

Trends in the Fisheries for Billfishes in the Pacific

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The status of commercial fisheries for billfishes prior to 1970 was reviewed at the 1972 International Billfish Symposium (Ueyanagi 1974) and can be summarized: (1) Billfishes are taken primarily by the tuna longline fishery; (2) most are captured incidentally; (3) although billfish catches may be incidental to the tunas, they are nevertheless regarded highly in Japan with some species commanding high prices in the markets as *sashimi* (sliced raw fish usually eaten with soy sauce and horseradish); (4) Japan's tuna longline fishery covered virtually the entire distributional range of the billfishes by 1965, about the same time its billfish production peaked; and (5) during the 1960s, the catches of various billfish species were high but, around 1963, blue marlin (*Makaira mazara*) catches began declining in the South Pacific region, while catches of striped marlin (*Tetrapturus audax*) tended to fluctuate markedly from year to year.

During the 16 years since the 1972 International Billfish Symposium, certain characteristics of the billfish fisheries and resources have remained virtually unchanged while others have undergone marked changes. For example, the characteristics listed in (1), (2), and (3), above, are essentially the same today as in the pre-1970 period. There have been changes in the target species, fishing areas, fishing seasons, and fishing methods (e.g., fishing at greater depths) over the past several decades by distant-water fishing nations that have undoubtedly affected the catch and species composition in the longline fishery. Thus, interpretation of the billfish resources based on nominal catch-and-effort data must be

viewed cautiously. The present discussion will focus on the post-1970 years, although some references will be made to the pre-1970 period.

Utilization and Markets

Billfishes are utilized in Japan as *sashimi*, as an ingredient for *sushi*, or sold as *kirimi* (fillet) to be broiled or baked. They are also processed into *kasuzuke* (fish preserved in *sake* lees) or *misozuke* (fish preserved in *miso*, a soybean paste). In the past, billfishes have been used as ingredients in manufacturing sausage and ham.

In other countries, the demand for billfishes is increasing as a food product, especially for swordfish, which is highly prized in the U.S.A. markets as "steaks." The billfish catches of the Korean and Taiwanese longline fleets based in American Samoa are reported to be directed at the Japanese markets (G. Yamasaki pers. commun.). Finally, a major effort has been made in recent years by recreational fishing interests in the Pacific to have fishermen tag and release their billfish catches in order to obtain information on migration pathways and to maintain viable billfish populations.

At the Tokyo Fish Market, the average prices of billfishes increased markedly during the 1970s, with the exception of sailfish (*Isstiophorus platypterus*) and shortbill spearfish (*Tetrapturus angustirostris*; Fig. 1 (Tokyo Metropolitan 1987)). The price increase for striped marlin was especially pronounced — nearly threefold from 1970 to 1985. The sharp increase in market prices after 1967 was due to certain technological developments in the Japanese tuna longline fishery. In a quest for southern bluefin

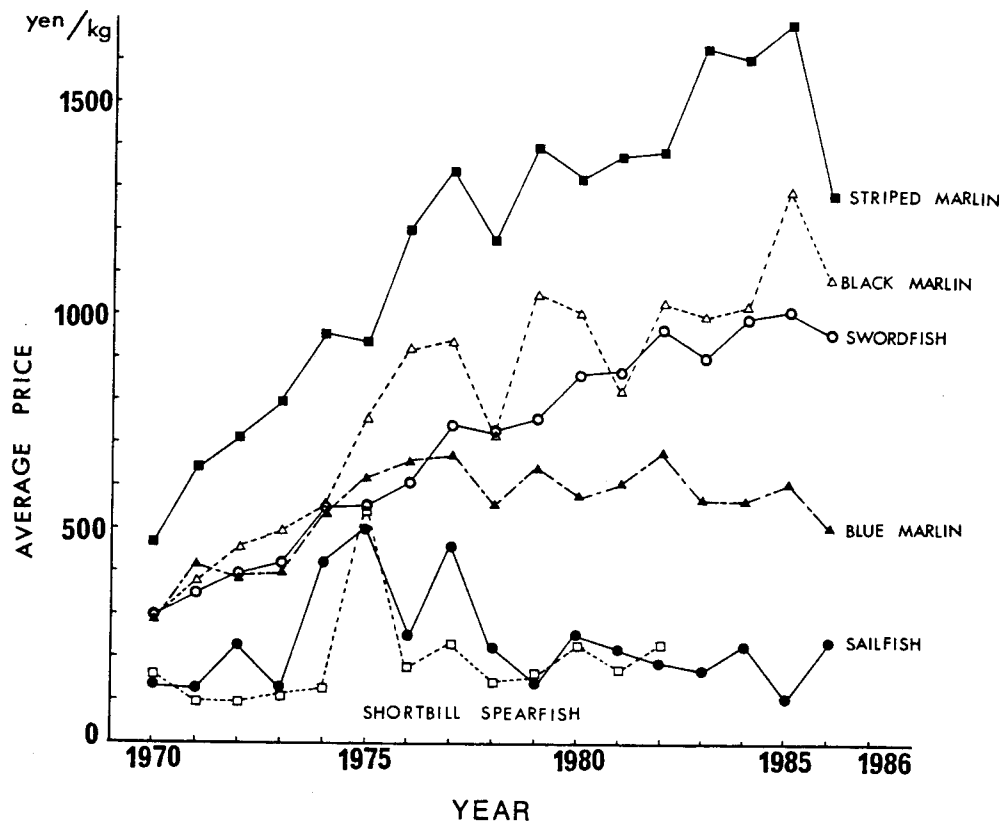


Figure 1. Average prices of billfishes (fresh) at the Tokyo Fish Market, 1970-1986.

tuna (*Thunnus maccoyii*), the Japanese longline began outfitting their vessels with freezers capable of quick-freezing fish to -55°C . The frozen fish were then maintained in fishholds at -40°C . Billfishes brought back to Japan under such refrigerated conditions were in great demand in the *sashimi* market; this was especially true for striped marlin. The rate of increase in prices slowed around 1977; prices remained relatively stable in the early 1980s.

Review of the Fisheries

Trends in Catch

Based on total landings, catches of striped marlin were low [7,000 to 9,000 metric tons (mt)] in 1955-1960, high (ca. 23,000 mt) in 1964-1971, and then relatively low (10,000 to 15,000 mt) in 1972-1985 (Fig. 2A). A more detailed examination of the available data is re-

quired to determine whether the post-1972 decline in striped marlin catches reflects a true reduction in abundance or results from a change in fishing strategy (e.g., use of deeper fishing longline gear).

Catches of black marlin, *Makaira indica* (Fig. 2A), and blue marlin (Fig. 2B) declined as well. Black marlin catches were 5,000 to 6,000 mt annually from 1955 to 1958, then slowly declined to around 3,000 mt in 1985. Except for a notable peak in 1961-1963, blue marlin catches fluctuated between 12,000 and 19,000 mt since 1964.

