THE BILLFISH FISHERY RESOURCE OF THE CALIFORNIA CURRENT

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ABSTRACT

Two species of billfish—swordfish, *Xiphias gladius*, and striped marlin, *Tetrapturus audax*—contribute substantially to fisheries off southern California. Both are highly migratory, worldwide in distribution, and occur seasonally in southern California waters—the northern fringe of their range in the eastern Pacific. Catches are highly variable from year to year.

Since 1937, California has reserved striped marlin for the exclusive use of recreational fishermen, although the fish are commercially taken in most other areas of the Pacific including off Hawaii.

Swordfish are exploited primarily by commercial harpoon and drift gill net gear under a number of restrictive regulations. Management of the fishery is based primarily on social and economic considerations, which attempt an equitable allocation of fish to user groups. A Preliminary Fishery Management Plan for billfish was drafted for the Pacific Fishery Management Council in 1981; however, after review, the plan was not implemented, and management was retained by California.

RESUMEN

Dos especies de Xiphidae, *Xiphias gladius* (pez espada), y *Tetrapturus audax* (Marlín listado) contribuyen en proporción considerable a las pesquerías del Sur de California. Ambas especies se distribuyen por todos los océanos, realizan amplias migraciones, y aparecen en ciertas épocas del año en aguas del Sur de California, zona que constituye el límite septendrional de su distribución en el Pacífico oriental. Las capturas que se obtienen varían ampliamente de un año para otro.

En California, desde 1937 se ha seleccionado el Marlín listado para la pesca deportiva, aún cuando también se pesca comercialmente en otras áreas del Pacífico, incluyendo la región de Hawaii.

La pesca comercial captura pez espada con harpón y trasmallos, pero ajustándose a estrictas regulaciones. La administración de la pesquería se basa principalmente en consideraciones socials y económicas, que tratan de establecer una distribución equitativa entre los grupos interesados en esta pesquería. El plan preliminar para la regulación de la pesca de los Xiphidos ha sido diseñado en 1981 por el Consejo para la regulación de las pesquerías del Pacífico. Sin embargo, después de su revisión, el plan no se ha adoptado, pero las regulaciones han sido mantenidas por California.

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INTRODUCTION

Two species of billfish—swordfish, *Xiphias gladius*, and striped marlin, *Tetrapturus audax*—appear along the southern California coast during summer and fall and contribute substantially to local fisheries. Both are considered highly migratory. The swordfish is the only member of the family Xiphiidae. The striped marlin is a member of the family Istiophoridae, which includes spearfishes, sailfish, and black, white, and blue marlin. The stock structure of the swordfish and striped marlin in the Pacific is not clearly defined.

Swordfish are exploited by active and competitive commercial harpoon and drift gill net industries. Both species are esteemed by recreational game fishermen, although few swordfish are actually landed by recreational anglers. Since 1937, striped marlin in waters off California have been reserved exclusively for sportsmen.

SWORDFISH

Distribution

Swordfish are cosmopolitan in distribution, being found in tropical and temperate waters of all oceans. In the Pacific, statistics for the Japanese longline fishery indicate that swordfish are distributed between 50°N and 50°S latitudes. Distribution is not uniform: areas of apparent concentration are in the North Pacific (20°-45°N), in the eastern Pacific from California to Chile, and in the southwestern Pacific from Australia to New Zealand (Figure 1).

The stock structure of the Pacific swordfish population is not clearly understood. Two hypotheses are widely held: either the population consists of a single Pacific-wide stock, or it consists of three separate stocks with centers of concentration in the northwestern, southwestern, and eastern Pacific.

In the eastern Pacific, a coastwide movement of fish between Baja California and California is evidenced by limited tagging data and Japanese longline hooks in fish taken off southern California. This hypothesis is further supported by the seasonality of the Baja Cali-

