.0	841.1
Malaysia (excludes Sarawak)	1968	29.2	42.2	190.6	73.2	71.3	406.5
New Zealand	1967	0.2	29.0	6.7	0.3	23.4	59.6
Philippines	1968	153.3	238.7	493.6	5.3	53.7	944.6
Singapore							20.0
Ryukyu Islands	1968[5]	-	1.7	22.8	8.9	1.5	34.9
Thailand	1968	81.1		160.4	602.3	245.0	1,088.8
Vietnam (North)	1962[3]						289.0
Vietnam (Republic)	1969[7]	63.7			(355.5)	44.7	463.9
Total							20,849.7

1 Includes landings of fishes listed in the Yearbook of Fishery Statistics (FAO, 1969) as (1) flounders, halibuts, soles, etc. and (2) redfishes, basses, congers, etc.

2 Includes landings of fishes listed in the Yearbook of Fishery Statistics (FAO, 1969) as (1) jacks, mullets, etc., (2) herrings, sardines, anchovies, etc., (3) tunas, bonitos, skipjack, (4) mackerels, billfishes, cutlassfishes, etc., and (5) sharks, rays, chimaeras.

3 Shomura and Gulland (in press).

4 U.S. Bureau of Commercial Fisheries, 1970.

5 Estimate provided by Dr. Tham Ah Kow, University of Singapore, Singapore.

6 Demersal catch probably listed in "unsorted and unidentified" category.

7 Brouillard, 1970.

TABLE II

Average annual rates of growth of fisheries production 1960-67 (from Comitini, 1970 : Table 2)

Country	Growth rates
Thailand	26.0[1]
West Malaysia	11.6[1]
Indonesia	8.3[1]
Philippines	7.7
Taiwan	8.5
Japan	3.5[2]
Korea	11.8

[1] Marine production only.

[2] Excludes whaling.

Sources : Thailand, Statistical Section, Department of Fisheries, Bangkok.

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TABLE III

Landings of coastal and offshore pelagic fishes, 1968
(data from FAO, 1969)

Country	Jacks, mullets, etc.	Herrings, sardines, anchovies, etc.	Tunas, bonitos, skipjacks	Mackerels, billfishes, cutlassfishes, etc.	Sharks, rays, chimaeras	Total: Coastal and pelagic fishes
		Thousand metric tons				
Australia	7.7	0.8	6.8	5.4	6.1	26.8
China (mainland			(No data)			
China (Taiwan)	34.0	30.0	101.8	56.2	33.1	255.1
Hong Kong	10.6	3.8	-	3.0	2.2	19.6
Indonesia			(No data)			
Japan	607.8	527.0	545.0	1,165.0	53.0	2,897.8
Korea (North)			(No data)			
Korea (Republic)	44.3	68.0	43.6	34.2	18.0	208.1
Malaysia (excludes Sarawak)	35.2	38.8	5.2	104.9	6.5	190.6
New Zealand[1]	4.5	-	-	0.2	2.0	6.7
Philippines	258.9	99.1	44.5	90.0	1.1	493.6
Singapore			(No data)			
Ryukyu Islands	0.7	-	19.1	2.0	1.0	22.8
Thailand	-	-	-	148.1	12.3	160.4
Vietnam (North)			(No data)			
Vietnam (Republic)			(No data)			
Total	1,003.7	767.5	766.0	1,609.0	135.3	4,281.5

[1] Landings for 1967.

TABLE IV

Landings of the principal species in the "jacks, mullets, etc." category, 1968 (data from FAO, 1969)

Country	Horse mackerel, jack mackerel, scad	Saury
	Catch in thousand metric tons	
Japan	358.0	140.0
Philippines	160.6	
China (Taiwan)	16.7	
Malaysia (West Malaysia)	6.9	
Hong Kong	5.1	
Korea (Republic)	2.5	29.9
Ryukyu Islands	0.3	

TABLE V

Average landings of tunas and related species, 1965-67 (data provided by A. Suda)

Country	Catch
	Thousand metric tons
Japan	182.0
Korea (Republic)[1]	7.5
Ryukyu Islands	6.6
Taiwan[1]	15.9
Malaysia	5.0
Philippines	27.0
Australia	7.0
New Hebrides	3.4

[1] Fifty percent of the catch of each country from the Pacific and Indian Oceans is allocated to the IPFC areas.