The combined annual catch of sailfish and shortbill spearfish was 3,000 mt in the 1950s (Fig. 2B). The catch increased to nearly 13,000 mt in 1965, remained at that level until 1969, then steadily declined to 3,100 mt in 1985. The 1976-1978 catch of sailfish and spearfish is not included in Figure 2B because the data are questionable.

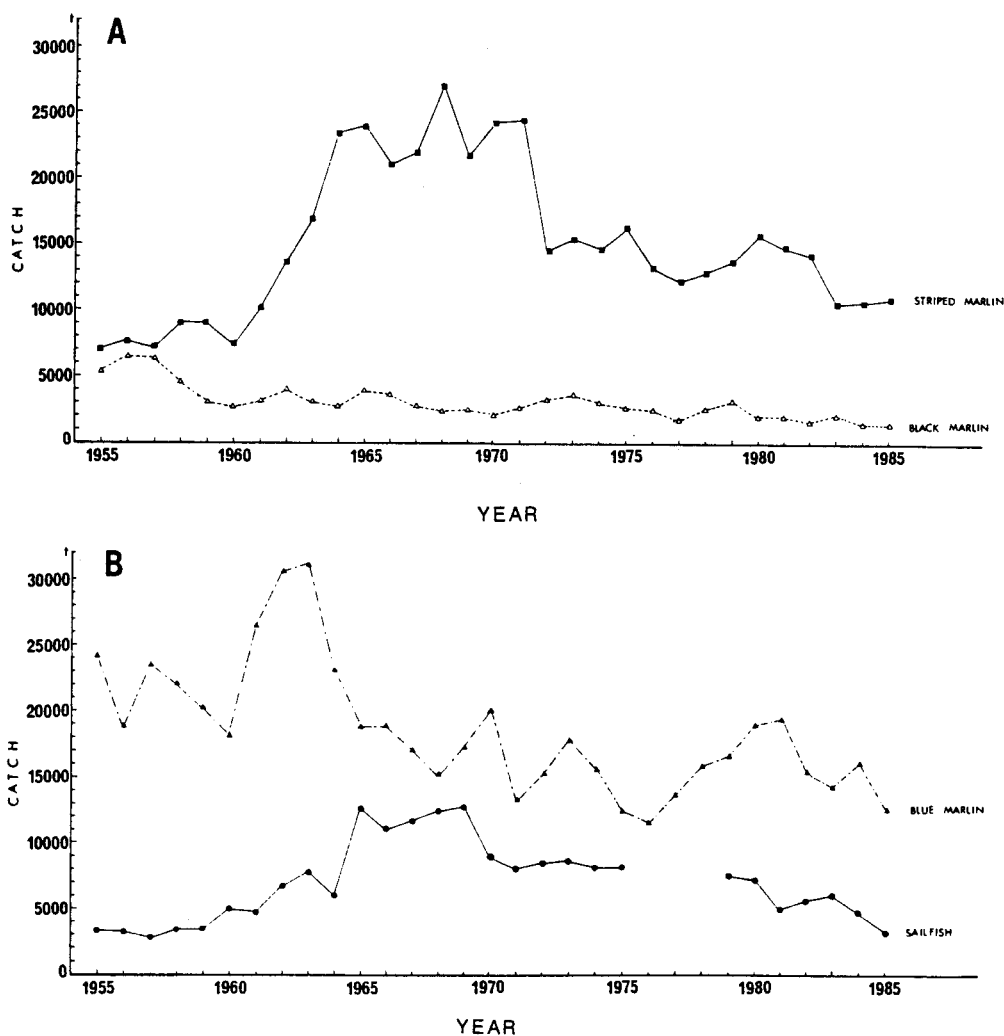


Figure 2. Annual catch of billfishes in the Pacific Ocean, 1955-1985: (A) striped marlin and black marlin; (B) blue marlin and combined catches of sailfish and shortbill spearfish. Data are from Shomura (1980) and the FAO (1976, 1979, 1984, 1987).

Trends in the Longline Fishery

The commercial catch of billfishes by the longline fishery, which primarily targets various tuna species, increased as the fishing grounds expanded. Since the 1960s, most of the catch has been made by the longline fishery. The expansion of the longline fishery has been described by Ueyanagi (op. cit.). The Japanese longline fishery in the Pacific gradually began expanding eastward in the early 1950s. By 1965, the fishery had extended throughout the tropical and sub-

tropical waters of the Pacific and, thus, covered virtually the entire distributional range of the various billfish species. The habitats of the billfishes caught by longline ranged from temperate to tropical waters and from coastal to offshore waters. During the late 1960s and early 1970s, the Japanese longline fleet began focusing on the southern bluefin tuna and bigeye tuna (*Thunnus obesus*); thus, the Japanese fleet's effort in the subtropical zones was reduced. The longline fleets of Korea and Taiwan, however, filled that void in the South Pacific (Ito and Yamasaki in press).

Japan's Longline Fishery

During the 1970s, the Japanese longline fishery made a substantive change in its fishing operation. The gear for many fishing vessels was modified to fish in deeper waters for bigeye tuna. Around 1970, bigeye tuna constituted about 30% of the tuna and billfish catches and, by 1980, had increased to 40%. This increase has been attributed to the deeper fishing longline gear. The shift to a deeper fishing mode has undoubtedly changed the catchability coefficient for several species, including the billfishes, taken by longline gear. In 1970, the billfish catch comprised about 21% of the total longline catch; by 1980, the billfish percentage had declined to 13%. Because billfishes are generally considered to inhabit the upper strata of the water column, the change in longline gear may have resulted in a major change in catch per unit of effort (CPUE).

Changes in Longline Fishing Grounds

During the late 1960s and early 1970s, Japanese longline fishing effort was concentrated in the high latitudes of the Southern Hemisphere near Australia and New Zealand for southern bluefin tuna, in the temperate and tropical waters of the central and western Pacific for yellowfin tuna (*Thunnus albacares*) and bigeye tuna, and in the waters off Mexico for striped marlin (Fig. 3). By 1975, fishing effort in the coastal waters of Mexico had decreased substantially (Fig. 3). Longline fishing effort increased markedly in the equatorial region of the central and eastern Pacific in the 1980s (Fig. 3), principally because of the success in catching the highly prized bigeye tuna in deeper waters. According to Suzuki (in pres), longlining comprised more than 50% of all fishing operations in the equatorial waters in 1980. Since deep longlining is less effective in catching billfishes than is conventional

