

## Management Of California's Nearshore Fishes

Richard D. Methot, Jr.

An effective management regime must be able to balance conflicting interests and evolve with changing circumstances. Conflict over the harvest of a fishery resource occurs among commercial fishermen using different gears, recreational fishermen, and environmentalists with non-consumptive interests in the resource. The conflicts rarely occur on the seas. The arenas for confrontation are the news media, legislative lobbies, fishery councils, and courts. Jurisdictional conflicts and limitations also occur. These may be interstate, international, or between state and federal agencies.

Neither the stock nor the fishery stands still while managers attempt to resolve user conflicts and protect the health of the resource. Management measures designed to regulate yesterday's problems may be inadequate or inappropriate for regulation of tomorrow's fishery. Fishing technologies change. Additionally, stock abundance and availability typically fluctuate due to natural causes. During periods of decreasing stock levels public pressure to restrict the fishery usually increases. If the decline is actually due to natural causes then by the time new regulations come into force the stock may have started its natural recovery. In this case the regulations would appear successful but their true effect would be difficult to evaluate.

Management of a resource implies regulation. However, a fishery may be regulated without attempting comprehensive management. A regulation may be as specific as an area closure to reduce conflicts between purse-seine and gill-net fishermen. On the other hand, a comprehensive management plan may include a determination of optimum yield and a scheme to harvest that yield efficiently. The data requirements for development of a comprehensive management plan are daunting. Most management discussed

here falls between simple regulations and full management plans.

Several of California's nearshore species have long histories of exploitation by commercial and recreational fishermen and of regulation by the State of California through its legislature and its Fish and Game Commission. Four of these species will be considered here: chub (Pacific mackerel (*Scomber japonicus*), Pacific bonito (*Sarda chiliensis*), California halibut (*Paralichthys californicus*), and white seabass (*Atractoscion nobilis*). Their management histories will be described briefly. The regulatory measures enacted to preserve these resources and equitably distribute the yields will be emphasized.

Catch statistics presented here have been collected and summarized by the California Department of Fish and Game (CDFG). Commercial and partyboat (commercial passenger fishery vessel—CPFV) landings through 1969 are excellently summarized in Frey (1971). Data from 1970 through 1976 have been published annually. Data since 1976 are not yet published and data for 1980 to the present are preliminary (R. Collins, pers. comm.). Catches by independent sport fishermen have been estimated by Wine (1978, 1979a, 1979b, 1982).

### Chub (Pacific) Mackerel

Chub (Pacific) mackerel are one of southern California's "wetfish" that are harvested commercially by purse seine. Although fresh and smoked chub mackerel are good to eat, these fish are not prized by sport fishermen. Additionally, a school of mackerel can be a nuisance to a CPFV trying to target on more desirable species. Chub mackerel attract effort at piers and jetties, particularly from some ethnic groups. In 1981 it was the most common species

landed by private sport fishermen (Wine 1982). The total sport harvest is very small compared to the commercial harvest and only the commercial harvest is regulated. The biology and population dynamics of this species have received extensive study (e.g., Parrish and MacCall 1978).

The history of the chub (Pacific) mackerel population is characterized by a long decline and a recent recovery (Fig. 1). The commercial fishery expanded during the 1920s and peaked at 73,000 tons in 1935. Catches declined during the 1940s and, by 1958 to 1964, the average catch in California was 18,000 tons. The CDFG expressed concern to the California Assembly in 1951 but no action was taken.

