LONGLINES AND BILLFISH

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The introduction of longline fishing gear for the taking of pelagic species opened the world's billfish stocks to significant exploitation. Billfishes are scattered over wide areas and so were never taken in large number by customary fishing methods. The world commercial fisheries were quick to seize the opportunity to "skim the cream" from these lightly harvested populations. The pressure of longlining immediately raised the question of overexploitation, particularly in those areas where angling for sailfish, swordfish, and the marlins was well established.

Stocks of fish may be overexploited to varying degrees. Some may be reduced to a point below the level necessary for attractive sport angling, some below the levels of profitable commercial return, and some to the point where their future as a stock or as a species may be in doubt. Because they range widely over the oceans, and are relatively scarce, scientific study of billfish has been inordinately expensive. Therefore, information needed to answer the question "are billfish being overfished?" is lacking. This paper attempts to summarize the general knowledge of the problem.

Japan Pioneered Longlining

Longline gear was originated and developed in Japan's home waters in the 1950s.

Table 1 - Common and Scientific Names of the Billfishes and Their General Distribution

Common Name	Scientific Name	Range
Swordfish	Xiphias gladius Linn.	Worldwide
Sailfish	Istiophorus platypterus (Shaw and Nodder)	Tropical Worldwide
Black marlin	Makaira indica (Cuvier)	Tropical Indo-Pacific
Blue marlin	Makaira nigricans (Lac.)	Tropical Worldwide
White marlin	Tetrapturus albidus Poey.	Tropical Atlantic
Shorebill spearfish	Tetrapturus augustirostris Tanaka	Tropical Indo-Pacific
Striped marlin	Tetrapturus audaz (Philippi)	Tropical Indo-Pacific
Longbill spearfish	Tetrapturus pfleugeri Robins and deSylva	Tropical Atlantic
Mediterranean spearfish	Tetrapturus belone (Raf.)	Mediterranean

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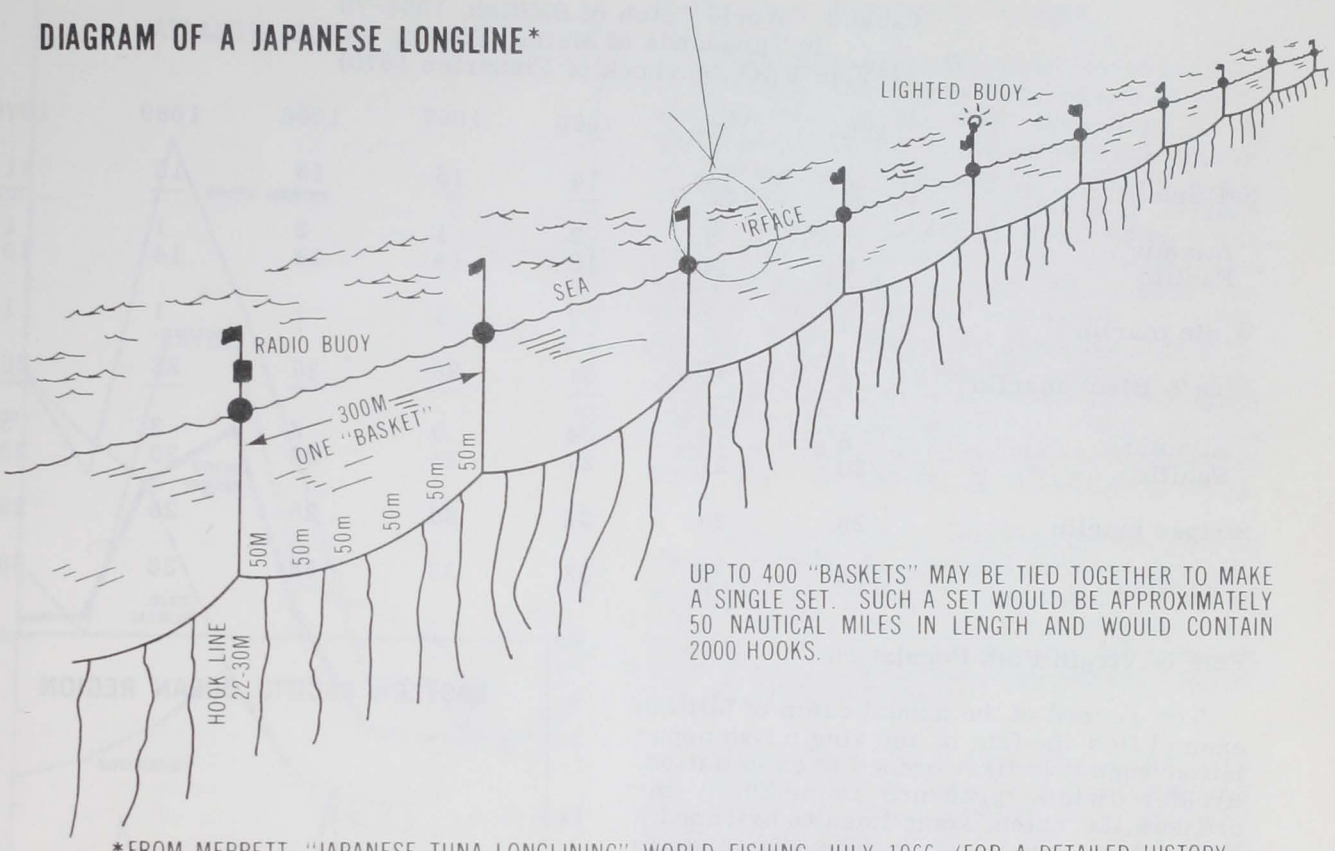