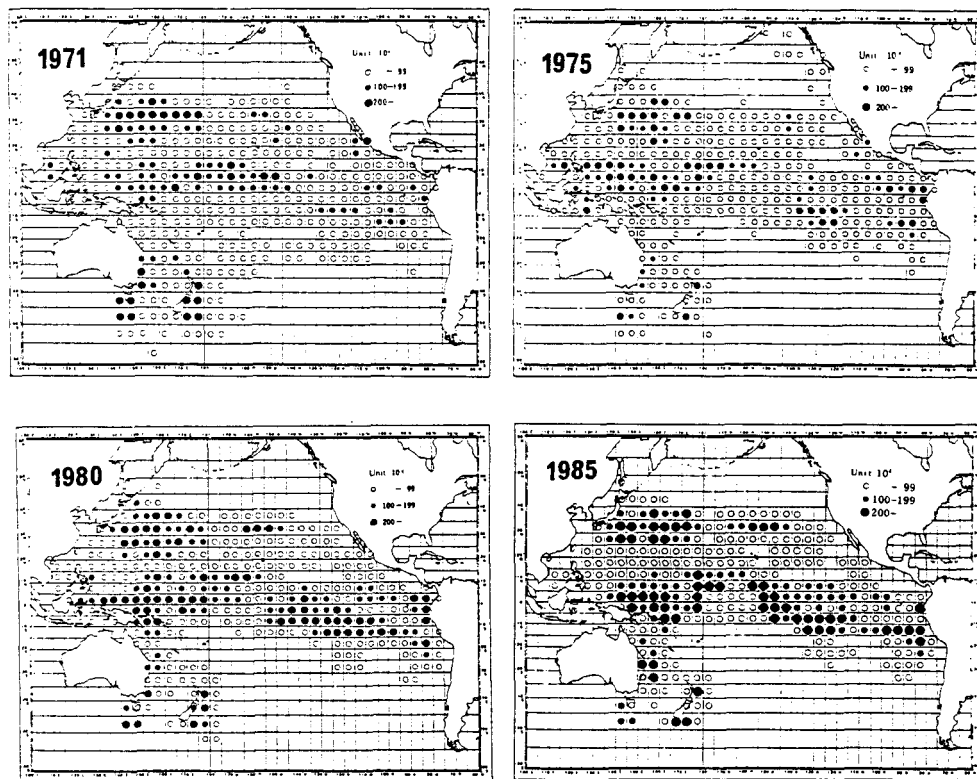


Figure 3. Comparisons of the distribution of estimated total fishing effort (in number of hooks) expended by the Japanese tuna longline fishery for 1971, 1975, 1980, and 1985 (from the Fisheries Agency of Japan 1973, 1977, 1982, unpub. data).

longline gear (Miyabe and Bayliff 1987), the production of billfishes obviously has been affected by the increased use of deep longline gear. The equatorial region later experienced further increases in the use of deep longline gear, which constituted about 90% of all longline operations in the area in 1985 (Suzuki in press).

Catch and Effort

The total fishing effort (in number of hooks) expended by the Japanese longline vessels in the Pacific Ocean apparently leveled off at around 280 million hooks per year during the first half of the 1970s (Fig. 4). A trend toward increased effort occurred, however, during the second half of the 1970s. After peaking in 1981 at around 400 million hooks, fishing effort declined and leveled off at around 330 million hooks after 1983. The increase in total fishing

effort during the second half of the 1970s reflects the increase in the number of hooks fished per longline operation. On the other hand, the decrease in fishing effort in 1982 and 1983 is believed attributable to the 20% *gensen* (fleet reduction) in the tuna longline fishery during 1981-1982.

Because the longline fishery is responsible for a large share of the billfish catches in the Pacific, the trends in longline catch of billfishes (Fig. 4) are generally similar to those discussed earlier under the total billfish catch.

CPUE by Area

The annual variations in CPUE (number of fish caught per 1,000 hooks fished) of the principal billfish species were examined for three areas in the Pacific: Area 1, north of lat. 15°N; Area 2, lat. 15°N-15°S; and Area 3, lat. 15°-30°S (Fig. 5). Because the fishing effort (in number

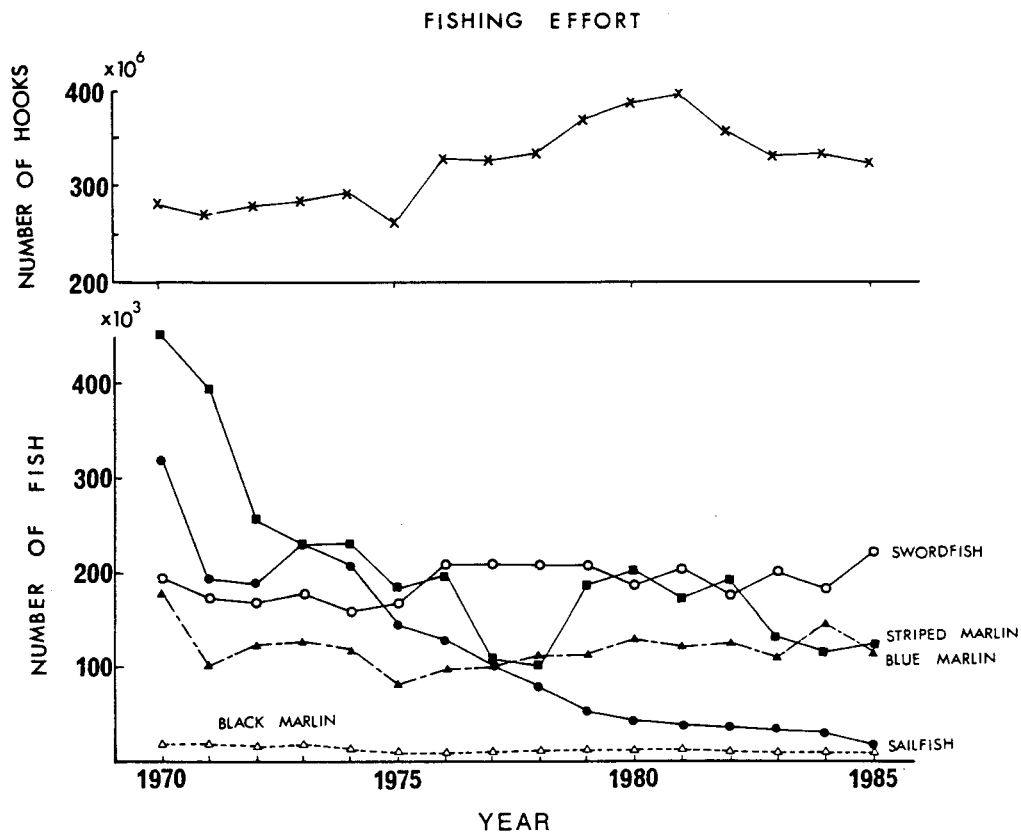


Figure 4. Annual fishing effort (in number of hooks) and catch of billfishes by the Japanese tuna longline fishery in the Pacific Ocean, 1970-1985.

of hooks) used to obtain CPUE is nominal, unstandardized effort, the CPUE values are not intended to reflect accurately the absolute resource levels, and interpretations based on these statistics should be viewed with caution.