During 1965 to 1970, catches declined further, to less than 3000 tons annually, and concern increased for the health of the resource. In 1968, legislation was introduced to establish a moratorium on commercial fishing, but it was not until August 1970 that a two-year moratorium was established on the commercial chub mackerel fishery. To reduce the impact on other fisheries, each load of "wetfish" was allowed to contain 18% by weight as incidental catch of chub mackerel. Two years later, the moratorium was extended indefinitely with provisions to allow a fishery to begin when the stock recovered. The moratorium would remain in effect until the spawning stock level was over

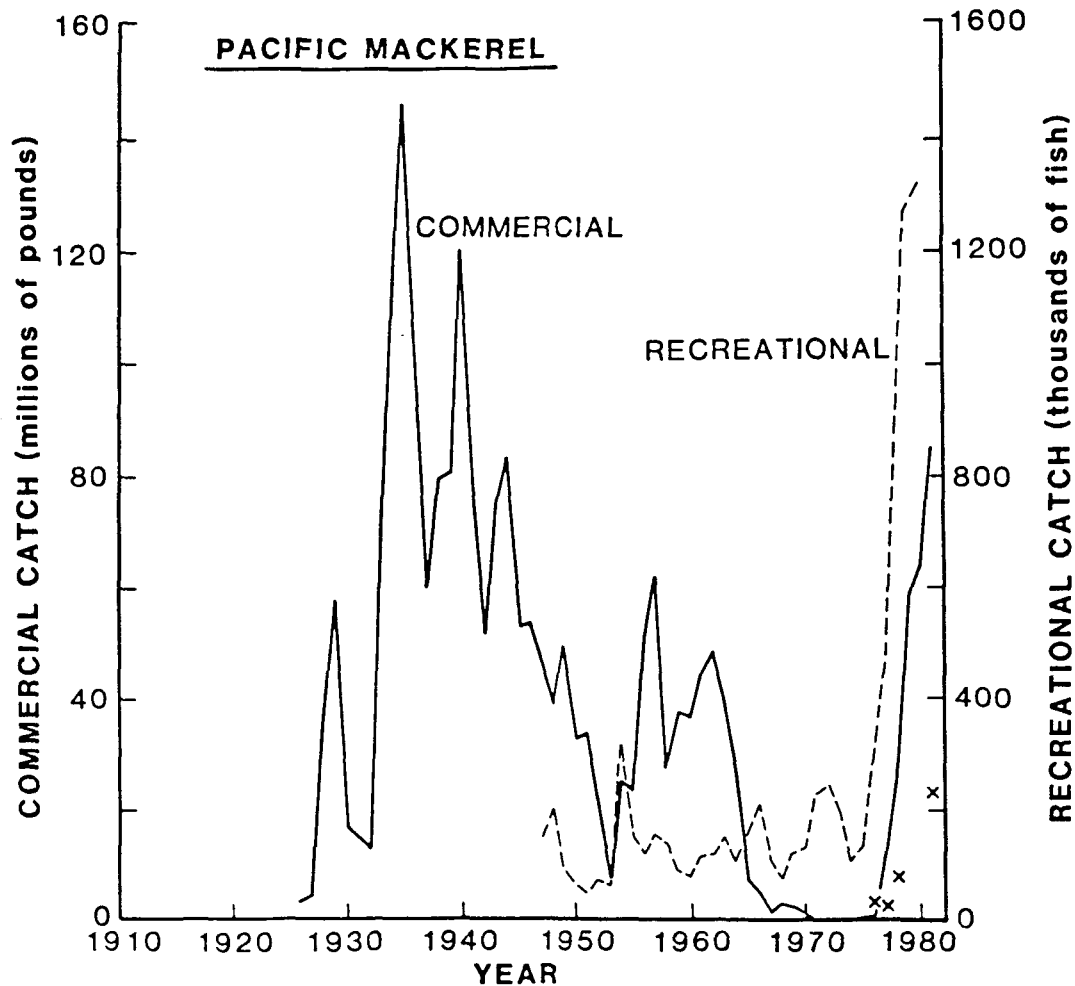


Figure 1. History of the chub (Pacific) mackerel (*Scomber japonicus*) fisheries. The solid line is the total harvest by commercial fishermen. The dashed line is the harvest by commercial passenger fishing vessels. The X's are harvests by independent sport fishermen.

10,000 tons. The allowable quota was set at 20% of the spawning stock over 10,000 tons and 30% of the spawning stock over 20,000 tons.