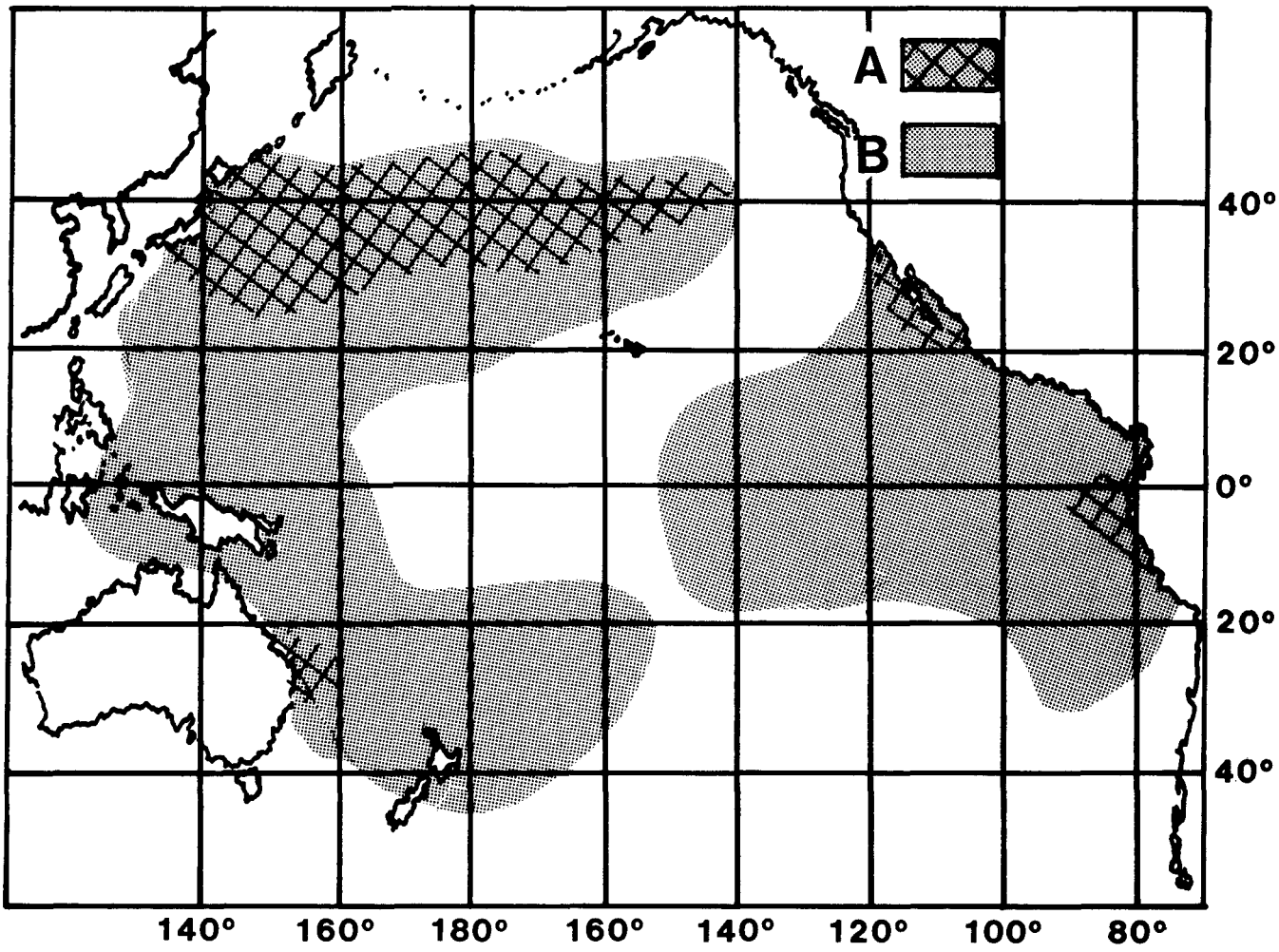

Figure 1. Distribution of swordfish determined from Japanese longline catch data: (*A*) high catch rate areas; (*B*) lower catch rate areas.

fornia and southern California fisheries. The Japanese longline fishery peaks off Baja California in December and January, followed by the southern California season, running from summer through fall.

Swordfish are found from the surface to at least 2,000 feet deep. They are caught by surface harpoon and rod-and-reel gear and at greater depths by gill nets and longlines.

Commercial Swordfish Fisheries in the North Pacific

In the North Pacific Ocean, the swordfish resource is exploited by several coastal and island nations. Japan, Taiwan, and Korea have large and mobile longline fleets and together account for most of the Pacific catch. Their combined longline fleets comprise over 2,000 vessels. In recent years, drift gill nets have accounted for 9%-10% of the swordfish taken by the Japanese fishery off Japan. The total annual Pacific catch of swordfish ranges from 10,000 MT to 19,000 MT and averages about 14,000 MT (Figure 2). A record of 24,286 MT of swordfish was caught in 1961. In the eastern Pacific (east of 150°W) off Mexico the annual catch of swordfish by foreign longline vessels averages about 4,700 MT a year (Figure 3).

The status of swordfish stocks in the Pacific was assessed by participants at the 1977 Billfish Stock Assessment Workshop (Shomura 1980). The participants concluded that, assuming a Pacific-wide stock, the resource is not overexploited and is in good condition. They further noted that catch per unit effort (CPUE) data from the Japanese longline fishery did not suggest overfishing of any of the hypothesized stocks.

California Commercial Swordfish Fisheries

Harpoon fishery. The swordfish harpoon fishery operates in the waters between Santa Barbara and the Mexican border (Figure 4).

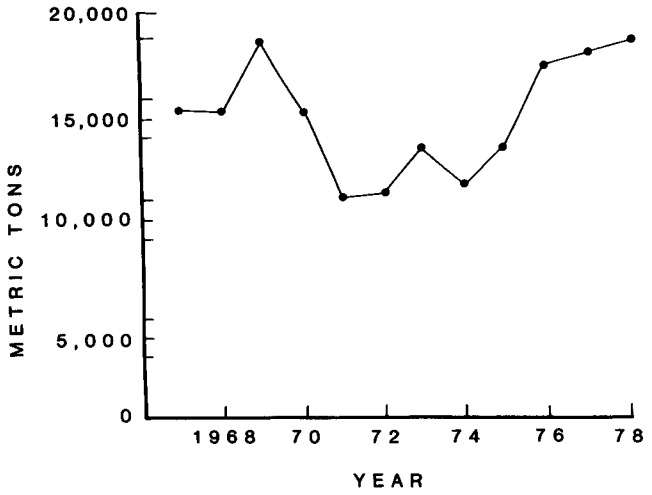

Figure 2. Catch of swordfish in the Pacific Ocean, 1967-78 (F.A.O.).

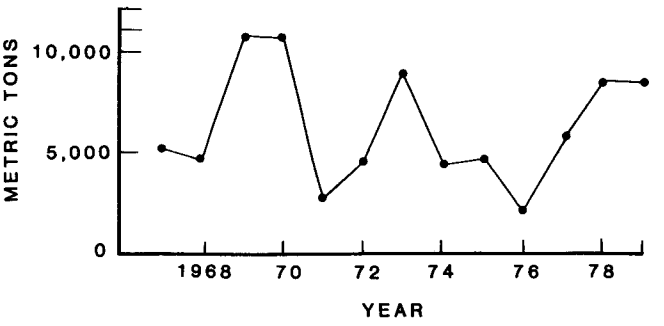

Figure 3. Estimated catch of swordfish in the eastern Pacific Ocean, east of 150°W longitude.

The fishery began sometime before 1908. In the early years catch records for swordfish and striped marlin were compiled as though these fish were the same species. Recognition of their separate status for the purpose of compiling fishery statistics first occurred in 1931 (Clark 1931).