TABLE VI

Landings of mackerel, 1968

Country	Mackerels (*Scomber* spp., *Pneumatophorus* spp.)	Indian mackerel (*Rastrelliger* spp.)	Spanish mackerel, seer-fishes (*Scomberomorus* spp., *Cybium* spp.)
Australia	-	-	1.0
China (mainland)		(No data)	
China (Taiwan)	19.0	-	4.1
Hong Kong	1.5	-	-
Indonesia		(No data)	
Japan	1,015.0	-	20.0
Korea (North)		(No data)	
Korea (Republic)	10.5	-	5.1
Malaysia (excludes Sarawak)	-	95.6	6.9
New Zealand	-	-	-
Philippines	-	49.9	9.8
Singapore		(No data)	
Ryukyu Islands	-	-	-
Thailand	-	148.1	-
Vietnam (North)		(No data)	
Vietnam (Republic)		(No data)	

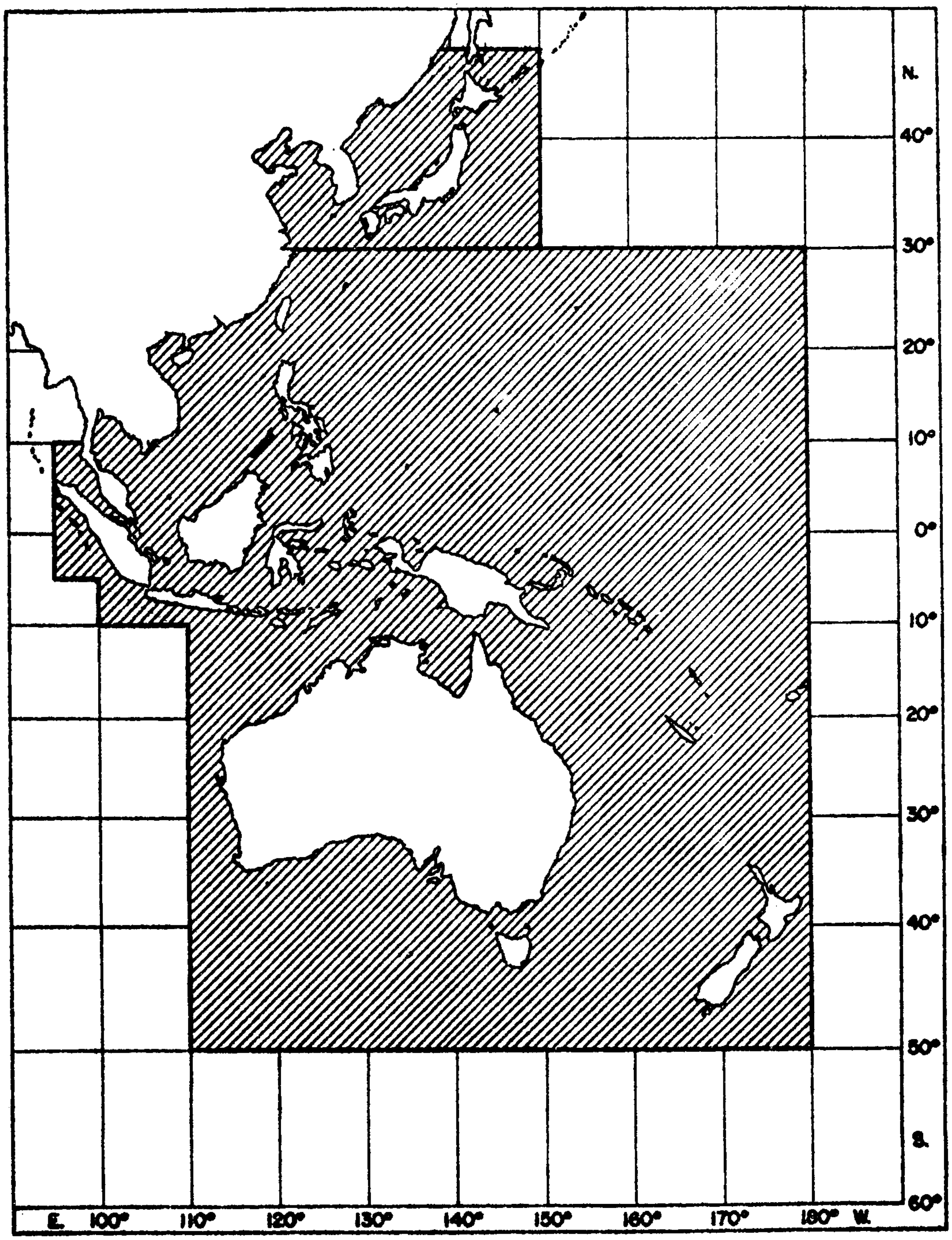

Fig. 1. Area included in the discussion of coastal and high-seas pelagic resources.