During the mid-1970s, large numbers of chub (Pacific) mackerel were found schooling with jack mackerel. Commercial "wetfish" fishermen complained that compliance with the 18% incidental catch tolerance was at best difficult and probably unnecessary. In June, 1977, urgent legislation temporarily increased the tolerance factor to permit continued fishing for jack mackerel without capturing illegal quantities of chub mackerel. CDFG biologists determined that the stock level was above the cut-off point and, in January, 1978, the first chub mackerel quota of 5000 tons was established for the 1977-1978 fishing season. This quota was harvested and, in July, 1978, new legislation changed the quota formula to one based on total stock rather than spawning stock (thus increasing the 1977-1978 quota from 5000 to 9300 tons). It also gave the Director of CDFG more discretion in setting the incidental catch tolerance factors and in adjusting quotas as new information became available.

The 1978-1979 quota was set at 14,000 tons and later raised to 18,000 tons based on new biological data. The Director set various trip limits and other restrictions to distribute this quota over as long a period as possible. The 1978 legislation was set to expire in 1981 and, in the summer of 1980, the California Assembly enacted Assembly Bill 2194 which defined the fishing season, the limits of the stock, and the quota formula (including a moratorium when the stock level is below 20,000 tons). It directed the CDFG to determine the stock level, set the quota, monitor the catch, and establish incidental catch tolerance factors after the quota has been harvested.

In retrospect it seems that the original legislation in 1970 and 1972 was close to the mark. By establishing a moratorium and limiting catches during the early stages of the recovery, it probably allowed the resource to recover to a sufficient level from which it could explode to the high abundance of 1979-1980. The major shortcoming of the 1970-1972 legislation seems to be that it did not give the Director of CDFG sufficient flexibility to adjust incidental catch allowances during the transition period when Pacific mackerel were increasing in abundance. A similar situation could soon arise with another

species, Pacific sardine (*Sardinops sagax*), that has been at low abundance and protected by a moratorium for many years. In recent years their incidence in loads of other "wetfish" has greatly increased. If the sardine increase substantially in abundance, the chub (Pacific) mackerel experience will provide a useful precedent. Recovery of a resource could easily be "nipped in the bud" if too large a fishery is allowed too soon.

It is interesting to note that the management guidelines established by the California Assembly differ greatly from the optimum yield guidelines specified in the Magnuson Fishery Conservation and Management Act of 1976. The goal of the Assembly Bill 2194, in 1980, was ". . . that [chub] mackerel be maintained at a total population above 20,000 tons in specified waters" and dictated a quota formula to accomplish this goal. The biological and economic data required to achieve that goal are much fewer than those required to harvest the stock optimally. Optimality is a difficult state to define for a highly fluctuating resource. The goal defined by the California Assembly is both pragmatic and realistic.

The chub (Pacific) mackerel resource and its management regime seem to be healthy. The stock is relatively abundant and a quota formula is in effect to prevent overfishing. The commercial fishery is conducted primarily by the old and rather stable "wetfish" fleet so great pressure to expand the fishery is not anticipated.

The potential future trouble spots are few. Should the Mexican fishery for chub (Pacific) mackerel greatly increase, an international team of fisheries scientists probably should be established to define better the stock structure and determine to what extent the two fisheries compete for the same resource. A resurgence of sardines and attendant incidental catch in the chub mackerel fishery could lead to legal conflicts. Finally, the meteoric rise in this stock's abundance could be followed by an equally rapid natural demise. Assembly bill 2194 makes no explicit mention of natural stock variability. Fisheries managers and commercial fishermen should not be blamed if the stock level does not remain above 20,000 tons.