Prior to the mid-1920s there was very little demand for swordfish, and annual landings were low (Fitch 1960). Demand expanded in the second half of the 1920s as markets developed in the northeastern U.S. (Gillespie 1930; Fitch 1960). In response to this demand, California landings increased from about 10 MT in 1925 to over 58 MT in 1927. Between 1927 and

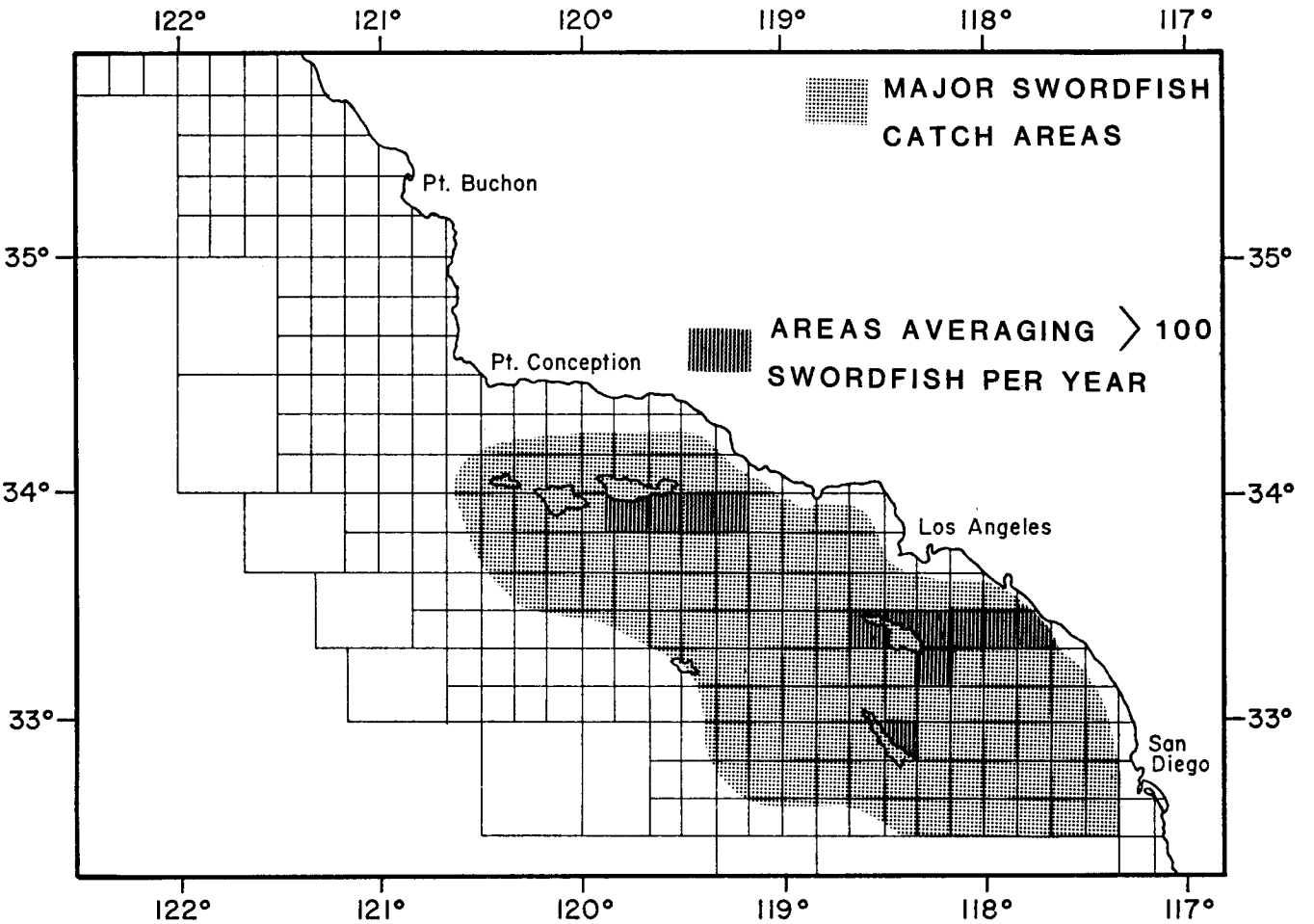

Figure 4. Area of operation, California harpoon fishery for swordfish, 1974-78.

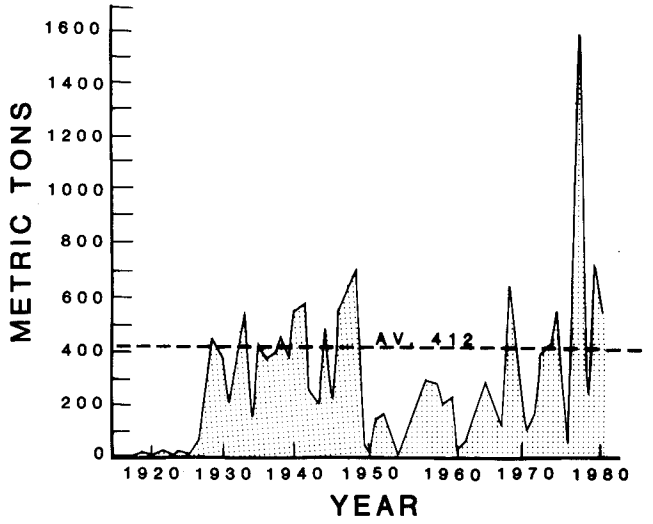

Figure 5. Swordfish landings in California, 1918-80, in metric tons adjusted to round weight (dressed weight plus 30%).

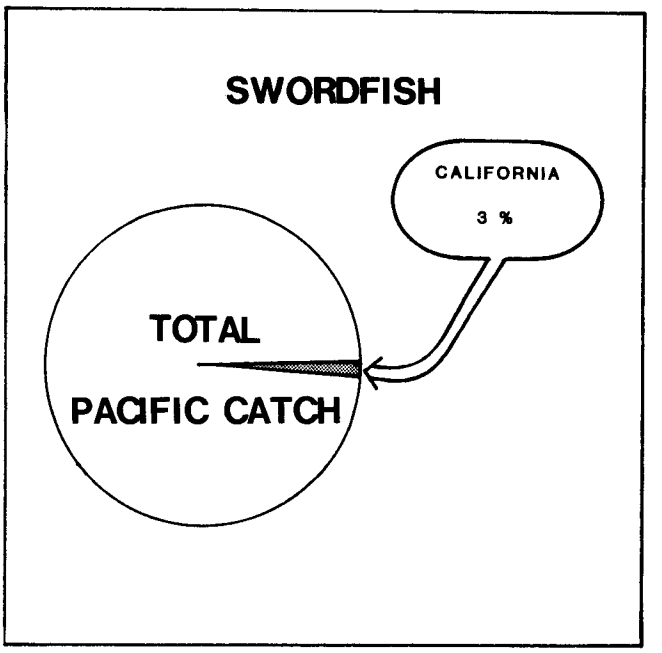

Figure 6. Average California swordfish landings are approximately 3% of the total average Pacific Ocean landings.