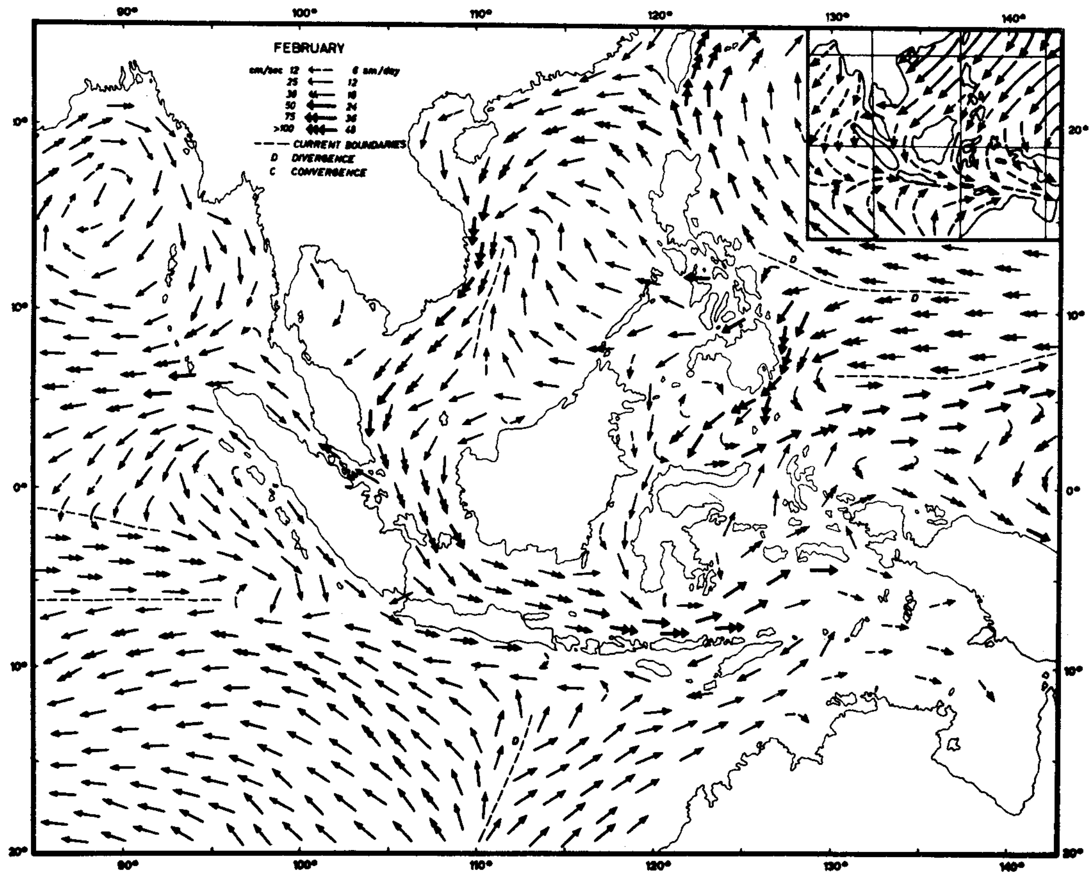

Fig. 2. General circulation of surface water in February (from Wyrtki, 1961).