### Pacific Bonito

A commercial fishery for bonito has existed throughout this century but large commercial landings did not occur until 1966 when market

demand increased. Bonito are fished by local "wetfish" seiners and by large tuna seiners fishing along southern Baja California after tuna fishing trips. Bonito have occasionally been a large component of the recreational fishery but this catch is much smaller than the commercial

catch. In 1981, local purse seiners harvested 10.8 million lbs., U.S. tuna purse seiners harvested 5.7 million lbs. off Baja California, the CPFV fleet landed 0.99 million lbs., and the independent sport fishermen landed 0.26 million lbs.

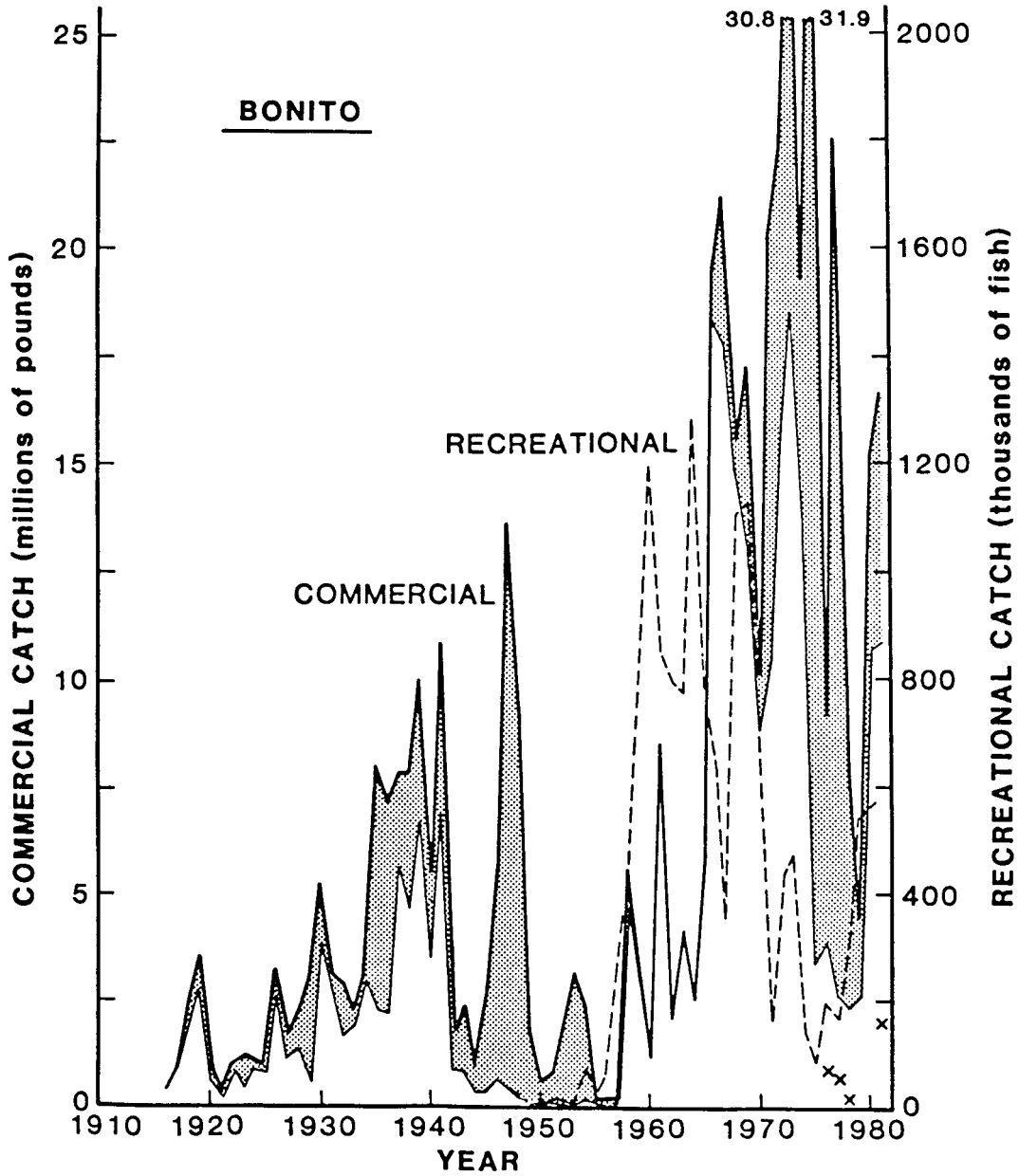


Figure 2. History of the Pacific bonito (*Sarda chiliensis*) fisheries. The solid line is the total harvest by commercial fishermen. The dashed line is the harvest by commercial passenger fishing vessels. The X's are harvests by independent sport fishermen. The shaded region indicates the portion of the U.S. commercial harvest made in Mexican waters.

Collins et al (1980) identified two segments of the bonito stock. The northern segment is composed of young fish that remain in southern California waters through their first spawning season. These small fish support the U.S. recreational fishery and were increasingly exploited by the local commercial fishery after 1975. The southern segment is composed primarily of larger fish that migrate annually from southern Baja California into U.S. waters. When available in U.S. waters, these fish attract the commercial fishery.

There are two sorts of fluctuations in the landings of bonito: total landings and fractions of landings that occur in U.S. waters. Total landings have ranged from four to 32 million lbs. since expansion of the commercial market in 1966, and were greatest during 1973-1975 (Fig. 2). The transboundary distribution of the catch has fluctuated even more. Less than 10% of the commercial catch came from U.S. waters during the years 1946 to 1954. Greater than 98% came from U.S. waters during 1959 to 1965. Since 1971, the U.S. fraction has fluctuated between 11 and 73%. The recreational catch and catch-per-unit-of-effort in U.S. waters have fluctuated similarly to the fluctuations in the U.S. fraction of the commercial catch (Collins et al 1980).

Large commercial catches in U.S. waters probably are dependent on the availability of fish from the southern segment. It seems that the extent of the annual migration of the southern segment is influenced by ocean temperature. When the ocean is warm (e.g., 1958 to 1960) a larger fraction of the southern segment moves into U.S. waters. This variable migration of the bulk of the population will complicate evaluation of management of this species. Even with effective management, there will be occasional periods of low availability in U.S. waters that may persist for several years.