1948, landings fluctuated about a gradually increasing trend to a maximum of 622 MT in 1948. Landings declined to 16 MT in 1950, apparently because of a temporary shift in effort from swordfish to albacore. In 1951 the swordfish fishery resumed and has since fluctuated about a gradually increasing trend. In 1978 a maximum catch of 1,751 MT was recorded. The harpoon fishery has generally averaged a little over 400 MT per year since its beginning (Figure 5). This represents only 3% of the total Pacific-wide landings and 9% of the average eastern Pacific landings of swordfish (Figure 6).

Vessels engaged in swordfish harpooning are equipped with several items, some of which are unique to this fishery. Probably the most typical feature of a harpoon vessel is the *plank*. The plank is a scaffolding 20 to 30 feet long extending from the bow. The plank may be raised when the ship is traveling, particularly if seas are rough, or lowered into position when the vessel's crew is actively hunting swordfish. At the end of the plank is a small platform, termed the *pulpit*, on which the harpooner stands when the vessel is running a fish. Most of a fisherman's day is spent trying to see a fish at the water's surface. As an aid in locating fish, a second platform, or crow's nest, high on the vessel's mast is occupied during most of a fishing day. From the crow's nest a person can scan the nearby ocean surface for signs of finning. Binoculars are used to aid in the search. Once the fish is harpooned, line, buoys, and an attached marker-flag are thrown overboard, and the fish is allowed to tire while the vessel searches for more swordfish. It usually takes about 2 hours for a swordfish to become exhausted. Only then can the gear and fish be retrieved. Swordfish are dressed at sea and marketed with fins trimmed and the head removed back to the cleithrum.

The use of airplanes to locate swordfish began in the early 1970s. Between 1974 and 1975, the number of aircraft-assisted boats increased from 25 to 79. The number of planes engaged full-time in the harpoon fishery was approximately 20.[1]

Aircraft not only increase the searching area, but also make it possible to sight swordfish beneath the sea surface. The degree to which an aircraft can assist the searching operations is affected by weather and sea conditions (e.g., low stratus, haze and fog, heavy swell), and it is estimated that suitable conditions for the use of aircraft exist about 50% of the time. Aircraft tend to extend the fishing operation to include days of moderate chop, thereby extending the number of fishable days by an average of 25 per season. The catch per trip is greater for assisted than for unassisted vessels. Records for the 1974-75 season indicate that aircraft-assisted vessels landed about three times more swordfish than unassisted vessels.

The increased use of aircraft resulted in increased competition and conflict between commercial harpoon fishermen who did not use aircraft and those who did. Sportfishermen formed an alliance with harpoon fishermen who did not want the aircraft, and attempted to prohibit its use. In the 1973-74 session, the California legislature delegated the authority to man-

[1] Hooker, C. W. Swordfish, *Xiphias gladius*, and the California fishery. Calif. Dept. Fish and Game, Long Beach, unpublished report, 29 p.

TABLE 1
History of Billfish Regulations

Year	Regulation
1931	Marlin and swordfish included in list of game fish. Sportfishing license required for species on list.
1933	Shipment of marlin meat out of state prohibited.
1935	Harpooning marlin prohibited. (Swordfish may be taken with harpoon and hook and line.)
1937	Selling marlin meat prohibited.
1951	Two swordfish per angler per day.
1971	One marlin per angler per day.
1973-74	Swordfish may be taken by permit only (commercial). Authority given to Fish and Game Commission to regulate commercial swordfish fishing.
1974	Fish and Game Commission adopts commercial swordfish fishing regulations. Logbook required. Notice given that aircraft could not be used after June 28, 1976.
1976	Fish and Game Commission permits use of aircraft for reconnaissance flights. Aircraft may not be used within 5-mile radius of swordfish boat operating aircraft.
1977	Radius extended to 10 miles from boat for aircraft operations.
1979	Swordfish taken incidental to shark gill net fishing may be sold.
1980	Shark gill netting under limited entry and permit system. Swordfish and marlin may be taken as incidental fish in shark drift gill nets. Marlin cannot be sold. Gill net take by quota system, based on harpooned swordfish and recreational catch of marlin. Onboard California Fish and Game observers required on vessels fishing under shark gill net and harpoon permits. (Kapiloff Bill—A.B. 2564).
1982	Permits the use of drift gill nets to take shark and swordfish, limits entry into the fishery, restricts the size and use of gear, closes specific areas for specified time periods to the use of drift gill nets for taking shark and swordfish, continues the additional privilege tax on thresher and bonito shark landings, and also continues the fees for the drift gill net shark/swordfish and harpoon permit. Also sets forth conditions under which the Department of Fish and Game must evaluate the resource. (Beverly Bill—S.B. 1573).

age the harpoon fishery to the California Fish and Game Commission. In 1974, the commission voted to prohibit use of the aircraft, effective June 28, 1976. In November 1976, the restriction was relaxed to allow aircraft to be used outside a 5-mile radius of the fishing boat. In 1977 the limit was increased to 10 miles (Table 1). This permits the use of aircraft to locate fish, but does not allow its use as an aid to harpooning.