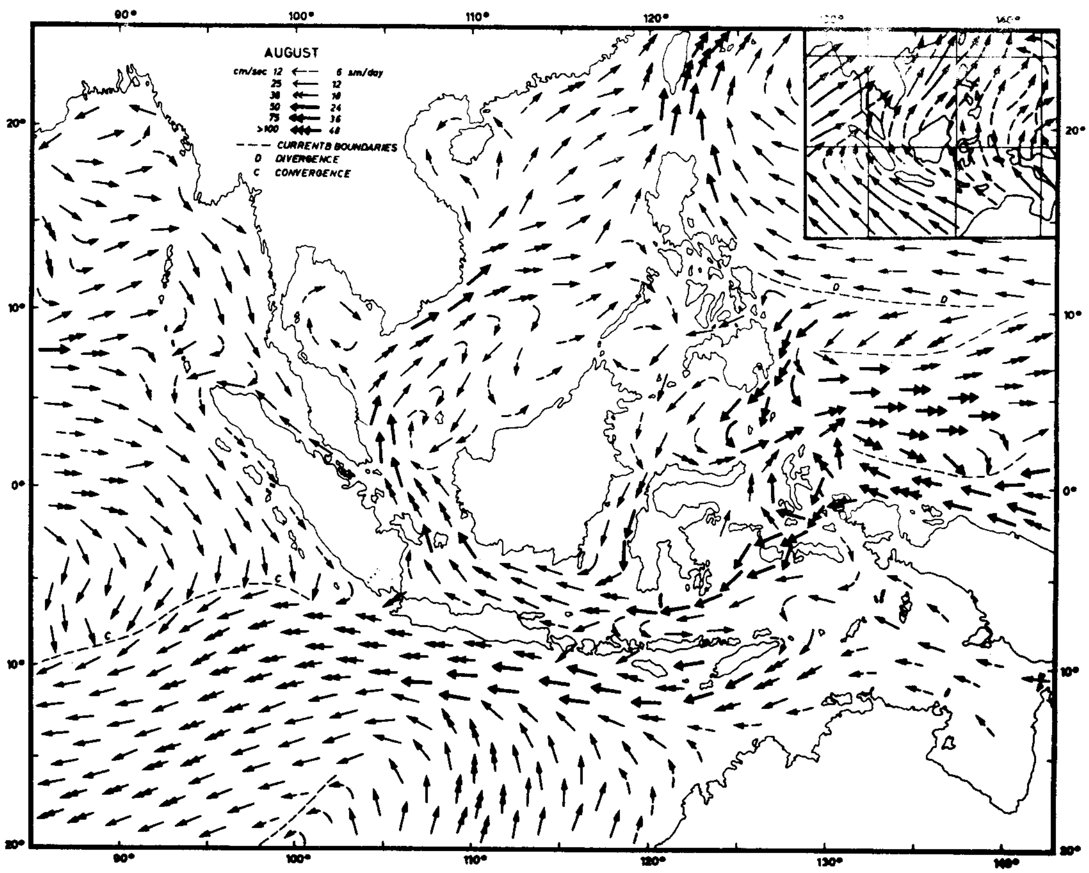

Fig. 3. General circulation of surface water in August
(from Wyrtki, 1961).