The bonito fisheries were substantially unregulated during the years of expansion. In response to declining southern California catches during the mid-1970s, and especially to a lack of large fish, a state-federal team of fisheries scientists was assembled to evaluate management options. According to the team (Collins et al 1980):

The overall goal of bonito management is to achieve an optimal long-term balance among the following specific objectives:

1. Ensure the reestablishment and maintenance of bonito in southern California,
2. Enhance the recreational catch of bonito in southern California,
3. Enhance the long-term yield from the U.S. commercial fishery, and
4. Reduce conflicts between recreational and commercial fishermen.

The team studied the population dynamics of bonito and considered six management options. Three of these options—area closures, season closures, and revision of U.S. yellowfin tuna regulations—were rejected by the team as ineffective. Area and season closures are ineffective because of the variable timing and location of the annual appearance of bonito in southern California. Revision of the tuna regulation was considered because bonito are often harvested along Baja California to top-off tuna loads. However, the team's analysis indicated that most of this top-off was not due to efforts to increase the allowable incidental catch of yellowfin tuna during its closed season. The team concluded that bonito were being harvested for their own market value, and a change in the yellowfin regulations would have little effect on bonito harvest at the end of yellowfin fishing trips.

The team recommended three options—catch quota for the commercial fishery, size limit in the commercial fishery, and a bag limit for the recreational fishery. Catch quotas were recommended to reduce fishing mortality and improve the status of the southern California segment of the stock. An earlier population model also indicated that bonito were being exploited at or beyond the level of maximum sustainable yield (MacCall, Stauffer, and Troadec 1976). A size limit of five lbs. or 24 inches was recommended for the commercial fishery. This would allow the fish to spawn at least once before entering the fishery and would reduce direct competition between commercial and recreational fishermen for the smaller fish. The team also considered a size limit of three lbs. This limit would have resulted in greater short-term yields but a severe reduction in the spawning stock and consequent long-term yields. Additionally, fish are near the size of three lbs. during the fishing season so enforcement problems were anticipated. Thus

the team's preference for a five lb. size limit was based on both biological and practical considerations. A size limit on the recreational fishery was considered unnecessary because of the small magnitude of the recreational harvest and impractical because of the small size of fish typically landed by sport fishermen. Instead the team recommended a recreational bag limit, especially during years of low abundance.