The California harpoon fishery is essentially a summer/fall fishery, with the majority of effort expended between June and November. During the seasons when swordfish are not available or are available only in limited numbers, many of the full-time and some part-time swordfish fishermen shift their efforts towards other species or take shoreside jobs. Other species pursued include albacore, *Thunnus alalunga*, (0-120 days per season per boat); rockfish, *Sebastes* spp, (0-65 days per season per boat); and occasionally white sea bass, *Cynoscion nobilis;* halibut, *Paralichthys californicus;* and salmon, *Oncorhynchus* spp. The swordfish harpoon and albacore seasons are nearly coincidental. However, the former is primarily an inshore fishery, while the latter is offshore. Most swordfish fishermen prefer swordfish fishing to albacore fishing and will switch to albacore fishing only when swordfish are unavailable and albacore abundant (Clemens et al. 1965).

Estimates of effort in the California harpoon fishery are unavailable before 1974, at which time a mandatory swordfish permit and logbook system was instituted. There were 397 permits issued in 1974. The number increased 203% to 1,223 in 1979, then decreased in 1980. Of the individuals issued permits (1974-78), an average of 52% actually fished for swordfish, as evidenced by the submission of logbooks and market receipts. Approximately 34% of the individuals issued permits recorded catches of swordfish. The number of swordfish caught by individual permit holders varies considerably. An average of 12% of the active permit holders catch 50% of the swordfish (Table 2).

Drift gill net fishery. The southern California drift gill net fleet targets on pelagic sharks and swordfish in the deeper waters surrounding the California Channel Islands. The drift gill net fleet has undergone a rapid expansion from 15 participating vessels in 1977 to about 200 in 1982.

Drift net fishing operations are conducted during nighttime hours. Until 1982 fleet activities were con-

TABLE 2
Profile of the California Harpoon Swordfish Fishery, 1974-81

Categories	Number by year							
	1974	1975	1976	1977	1978	1979	1980	1981
Permits issued	397	473	387	442	802	1,223	*979 **408	428
Permit holders landing zero fish	236	312	313	274	502	—	220	
Permit holders landing 1-50 fish	135	139	73	149	200	—	648	194
Permit holders landing 51-100 fish	16	12	0	14	53	—	334	3
Permit holders landing >101 fish	10	10	1	5	47	—	13	1

*Prior to September 15
**After September 15 (institution of $150 permit fee)
—Data not available

ducted in the area south of Point Conception to the Mexican border. In the summer of 1982 drift gill net operation began to expand northward to Morro Bay. Currently a small number of vessels are fishing on an exploratory basis as far north as Monterey Bay. All drift gill net operations north of Point Conception are severely limited by sea conditions.

During the late summer and fall, large-mesh drift gill nets become an effective means for landing swordfish. In fact, this gear proved so effective that in October 1981, 3,121 swordfish were landed. This resulted in the closure of the drift gill net fishery, pursuant to California regulations permitting only an "incidentally" caught swordfish to be taken by drift gill net. During September 1982, new regulations were adopted to allow for use of drift gill nets to target on swordfish.

The basic gear for drift gill net operations includes a hydraulically driven spool, or drum, on which the net is rolled. The spool is most often located on the vessel's stern. Since the net is laid out and retrieved over the stern, there is a danger of wrapping the net around the prop. In order to avoid this, a guard railing constructed of some corrosion-resistant material such as galvanized steel tubing is lowered into the water during fishing operations.

The net is constructed of nylon twine usually size 18 or larger. No. 36 twine is sometimes used in the largest mesh nets. The mesh sizes of nets used in this fishery may range from 8 inches to 20 inches stretched. Mesh sizes of 14 and 16 inches seem to be favored. Most nets range from 10 to 20 fathoms in depth and may be as long as 1000 fathoms.

When in use, the drift gill net hangs vertically in the water column, stretched between a buoyant "cork line" on top and a "lead line" on the bottom. The entire net is suspended by a series of floats, attached at intervals of about 10 fathoms. The floats are attached to the cork line via extension lines, usually from 1 to 3 fathoms long. As a result, the net is suspended beneath the surface commensurate with the length of these extensions.

The boat remains attached to the net at one end. Attached to the opposite end of the net is a buoy, on which a strobe light and radar reflector are mounted. Occasionally, the crew may detach the boat from the net and switch to the opposite end. This is done in an effort to keep the drifting net in a straight line, because currents sometimes cause the net to wrap around itself.

California Sport Swordfish Fishery

Rod-and-reel fishermen consider swordfish one of the most desirable big game trophy fish. The Tuna Club (Avalon) has maintained records since 1898 and recorded the first swordfish taken with rod and reel in August 1913 (Tuna Club 1948). Prior to 1971 sportfishermen were permitted to take swordfish by both rod and reel and harpoon. In that year, the Fish and Game Commission declared that swordfish could be taken only by hook and line with a sportfishing license, and that harpoon fishing required a commercial license.

Club records indicate an average (1967-80) annual catch of swordfish by the rod-and-reel fishery of 29 fish, a negligible number compared to total Pacific, eastern Pacific, or commercial California catches. The peak catch (130 fish) was taken in 1978 (Figure 7).

The rod-and-reel fishery for swordfish in California operates between Santa Barbara in the north and 60-Mile Bank (32° 02′N, 118° 12′W) in the south. Within this range most rod-and-reel catches are made in the same areas as harpoon catches. The fishery extends from May through December.

STRIPED MARLIN

Distribution

Striped marlin are distributed throughout the Pacific and Atlantic oceans between 45°N and 45°S latitude. CPUE statistics for the Japanese longline fishery suggest a horseshoe-shaped pattern of high population density in the Pacific (Figure 8). The greatest hook rates in the Pacific are recorded from the area off the southern tip of Baja California, Mexico. High catch rates are also recorded from the central North Pacific and the eastern South Pacific (DeSylva 1974). The center of the high catch rate area off Mexico remains in the same position throughout the year, but expands and contracts seasonally. Its most expanded state

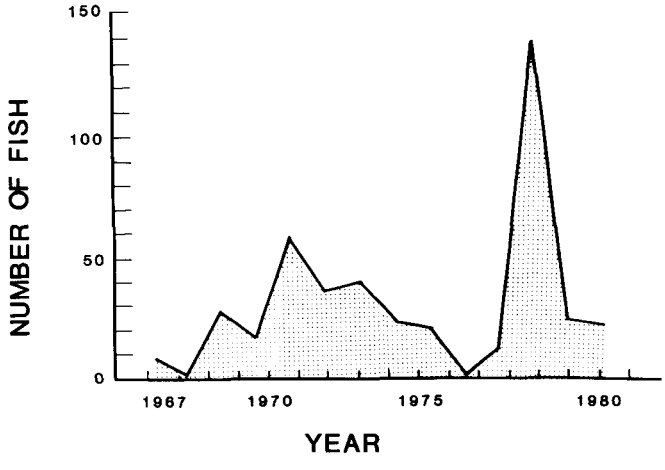

Figure 7. Annual catches of swordfish by the recreational rod-and-reel fishery off California, 1967-80 (PFMC 1981).