Fig. 1 - Diagram of longline gear in use.

By the early 1960s, Japanese longline vessels had extended their operations to the Eastern Pacific and into the Atlantic. Then, as now, the principal quarry for the longliners was not billfish as such but rather tuna and, in the Atlantic, broadbill swordfish. In the early days, billfish taken incidental to tuna fishing had little value. The development of "fish sausages" in Japan induced a limited market, but since 1966 most Japanese fishing vessels have been equipped with quick-freezing systems. The resultant improvement in quality increased demand. Now billfish command high prices in Japan because the flesh of striped marlin is considered equivalent to that of the expensive tunas. The Japanese fishing effort has spread throughout the world and takes about 70 percent of the world catch. Other countries now fishing longlines are Taiwan, Soviet Union, Mexico, and Cuba.

There have been only four areas in which longline fishermen have intruded into areas normally considered the province of sport fishermen: along the Pacific Coast of the Americas from Northern Peru to Northern Mexico, in the Atlantic along the Coast from Florida to New Jersey, the North Central Gulf of Mexico and, for the broadbill swordfish, the Atlantic from Cape Hatteras to Newfoundland.

For years swordfish have been harvested by harpooning. Longlining was introduced in 1962. The catch increased from 2100 metric tons in that year to 7500 in 1963. In 1969, the total catch in the Atlantic was 13,800 metric tons. A pronounced reduction in the catch of swordfish by U.S. and Canadian fishermen resulted from the finding in 1969 of mercury in swordfish flesh in excess of established limits in several countries.

Table 2 - World Catch of Billfish, 1964-70
in Thousands of Metric Tons
(From FAO Yearbook of Fisheries 1970)

	1964	1965	1966	1967	1968	1969	1970
Sailfish	8	16	14	15	16	15	11
Atlantic	1	2	2	1	2	1	1
Pacific	7	14	12	14	14	14	10
White marlin	4	5	3	1	1	1	1
Blue & Black marlin	38	33	31	28	26	26	26
Atlantic	8	6	4	3	3	3	3
Pacific	30	27	27	25	23	23	23
Striped marlin	28	26	24	26	25	25	25
Swordfish	34	32	33	33	34	38	38

Fate of Virgin Fish Population

The record of the annual catch of billfish exemplifies the fate of any virgin fish population when it is first opened to exploitation. Greater fishing pressure immediately increases the catch, sometimes to extraordinarily high levels, after which it tends to stabilize at a lower level. For example, as shown in Figure 2, the Japanese longline catch of sailfish in the Eastern Pacific region increased from 8,000 fish in 1962 to 417,000 in 1965. Declines in 1966 and 1967 were followed by another peak at 397,000 in 1968. The 1969 and 1970 catches again dropped to 194,000 and 263,000. The same phenomenon is recorded for the striped marlin catch. Data for the Atlantic Ocean catches shown in Figure 3 exhibit the same characteristics, except that catches apparently have stabilized at a relatively low level.