In Area 1, fishing effort initially decreased during 1970 to 1975, thereafter stabilizing at 80

to 100 million hooks (Fig. 5). The CPUE for striped marlin decreased markedly and, by 1975, was only one-half that in 1970; thereafter, the CPUE fluctuated between 0.5 and 1.0 fish per 1,000 hooks. Swordfish CPUE was generally stable at around 1.0 fish per 1,000 hooks. In Area 2, fishing effort increased steadily from

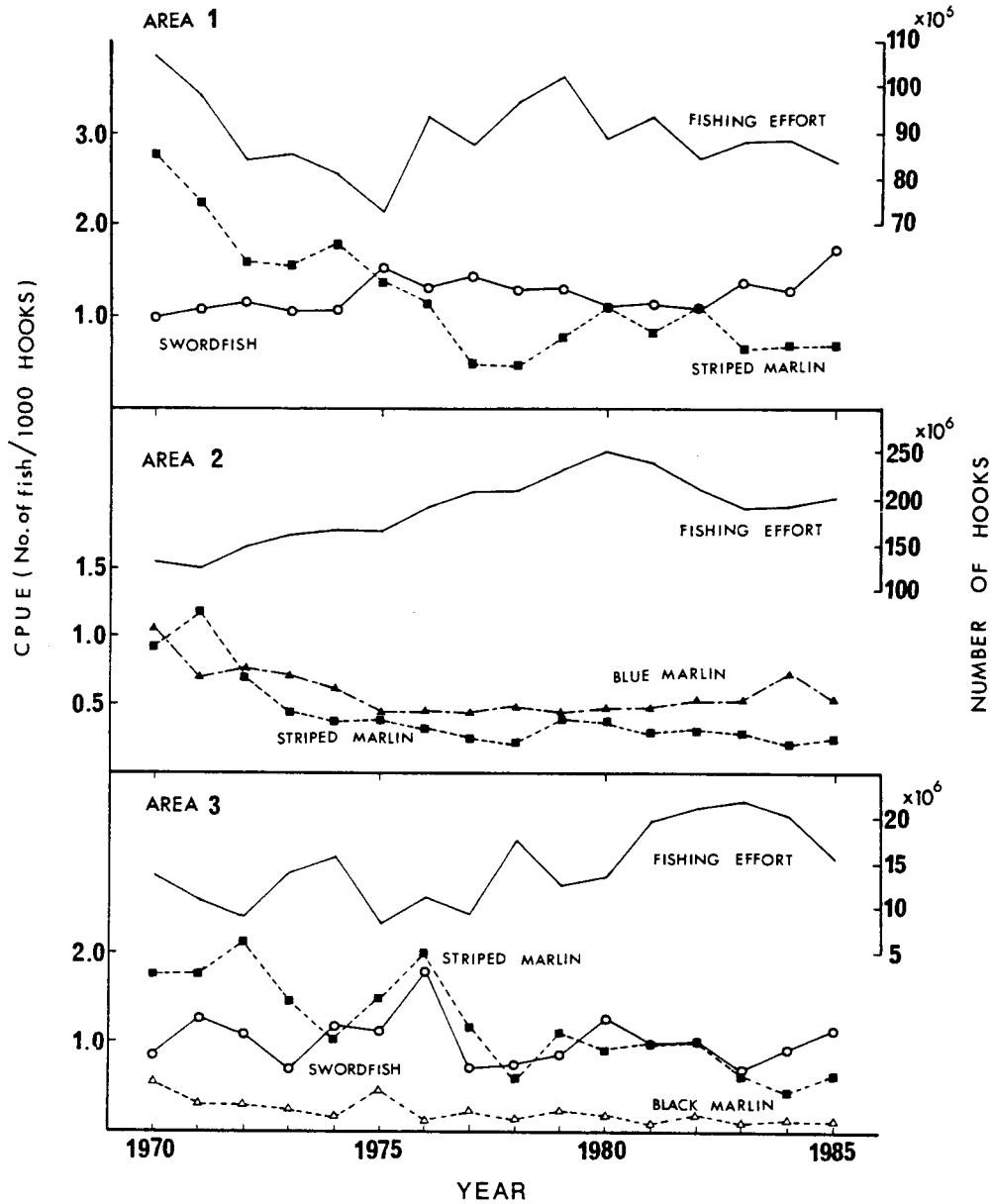


Figure 5. Annual fishing effort and catch per unit effort for principal billfish species by area, 1970-1985: Area 1, north of lat. 15°N; Area 2, lat. 15°N-15°S; and Area 3, lat. 15°-30°S.

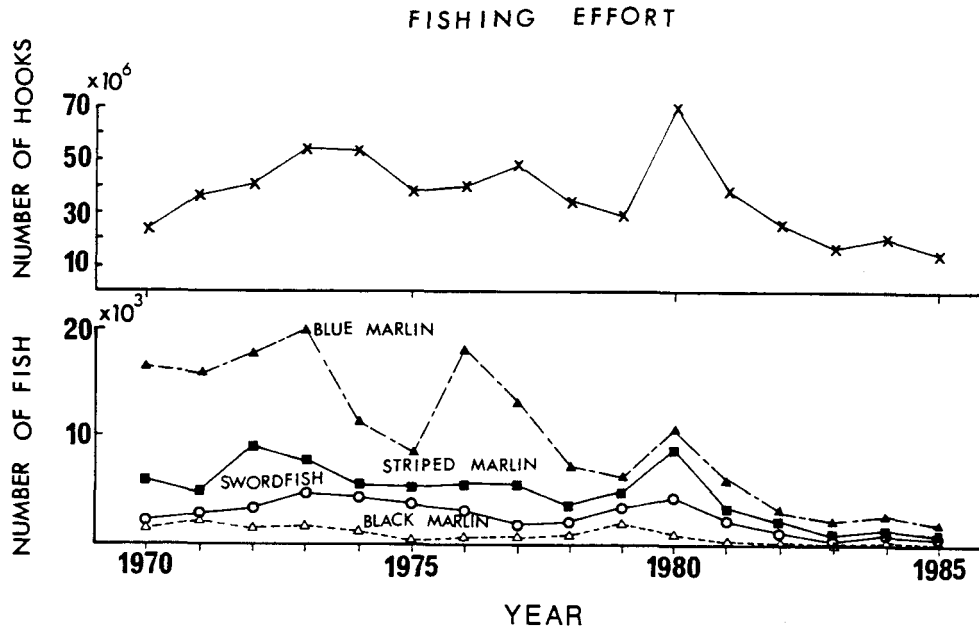


Figure 6. Annual fishing effort (in number of hooks) and catch of billfishes, by species, by the Taiwanese tuna longline fishery in the Pacific Ocean, 1970-1985.