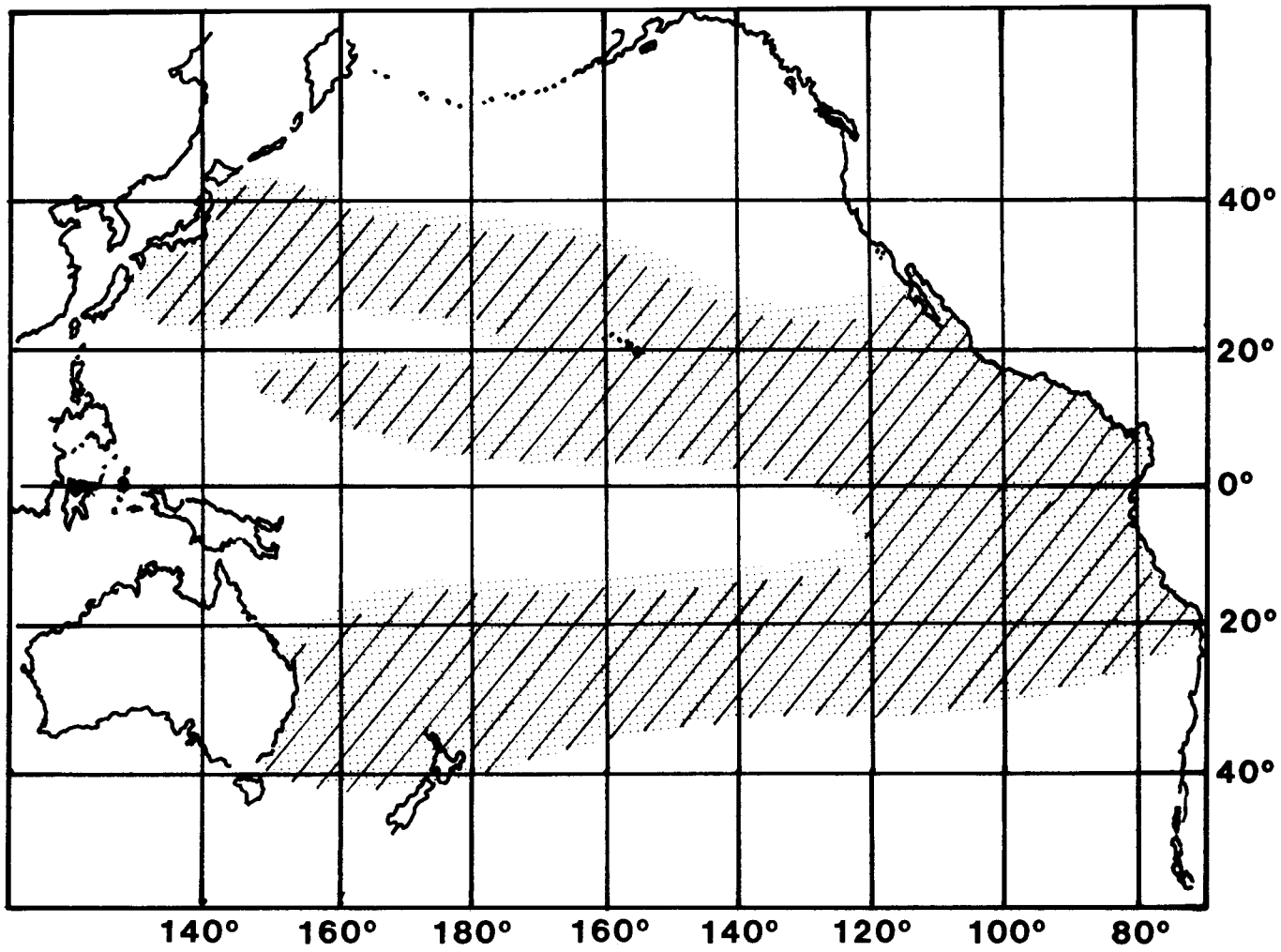

Figure 8. Distribution of high catch rate areas for striped marlin in the Pacific Ocean (Joseph et al. 1974).

occurs during the third quarter of the year, its least in the first quarter (Squire 1974).

Two recoveries of fish tagged off California suggest the possibility of long-range, transoceanic migration by striped marlin in the Pacific Ocean. One tag was recovered 1,500 miles west and one 2,400 miles south of the tagging area. Although these recoveries do not indicate particular migration routes, they do support the hypothesis that the striped marlin is highly migratory. Within the eastern Pacific, limited tag returns also suggest a northward migration along the west coast of Baja California, possibly to waters off California (Squire 1978).

Little is known of the vertical distribution of striped marlin. They are caught near the surface by trolled lines, harpoons, gill nets, and perhaps deeper by longlines. Striped marlin have been caught as deep as 289 m on experimental, vertical longline gear (Saito and Sasaki 1974).

The evidence is insufficient to delineate a particular stock structure for striped marlin in the Pacific. Participants at the 1977 Billfish Stock Assessment Workshop concluded that striped marlin in the Pacific are probably either (1) a single Pacific-wide stock or (2) one of two stocks separated roughly at the equator. Workshop participants concluded that on a Pacific-wide basis the resource is not overexploited and is in good condition. Considering the two-stock theory, participants concluded that the outlook is good for increased yields in the north Pacific stock with modest increases in fishing pressure.