To account for the recorded fluctuations in catch, it is necessary to consider not only the size of stocks but the maneuverability of the fishery and the amount of effort. In the Eastern Pacific, the number of hooks was doubled in 1963, compared with 1962, and increased substantially again in 1964.

These increases in fishing effort, although presumably directed toward tuna, evidently produced great increases in the billfish catch. Likewise, the fishing effort increased from 42 million hooks to 50 million hooks (19%) from 1967 to 1968--with an increase in the marlin catch of 47 percent, and of sailfish 40

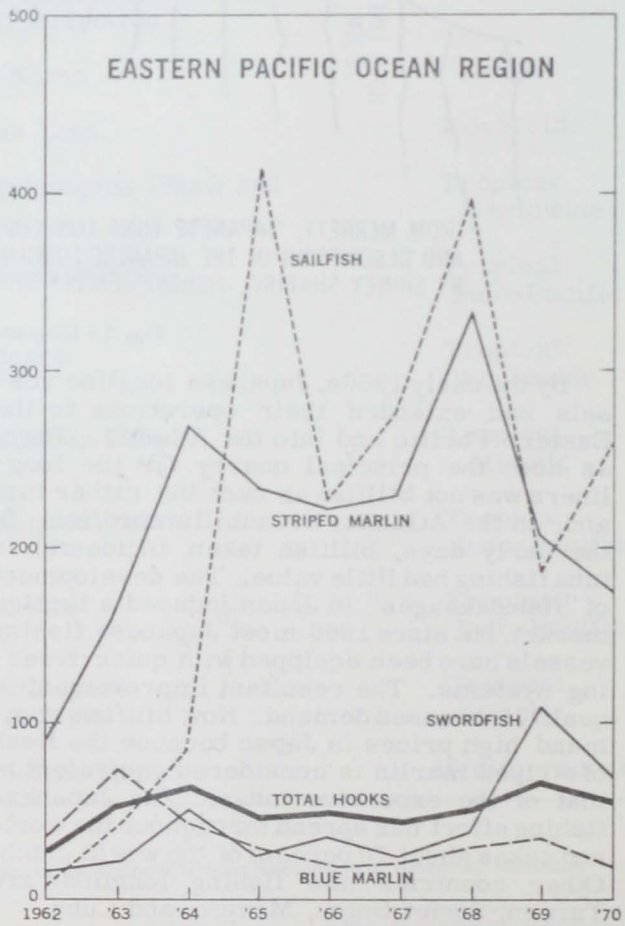

Fig. 2 - Japanese catch of billfish in the Eastern Pacific Ocean Region, 1962-70. Total hooks includes all fishing effort, billfish and tunas, given in millions of hooks per year. Catch shown in thousands of fish. (Annual Report on Japanese Tuna Longline Fishery, Research Division, Fisheries Agency of Japan, 1970).