1970 to 1980, reaching a peak of 250 million hooks in 1980 (Fig. 5). Effort declined subsequently, then stabilized at about 200 million hooks. The catch rate for blue marlin, the principal billfish species taken in this region, declined during the first half of the 1970s and, since then, has been stable at about 0.5 fish per 1,000 hooks. The striped marlin CPUE decreased steadily during the first half of the 1970s and stabilized thereafter at about 0.3 fish per 1,000 hooks.

Of the three areas, Area 3, the southernmost sector, had the lowest level of fishing effort (Fig. 5). Fishing effort was 10 to 15 million hooks during most of the 1970s, reached a high of about 22 million hooks in 1983, then dropped to 15 million hooks in 1985. The striped marlin CPUE fluctuated dramatically; however, apparently the average CPUE for the first half of the 1980s was lower than in the 1970s. Some fluctuations occurred in swordfish CPUE, but there were no long-term upward or downward trends. Black marlin CPUE declined slightly from 1970 to 1985.

Taiwan's Longline Fishery

The Taiwanese distant-water longline fleet

generally concentrates its fishing effort in the southerly latitudes of the central and western Pacific; albacore (*Thunnus alalunga*) is the tuna species sought by the fleet (Wetherall and Yong 1984). Fishing effort (in number of hooks) and catch (in number of fish) by species, based on available catch statistics (Tuna Research Center 1979, 1986) are presented in Figure 6. The total Taiwanese fishing effort in the Pacific fluctuated between 30 and 55 million hooks in the 1970s. Except for a peak of 70 million hooks fished in 1980, effort in the 1980s thus far has been around 20 million hooks. A general decline in blue marlin catch appears to have occurred over the 1970-1985 period, although some fluctuations are apparent. The striped marlin catch fluctuated between 5,000 and 9,000 fish from 1972 to 1980, then declined steadily from 1980 to 1985, probably reflecting the decline in fishing effort during the same period. In general, the swordfish (*Xiphias gladius*) and black marlin catches also declined over this 1970-1985 period.

In addition to the distant-water longline fleet, a fleet of smaller longline vessels operates exclusively in the coastal waters of Taiwan. The average annual catch by species for the 1975-

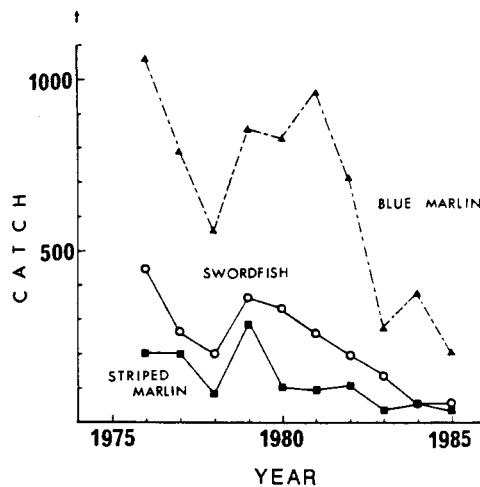


Figure 7. Annual catch of billfishes by the Korean tuna longline fishery, 1975-1985.

1986 period for the coastal fleet was 750 mt for striped marlin, 1,700 mt for blue marlin, 900 mt for black marlin, and 1,300 mt for sailfish (G. Sakagawa pers. comun.).

Korea's Longline Fishery

In general, the Korean longline fleet has operated throughout the tropical and subtropical Pacific. Effort was generally directed toward the yellowfin and bigeye tunas; thus, the Korean fleet tended to operate in more tropical waters than the Taiwanese longline fleet. Based on available statistics (Fisheries Research and Development Agency 1980, 1981, 1985), total fishing effort (in number of hooks) expended by the Korean longline fleet in the Pacific fluctuated between 60 million and 100 million hooks from 1975 to 1980. The annual catch of billfishes, by weight and by species, for 1976-1980, based on FAO (1979, 1984, 1987) statistics, is shown in Figure 7. The blue marlin catch declined markedly: from >1,000 mt in 1976 to about 200 mt in 1985. Striped marlin and swordfish catches also declined from 1976 to 1985.

Other Longline Fishing Effort

In addition to the large longline fleets of Japan, Korea, and Taiwan, other longline operations include a small fishery based in Hawaii, one longliner based in American Samoa, one longliner in Tonga, and a fleet in Indonesia. Hawaii's longline fleet has declined in numbers

since the 1950s, from a high of 76 vessels in operation in 1950 to 22 vessels in 1980. The vessels are small, generally 9 to 12 m long. New vessels have joined the longline fleet in recent years, and active longliners numbered 37 in 1984. The increase in fishing activity is due to increased fish prices and the expanded market, which includes airfreighting fresh tunas and billfishes to Japan and the continental U.S.A. to meet the increased demand for *sashimi*-quality fish. The total catch of the Hawaiian longline fishery equaled 1,695 mt in 1987 (Pooley 1988), of which the billfishes comprised 22.1%. Striped marlin and blue marlin constituted about 68.9% and 12.5%, respectively, of the total billfish catch. Small amounts of swordfish, black marlin, shortbill spearfish, and sailfish were also landed by the longline fleet.

Other Fisheries for Billfishes

Gill-Net Fishery

A gill-net fishery for billfishes and tunas has been operational in Japan for over 100 years. During the early years, fishing was confined to coastal waters. Since the 1970s, however, the fishery has expanded offshore as a result of the development of the *ome ami* (drift gill-net) gear and a shift in target species. The principal fishing areas of the *ome ami* fishery during the first half of the 1970s were the waters off the Sanriku district of Honshu Island, off Boso Peninsula, the South China Sea, and the Yellow Sea. In the *ome ami* gill-net fishery, a standard operation uses 12 km of net (17 to 18 cm mesh size). Using netting of >12 km per operation and mesh sizes of <15 cm by Japanese flag vessels is prohibited by regulations imposed by the government. Fishing vessels are 50 to 500 gross tons (usually, 90 to 100 gross tons). The vessels are used in other fisheries (e.g., salmon drift gill net, squid gill net, saury stick-held dip net, tuna longline, and squid jigging).

The gill-net fishery's catches of billfishes, tunas, and other species from 1970 to 1986 are listed in Table 1. The total billfish catch from 1973 to 1986 fluctuated between 3,600 and 10,200 mt. Some fluctuations have been attributed to changes in target species and in the number of vessels operating in the fishery. During the early 1970s, billfishes were the target species by the gill-net fishery; however, since the early 1980s, there has been a shift to target the tunas, especially albacore. Thus, the decline in the billfish catch may reflect the shift in target

species rather than a decline in the billfish population. Striped marlin comprised more than 50% of the total billfish catch; swordfish was about 25%. The blue marlin catch, which includes black marlin, has declined in recent years.