Landings

Striped marlin, together with other billfishes and tunas, are exploited in the Pacific by the longline fleets of Japan, Korea, and Taiwan. In the eastern Pacific, the fishery is primarily a Japanese operation, with some participation by Koreans and Taiwanese in recent years. Pacific-wide landings of striped marlin have ranged from 14,000 MT to 27,000 MT and rep-

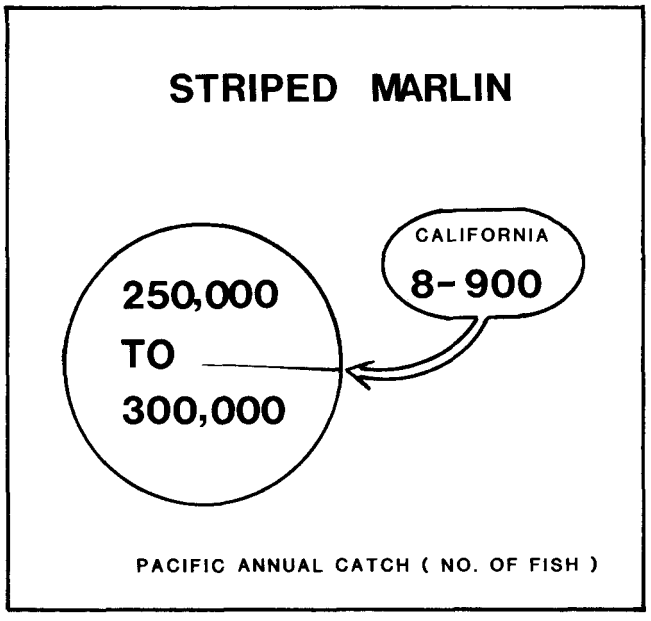

Figure 9. Comparison of the annual average California catch vs annual average Pacific Ocean catch.

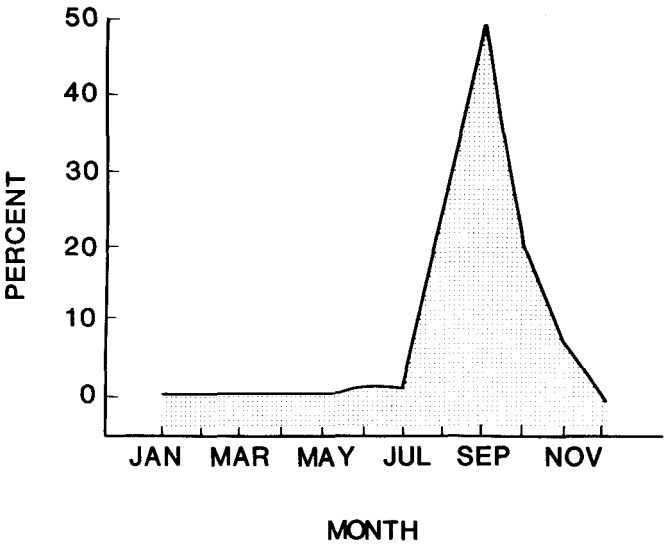

Figure 10. Average monthly distribution of the California catch of striped marlin (1963-79) by the recreational rod-and-reel fishery (PFMC 1981).

resent from 250,000 to 300,000 fish taken annually (Figure 9). The estimated annual landings in the eastern Pacific, east of 150°W longitude, average about 9,000 MT a year, or about 128,000 fish.

California Marlin Sport Fishery

The rod-and-reel fishery is seasonal and extends from July to November. The largest single monthly catches are usually made in September (Figure 10). Since 1941, most sport-caught marlin have been weighed at the docks of three major billfishing clubs: The Tuna Club, Avalon; The Balboa Angling Club, Newport; and The Marlin Club, San Diego. An estimated 90% of the total catch is weighed at these clubs. There is some duplication, because a member of one club may weigh his catch at another club's dock, nearer where the catch was made; subsequently, the catch may be listed by both clubs.

Club records indicate considerable fluctuation in annual catch, with an average (1941-80) of 751 striped marlin per year (Figure 11). In addition, a number of striped marlin are tagged and released, or released without tagging.

An average (1963-67) 11% of striped marlin landed in California by the rod-and-reel fleet was taken from Mexican waters. An average of 44% of the marlin landed at San Diego, and less than 1% of those landed at Los Angeles, were taken from Mexican waters.

The major portion of the marlin rod-and-reel fleet in southern California is berthed in the greater Los

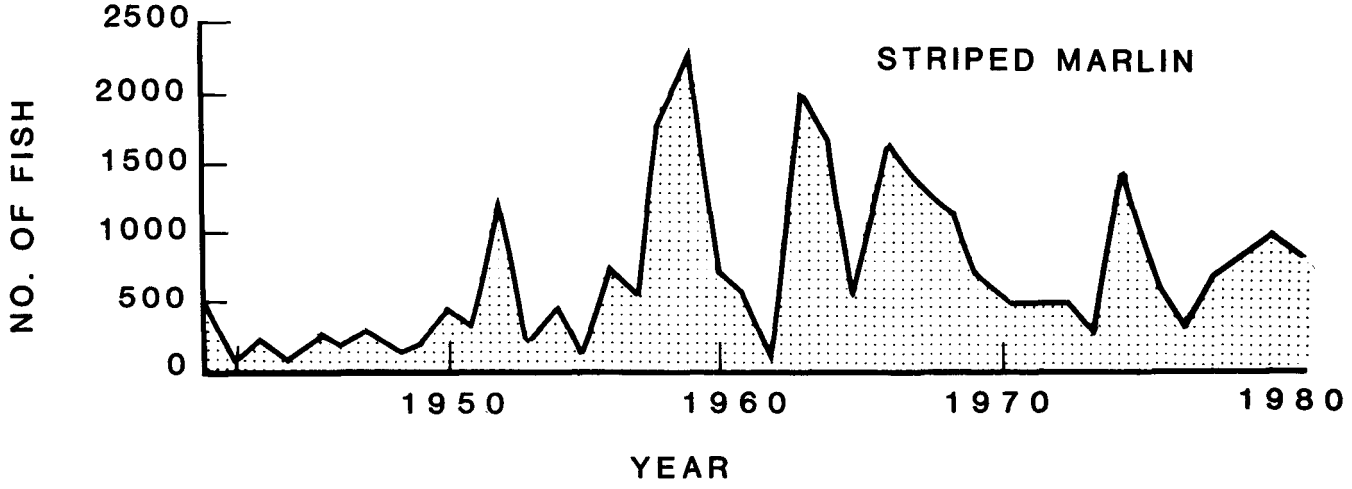

Figure 11. California striped marlin catch, 1941-80, in numbers of fish reported by major billfish clubs (PFMC 1981).