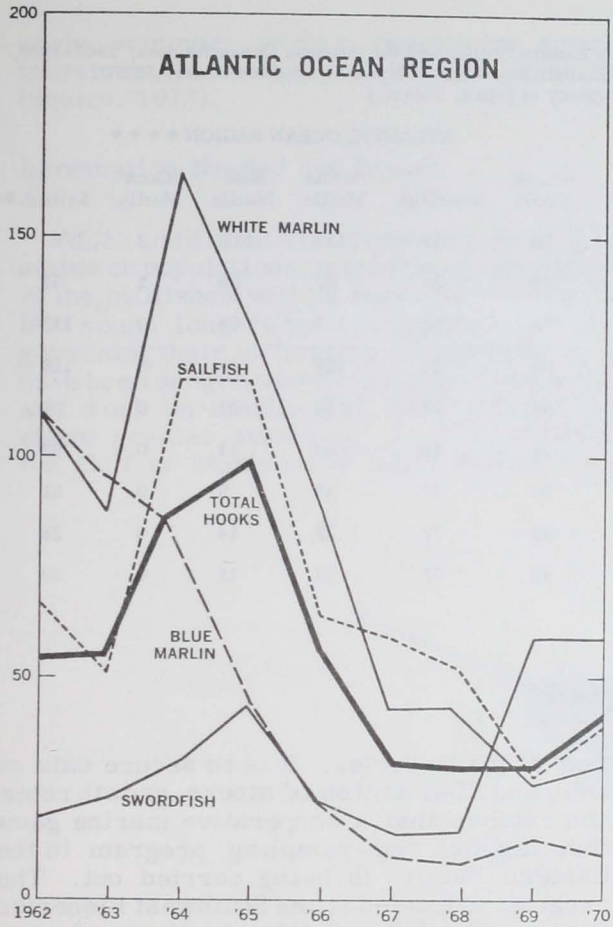

Fig. 3 - Japanese catch of billfish in the Atlantic Ocean Region, 1962-70. Total hooks includes all fishing effort, billfish and tunas, given in millions of hooks per year. Catch shown in thousands of fish. (Annual Report on Japanese Tuna Longline Fishery, Research Division, Fisheries Agency of Japan, 1970).

percent. Yet in 1969, with total hooks of 67 million, the striped marlin catch dropped to 208,000, and the sailfish catch to 194,000. It would appear that fish were relatively less available in 1969 than in 1968.

Availability, however, is not absolute evidence of reduced stocks. There may be a diversion of fishing effort to different areas. For example, the high sailfish catch in 1965 may have reflected the intrusion of the fishery into near-shore billfish concentrations. A similar movement might account in part for the relatively large increase in 1968 over 1967. A withdrawal of the longlines from near-shore fisheries to avoid direct competition with the intensive sport fishery off Baja California, or to seek better tuna catches elsewhere, might account for the decrease from 1968 to 1969.

Evidence of Population Changes

Other indices that give evidence of changes in population and characteristics are shifts in average size of fish and rates of catch. In the Eastern Pacific, there has been a decline in average size, indicating a reduced stock. The average weight for striped marlin taken by the Southern California sport fishery was about 150 pounds from 1952 to 1958, then dropped gradually through 1965 to about 130 pounds, where it has remained. In 1959, marlin taken during a Japanese scientific cruise averaged 143 pounds. Another scientific cruise in 1964 reported an averaged weight of 110 pounds (Talbot, 1970). Marlin taken off Mazatlan averaged 103 pounds in 1967, and 107 pounds in 1968 (Ware, 1970).

There is evidence that the success rate in the Eastern Pacific Fishery has also declined, an indication of fewer fish. An analysis of sailfish data shows catch rates ranging from slightly more than 10 fish per 100 hooks in 1964 to slightly less than 6 fish per 100 hooks in 1966 (Talbot, 1970).

Anglers fishing from Mexican sport-fishing centers report that fishing success has declined. Talbot and Squire (personal communication) estimated that in 1963 about 25,000 striped marlin and sailfish were taken along the Mexican coast. A more recent estimate is not available, but the concensus is that catch per boat per day has declined. Nevertheless, these waters continue to support one of the most attractive sport fisheries in the world.

Taken together, the available evidence confirms the parallel between the history of the billfish fishery adjacent to North America and the classic model of a lightly used fishery converted to a sustained fishery at a lower population level. At the present time, the population in the vicinity of Mazatlan appears to be adequate to support both an interesting sport fishery and a limited commercial fishery. The condition of fishing in the Atlantic and Gulf of Mexico is not as reassuring. If the exploitation continues to increase, reduction in the quality of the shore fishery is inevitable.

Need for International Management?

The possibility of a failing sport fishery leads to the question of the need to develop

Table 3 - Catches of Billfish by the Japanese Longline Fishery in the Eastern Pacific and the Atlantic Ocean Regions, 1962-1970, In Thousands of Fish. (Annual Report of Effort and Catch Statistics by Area in Japanese Longline Fishery, 1970. Research Division, Fisheries Agency of Japan, Tokyo.)