The distribution of striped marlin catches in the ome ami gill-net fishery for 1985 is based on catches by vessels over 10 gross tons (Fig. 8). The main fishing grounds for striped marlin are in the western Pacific. The catch sizes were 15 to 90 kg for striped marlin and 5 to 170 kg for swordfish (weights are based on the total weight less the weight of snout and viscera).

A commercial drift gill-net fishery in California, started in 1980, was directed at swordfish, discussed fully by Sakagawa (this volume). It is noted, here, only that small numbers of striped marlin are taken in this fishery; more than 90% of the billfish catch is swordfish.

Harpoon Fishery

Harpoon fisheries directed at billfishes are operated in coastal waters of Japan, Taiwan, and California. The annual billfish catch by the Japanese harpoon fishery, 1959-1971, fluctuated between 2,200 and 4,600 mt. It declined markedly after 1972, then has been stable at a level of less than 1,200 mt (Fig. 9). The average catch over the last 10 years was around 800 mt. Striped marlin are the main target of this fishery, making up about 50% of the total billfish catch. Sword-

fish and blue marlin (including black marlin) are next in importance, each representing around 20% of the total catch. The fishing grounds are located in waters around Izu and Bonin Islands and off Sanriku district of Honshu Island. The fishing vessels average <20 gross tons; most are 5 to 15 gross tons.

The total monthly catch of billfishes, by species, landed at the port of Shimoda, Japan, 1972-1978, is given in Figure 10 (Matsuoka and Tsuchiya 1979). Striped marlin are landed during January to July; the peak occurs in March. Blue marlin are landed in April and December; the high catches are in September and October. Swordfish are landed over an extended period; the peak occurs in May. Black marlin are landed in May-October; the peak period is in July-August. The body weights (viscera removed) of billfishes landed by the harpoon fishery are 20 to 70 kg (mean, 55 kg) for striped marlin, 90 to 260 kg (mean, 135 kg) for blue marlin, 30 to 200 kg (mean, 105 kg) for swordfish, and 60 to 220 kg (mean, 117 kg) for black marlin.

The average annual catch of the Taiwanese harpoon fishery for billfishes, during the period 1975-1986, was 130 mt for striped marlin and around 500 mt each for blue marlin, black marlin, and sailfish (G. Sakagawa pers. commun.).

A commercial harpoon fishery directed toward swordfish has operated in California waters since about 1913. Striped marlin can be taken

Table 1. Catch statistics of the Japanese gill-net fishery¹, 1970-1986.

Year	Striped marlin	Swordfish	Blue marlin ²	Sailfish	Subtotal	Tunas	Skipjack tuna and frigate mackerel	Total ³
1970	3	—	—	126	129	44	169	328.687
1971	10	1	—	54	65	32	146	347.611
1972	243	55	8	55	361	135	626	296.867
1973	3,265	720	268	98	4,351	348	548	311.628
1974	3,112	1,304	230	83	4,729	614	350	325.539
1975	6,534	2,672	795	149	10,150	951	507	295.050
1976	3,561	3,488	580	117	7,746	2,403	920	295.270
1977	4,424	2,344	998	398	8,164	1,599	1,864	322.777
1978	5,593	2,475	884	343	9,295	6,393	2,078	306.326
1979	2,532	983	513	347	4,375	4,464	1,012	301.484
1980	3,467	1,746	868	137	6,218	4,728	1,134	296.929
1981	3,866	1,848	1,165	362	7,241	12,749	2,571	327.649
1982	2,351	1,257	954	333	4,895	14,292	4,314	350.631
1983	1,845	962	931	276	4,014	6,611	3,933	291.950
1984	2,257	971	240	110	3,578	8,045	5,110	362.607
1985	2,323	1,026	401	146	3,896	10,599	2,471	376.129
1986	3,536	1,170	176	233	5,115	8,012	6,344	351.888

¹including ome ami gill-net, spanish mackerel gill-net, flying fish gill-net, saury gill-net, herring gill-net, etc.

²including black marlin

³including other fishes (sharks, cods, atka mackerel, flat fishes, spanish mackerel, etc.)

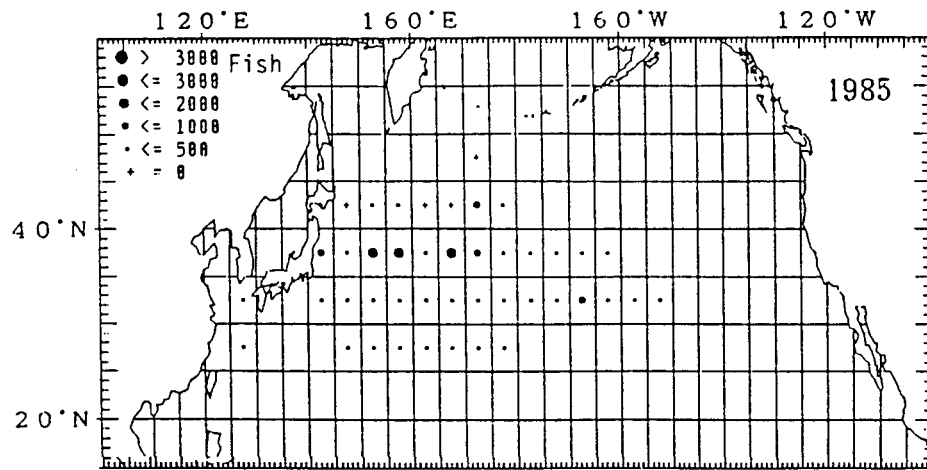


Figure 8. Distribution of striped marlin catch of the Japanese gill-net fishery for 1985.