Angeles area (Dana Point to Marina del Rey, California) and at San Diego. Catches are made in waters between the northern Channel Islands off California and the Coronado Islands, Mexico. In some years the catch is uniformly distributed over the area. In other years the catch may be centered either off San Diego in the south, or near Catalina Island in the Catalina Channel to the north. Club records indicate that rod-and-reel vessels tend to fish water nearest to their home ports.

HISTORY OF MANAGEMENT

Management of California's swordfish resource has never involved population concepts such as maximum sustainable yield. The state's commercial swordfish fleet has never ventured beyond the protected nearshore waters off southern California. As a result, the limited activities of this fleet pose no threat to the stability of a cosmopolitan high-seas stock like swordfish or striped marlin.

But management involves more than population statistics. Mediation of local conflicts between user groups, based on social or economic considerations, may dominate the development of any management regime. Such has been the history of billfish management in California. The state's management policies have historically reflected adjustments for the transfer and allocation of fish from one user group to another. The latest management legislation is no exception (Table 1).

Regulatory control over the sport fishery for striped marlin and the commercial harpoon fishery for swordfish is currently under the California Fish and Game Commission, a body appointed by the governor. Regulatory control over the use of drift gill nets to take swordfish remains in the state legislature. The Department of Fish and Game serves as a research and enforcement arm under the executive branch of state government. Its function is to collect information needed by the regulatory bodies to enable them to make management decisions. The needed information includes biological, social, and economic concerns. The department makes recommendations concerning management to the regulatory bodies.

In response to requirements of the U.S. Magnuson Fishery Conservation and Management Act of 1976, the Pacific Fishery Management Council initiated the development of a Fishery Management Plan (FMP) in 1979 for billfish and oceanic sharks within the West Coast Fishery Conservation Zone, 3-200 miles offshore. In late 1981 the council's Plan Development Team presented a draft FMP for the billfish and oceanic sharks for council review and action. The FMP presented background material on the history, biology, and socioeconomic factors influencing the fisheries, and offered a number of management options for consideration. The council noted that only a small percentage of the total Pacific billfish harvest was taken in waters under the council's jurisdiction and that only a fraction of the stock biomass occurred in the U.S. Fishery Conservation Zone. It further noted that, because of the highly migratory, transboundary nature of the billfish, stock management can only be accomplished through international cooperation. Additionally, the council noted that all participants in this fishery were California residents. Consequently, the council elected to delay further development of a federal plan at this time.

LITERATURE CITED

Clark, F. N. 1931. Common and scientific names of fishes, crustaceans and mollusks. *In* The commercial fish catch of California for the years 1930-1934, inclusive. Calif. Div. Fish Game, Fish Bull. 44.

Clemens, H. B., and W. L. Craig. 1965. An analysis of California's albacore fishery. Calif. Dept. Fish Game, Fish Bull. 128.

DeSylva, D. P. 1974. A review of the world sport fishery for billfishes (Istiophoridae and Xiphiidae). *In* R.S. Shomura and F. Williams (eds.), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972. Part 2: review and contributed papers. NOAA Tech. Rept., NMFS SSRF-675:12-33.

Fitch, J. E. 1960. Swordfish, *Xiphias gladius*. *In* Calif. Dept. Fish and Game. California ocean fisheries resources to the year 1960. State Printer, Sacramento, p. 63-64.

Gillespie, A. 1930. Swordfish. *In* The commercial fish catch of California for the year 1928. Calif. Div. Fish and Game, Fish Bull. 20:59-61.

Joseph, J., W. Klawe, and C. Orange. 1974. A review of the longline fishery for billfish in the eastern Pacific Ocean. *In* Proceedings of the International Billfish Symposium. Kailua-Kona, Hawaii, 9-12 August 1972, Part 2, review and contributed papers. NOAA Tech. Rept., NMFS SSRF-675, 335 p.

PFMC, Pacific Fishery Management Council, 1981. Fishery Management Plan for Pac. coast billfish and oceanic shark fisheries. (Draft)

Saito, S., and S. Sasaki. 1974. Swimming depth of large-sized albacore in the South Pacific Ocean—II vertical distribution of albacore catch by an improved vertical longline. Bull. Jap. Soc. of Scientific Fisheries 40(7):643-649.

Shomura, R. S., (ed.) 1980. Summary report of the billfish stock assessment workshop—Pacific resources. NOAA/NMFS Southwest Fisheries Center. Adm. Rept. No. 51-1, 14 p.

Squire, J. L. 1974. Catch distribution and related sea surface temperature for striped marlin, *Tetrapturus audax*, caught off San Diego. *In* Proc. of the Int. Billfish Symp. Kailua-Kona, Hawaii, 9-12 Aug. 1972, Part 2, review and contributed papers. NOAA Tech. Rept. NMFS SSRF-675, 335 p.

———. 1978. 1978 Newsletter—Cooperative Marine Game Fish Tagging Program—1977 results, and Pacific Billfish Angler Survey—1977 results, . NOAA-NMFS Southwest Fisheries Center, Adm. Rept. L. J. No. 78-4, 16 p.

Tuna Club. 1948. The history of the Tuna Club, Avalon, Santa Catalina Island, California. Avalon, 187 p.