	EASTERN PACIFIC OCEAN REGION ***						ATLANTIC OCEAN REGION ****					
	No. of Hooks	Swordfish	Striped Marlin	Blue Marlin	Black Marlin	Sailfish**	No. of Hooks	Swordfish	White Marlin	Blue Marlin	Black Marlin	Sailfish**
1962	25	13	84	37	2	8	54	19	111	111	3	67
1963	52	22	166	76	4	39	55	24	87	96	1	51
1964	62	50	270	43	4	86	85	31	163	84	0	118
1965	44	24	236	26	3	417	98	44	129	45	0	118
1966	48	36	223	22	4	232	54	22	89	22	0	65
1967	42	24	230	22	4	284	31	16	43	11	0	59
1968	50	37	338	28	4	397	30	17	43	9	0	52
1969	67	112	208	34	4	194	30	57	27	14	0	28
1970	52	67	177	20	3	263	42	57	32	11	0	39

* In millions of hooks
** Includes spearfish
*** West Coasts of the Americas to 130° W. Long.
**** Entire Atlantic Ocean

a rational international management system for taking billfish. Treaties such as that establishing the International Commission for the Conservation of Atlantic Tuna and Tuna-like Fishes (ICCAT) provide mechanisms by which pelagic species such as the billfish can be given necessary protection. Actions of the international bodies are being designed to protect the resource itself, with the ultimate goal of benefiting all fisheries. There is ample authority within ICCAT, for example, to establish regulations that give special protection to billfishes when it can be demonstrated that such protection is needed to conserve the resource at any agreed-upon level of abundance. Other arrangements, such as extension of fishery jurisdiction to as much as 200 miles, would be ineffective in conserving the pelagic migratory species. Such arrangements would give individual nations authority over fishery stocks in their territorial seas--but cannot guarantee effective conservation of migratory species that travel widely and may be found off many countries in various seasons.

Cooperative Tagging Program

To make United States participation in international regulatory bodies effective, it is essential to have adequate information on the biology of billfishes and the characteristics of the fisheries. It is to secure data on size and distribution of stocks, growth rates, and catches that a cooperative marine game fish tagging and sampling program in the Eastern Pacific is being carried out. The program is located at the Southwest Fisheries Center at La Jolla, California, the headquarters for work on tuna and related fishes undertaken by the National Marine Fisheries Service. Limited information on general biology--particularly size, condition, and spawning--has been obtained from specimens taken off Baja California and Mazatlan. The principal effort of the Pacific billfish work has been in a cooperative tagging program with the Mexico Department of Fisheries, International Game Fish Association, the Woods Hole Oceanographic Institution, and the California Department of Fish and Game. During 1971, 2,412 marine game fish were tagged by cooperators. Since 1954, anglers have tagged 15,070 billfish in the Pacific. Returns of tags have been slightly under one percent for striped marlin, a trace for sailfish (8 of 4,613 fish tagged) and black marlin (2 of 538 tagged), and none for 203 tagged blue marlin. Striped marlin show a southerly movement from Baja and Mazatlan, where tagged, toward the Revillagigedo Islands in late spring and summer. There are indications of a movement northwestward from Cape San Lucas to the west coast of Baja in

early summer; other recoveries show a movement to southern California in the fall (Squire, 1972).

Information Needed and Sought

Much additional knowledge concerning the status of populations, migrations, and biology of the billfishes will be necessary to formulate sound long-range management policies governing their utilization. Substantial funds have been programmed for marine game fish, and work on marlin and other billfish will share greater attention. In 1972, efforts in the Gulf of Mexico and South Atlantic were strengthened. A substantial increase is planned for 1973 in the studies of billfish off Southern and Baja California. Billfish and other game species will be collected routinely and systematically by the comprehensive program of high-seas sampling known by the acronym MARMAP. Ultimately, MARMAP will involve extensive surveys to determine the abundance, distribution, and growth characteristics of important game and commercial species--also, spawning locations and distribution patterns of eggs and larvae. Concurrently, investigations will be made of the physical, chemical, and biological factors controlling the distribution and abundance of fish, eggs, and larvae.