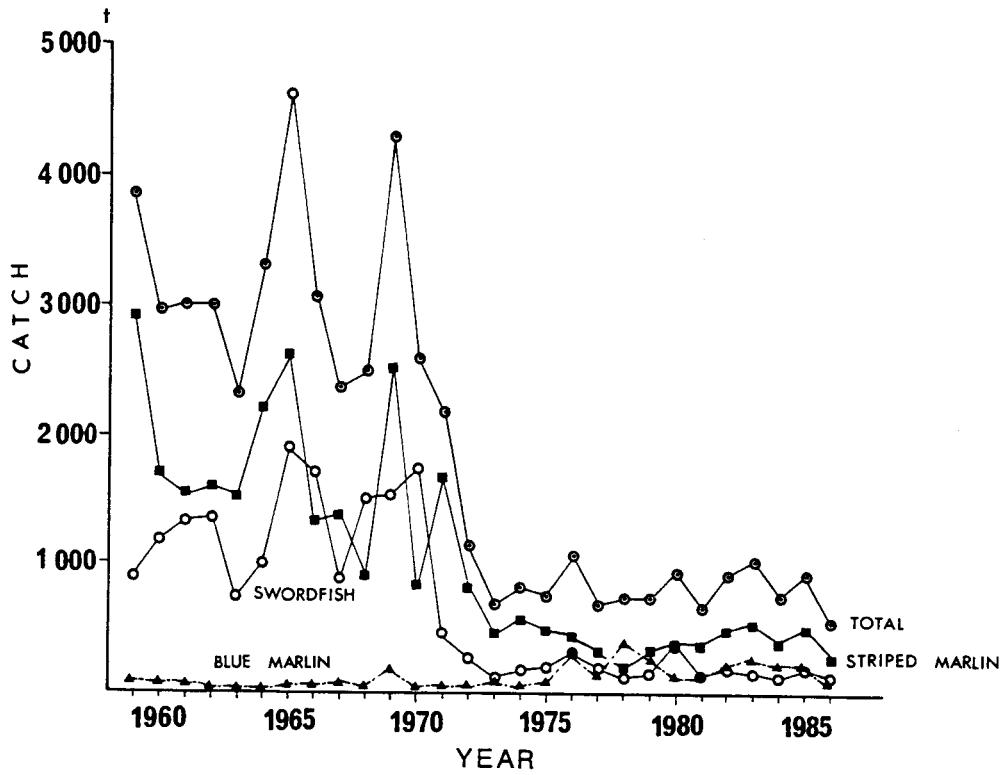


Figure 9. Total annual catch of billfishes landed by the Japanese harpoon fishery, 1959-1985.

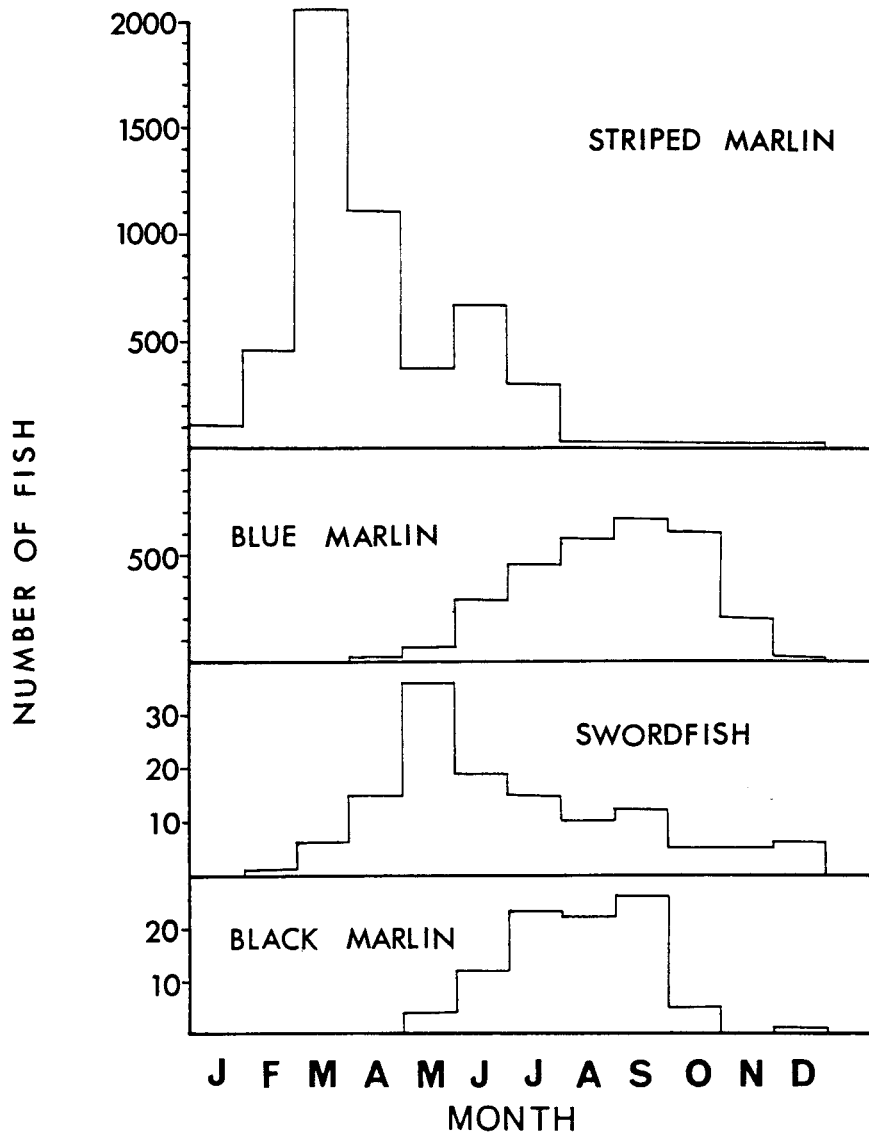


Figure 10. Monthly total catch of billfishes, by species caught by the Japanese harpoon fishery and landed at Shimoda, 1972-1978. Data are from Matsuoka and Tsuchiya (1979).

in this fishery, but the sale of this species is prohibited by the State of California. Thus, there are presently no reported landings of striped marlin (Anonymous 1979).

Purse-Seine Fishery

The incidental catch of billfishes by Japanese

single purse-seiners operating in the tropical waters of the western Pacific from 1985 to 1987 is shown in Table 2. The billfishes made up only 0.1% of the total purse-seine catch. Blue marlin were the dominant species caught by the purse-seiners; they represented 99.3% of the total billfish species taken, sailfish and black

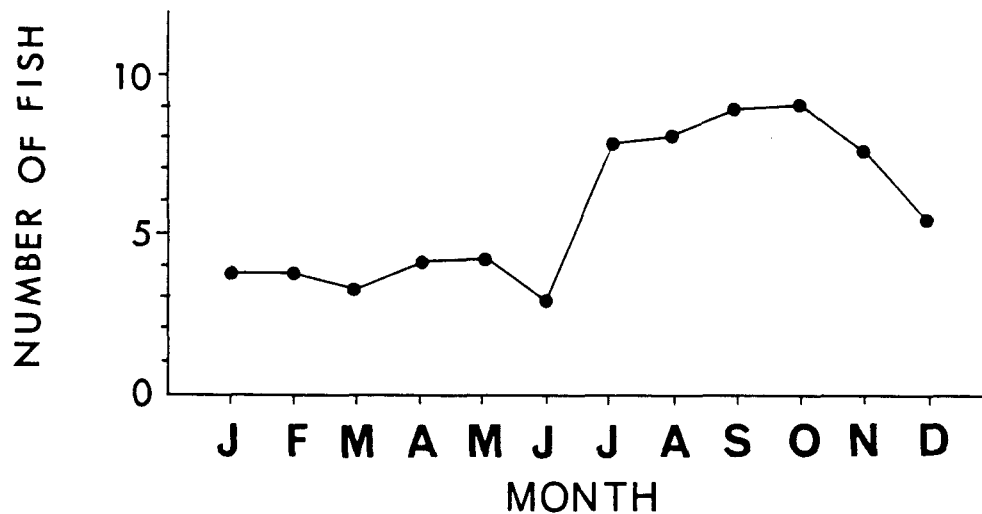


Figure 11. Average monthly catch of billfishes per cruise of the Japanese single purse-seiners in 1987.

marlin representing 0.05 and 0.02%, respectively, of the total billfish catch. No records are available on striped marlin or swordfish taken by Japanese purse-seiners. The average monthly catch of billfishes in 1987 was about four fish per January-June cruise and eight fish per July-December cruise (Fig. 11). The blue marlin caught by the Japanese single purse-seiners were 10 to 250 kg; a dominant mode was noted at 50 to 60 kg.

Set Net Fishery

Billfishes are also caught incidentally by the set-net fishery. The average annual billfish catch by the set-net fishery in Japan, 1970-1986, was about 360 mt (Ministry of Agriculture 1982,

1987). Sailfish was the dominant billfish species in the catch.

Recreational Fishing

Recreational fishing directed at billfishes occurs throughout the Pacific (Goadby 1970). Important sites include the coastal communities along the southern tip of Baja California, the mainland of Mexico, the Hawaiian Islands, the Bay of Plenty in New Zealand, and eastern Australia (de Sylva 1974). Other sites with growing recreational interests include Fiji, French Polynesia, Guam, the Commonwealth of the Northern Mariana Islands, and Coastal communities along Central and South America.

Table 2. Incidental catch of billfishes by Japanese single purse-seiners, 1985-1987.

Month	No. of boats	1985		No. of boats	1986		No. of boats	1987	
		Tons	%*		Tons	%*		Tons	%*
January	18	14.1	0.14	23	11.7	0.10	18	9.1	0.10
February	20	12.9	0.12	19	6.5	0.06	18	10.3	0.11
March	18	12.1	0.13	29	9.1	0.06	22	8.2	0.07
April	21	10.0	0.09	25	11.0	0.08	16	6.7	0.08
May	20	9.9	0.09	18	8.6	0.09	19	9.0	0.08
June	19	8.9	0.08	21	12.9	0.12	20	5.8	0.05
July	19	9.9	0.10	14	11.8	0.16	11	7.8	0.12
August	14	10.2	0.13	18	13.1	0.15	18	15.5	0.15
September	19	15.4	0.15	13	11.3	0.17	11	10.4	0.17
October	10	6.5	0.12	25	19.8	0.15	15	13.8	0.15
November	19	8.3	0.08	19	8.0	0.08	17	9.9	0.09
December	17	12.4	0.14	25	15.4	0.11	17	7.0	0.06
TOTAL	214	130.5	0.11	249	139.2	0.10	202	113.5	0.10

*%: Billfish catch/total catch

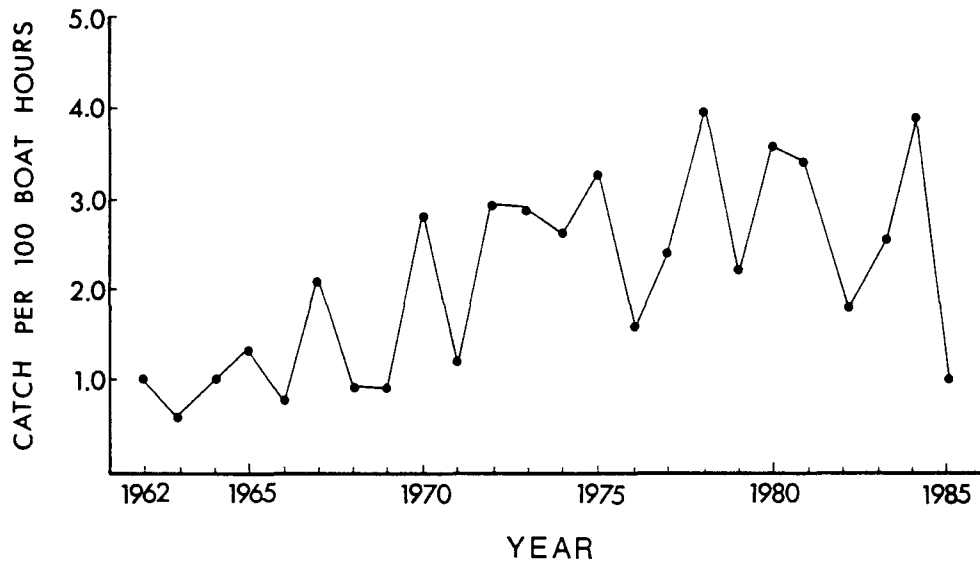


Figure 12. Blue marlin catch per unit effort (per 100 boat-hours) for the Hawaiian International Billfish Tournament, 1962-1985.

Presently, no good estimates are available on the total billfish catch and effort expended by recreational fishing vessels in the Pacific. Although catch-and-effort statistics of commercial fishing activities are generally maintained by government offices, data on recreational fishing activities are sadly lacking in many countries. Some measure of the trends in availability of billfishes is provided by the results of the Pacific Billfish Angler Survey (Squire 1987). Unfortunately, the survey is based on a select population of recreational fishermen, so it does not allow for estimates of Pacific-wide total catch or effort. The 1986 survey reported 13,711 fishing days and a catch of 6,949 billfish for the Pacific (Squire 1988).

The blue marlin CPUE fluctuated markedly from year to year, based on the Hawaiian International Billfish Tournament records from 1962 to 1985 (Fig. 12). An eightfold range in blue marlin CPUE occurred. Although recreational fishing data provide some indication of the status of stocks, caution should be exercised in interpreting those data. Some of the fluctuations are attributable to changes in availability and abundance; however, man-induced changes should not be overlooked. The general trend in recreational fishing is toward use of lighter line and tackle. Because catch-and-effort statistics are usually based on landed catch, the presumed

increase in fish loss associated with the lighter tackle is not accounted for in the analysis. A high-priority need exists for a more complete assessment of the catch and effort for billfishes by the entire recreational fishing community in the Pacific. This need probably exists for other oceans, as well.

General Discussion

Billfishes are taken by a wide variety of fishing gear types; however, longline gear has been the principal method of capture over the past several decades. In recent years, the shift in target species of the longline fishery toward bigeye tuna, by using deeper fishing gear, has added a complexity to the use of catch-and-effort statistics as measures of resource abundance. Although Japanese longliners have shifted their fishing effort to high-priced tuna species, they have been replaced in some areas by Taiwanese and Korean longliners.

The gill-net, purse-seine, and recreational fisheries have experienced changes in billfish catches. The catch of billfishes by the Japanese gill-net fishery declined in recent years, principally because of a shift in target species to albacore. A newly developed tuna purse-seine fishery in the western central Pacific has resulted in the capture of small quantities of billfishes by the Japanese single purse-seine vessels. Finally, the

billfish catch by a large, widely dispersed recreational fishing community in the Pacific may be increasing; however, details of its magnitude in terms of catch and effort are still lacking.

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