In 1980, the California Legislature enacted a bill that established a size limit of five lbs. or 24 inches on the catches of the commercial and recreational fishery. No catch quota was established. Although the team's analysis did not indicate the need for a size limit on the recreational fishery, political considerations required regulations that have roughly equal impact on all resource users. Both fisheries were given tolerances for undersized fish. The commercial purse seiners were allowed 18% by weight of their load to be undersized fish. The recreational allowance was two undersized fish during winter months and five undersized fish during the summer when young of the year fish are common. Because the daily bag limit is 10 fish, the winter tolerance is 20% by number when full limits are landed.

The size-limit legislation is set to expire in 1985. During the intervening time, the effect of the regulation will be monitored. The eventual question will be: Has the resource recovered? Evaluation of that question with only five years of information will be difficult. Year-to-year variability in the portion of the stock available to U.S. fishermen is great. Changes in oceanographic conditions could bring a large portion of the southern segment into U.S. waters and confound analysis of changes in the local segment. More biological information on the relation between the northern and southern segments of the stock is desperately needed and difficult to obtain. With more data and a concerted analytical effort, there is a chance that the southern segment's migration could be predicted from oceanographic conditions.

The establishment of the size limit should greatly reduce the commercial fishery's harvest of small fish. This may improve recreational fishing in U.S. waters. In 1982, the Mexican government did not grant licenses for U.S. fishermen to harvest bonito in Mexican waters. This was primarily because of a dispute over tuna fishing. The results of the exclusion could

be beneficial if this fishing effort disappears, or detrimental if it shifts to U.S. waters. Most of the excluded vessels are long-range tuna seiners that are unlikely to fish locally. Further declines in bonito abundance should trigger reconsideration of the state-federal team's (Collins et al 1980) recommendation that a quota formula—perhaps similar to that for chub mackerel—be established. However, until information on the stock in Mexican waters and the Mexican harvest are incorporated in the analysis, we can only regulate the U.S. fishery. Management of the total resource requires biological information and cooperation with the Mexican government.

### California Halibut

The California halibut has supported a commercial and recreational fishery throughout this century. The otter trawl was the traditional commercial fishing gear but entangling nets recently have dominated the fishery. The recreational fishery is conducted with hook and line using rather specialized techniques so incidental catch of other species is low. Little is known about the life history and population dynamics of this species.

Commercial landings of halibut in California have fluctuated greatly (Fig. 3). Periods of relatively high catch occurred during 1916 to 1922, 1944 to 1949, 1962 to 1968, and 1979 through 1982. The amplitude of these high catches declined during 1916 to 1950. The trend is not evident since 1950. The high catch of 1981, 1.2 million pounds, is similar to the high catch of 1964 to 1965, 1.1 million pounds. Additionally, the low catch of 1969 to 1974, about 0.3 million pounds is similar to the minimum during 1958 to 1960.

Recreational landings data from CPFV are available since 1947 and indicate the same peaks and valleys as the commercial landings until the early 1970s (Fig. 3). The recreational catch was about 40% of the commercial catch during the period from 1947 to 1970 (assuming four lbs. per fish; Karpov 1981). The recreational catch declined substantially since 1970 and, by 1976, the commercial catch increased to about eight times the recreational catch. During this period independent sport fishermen increased their proportion of the sport catch. CPFVs cannot profitably target on scarce halibut because the incidental catch of other species is low.

Two regulations historically have affected the commercial halibut fishery: exclusion of trawls

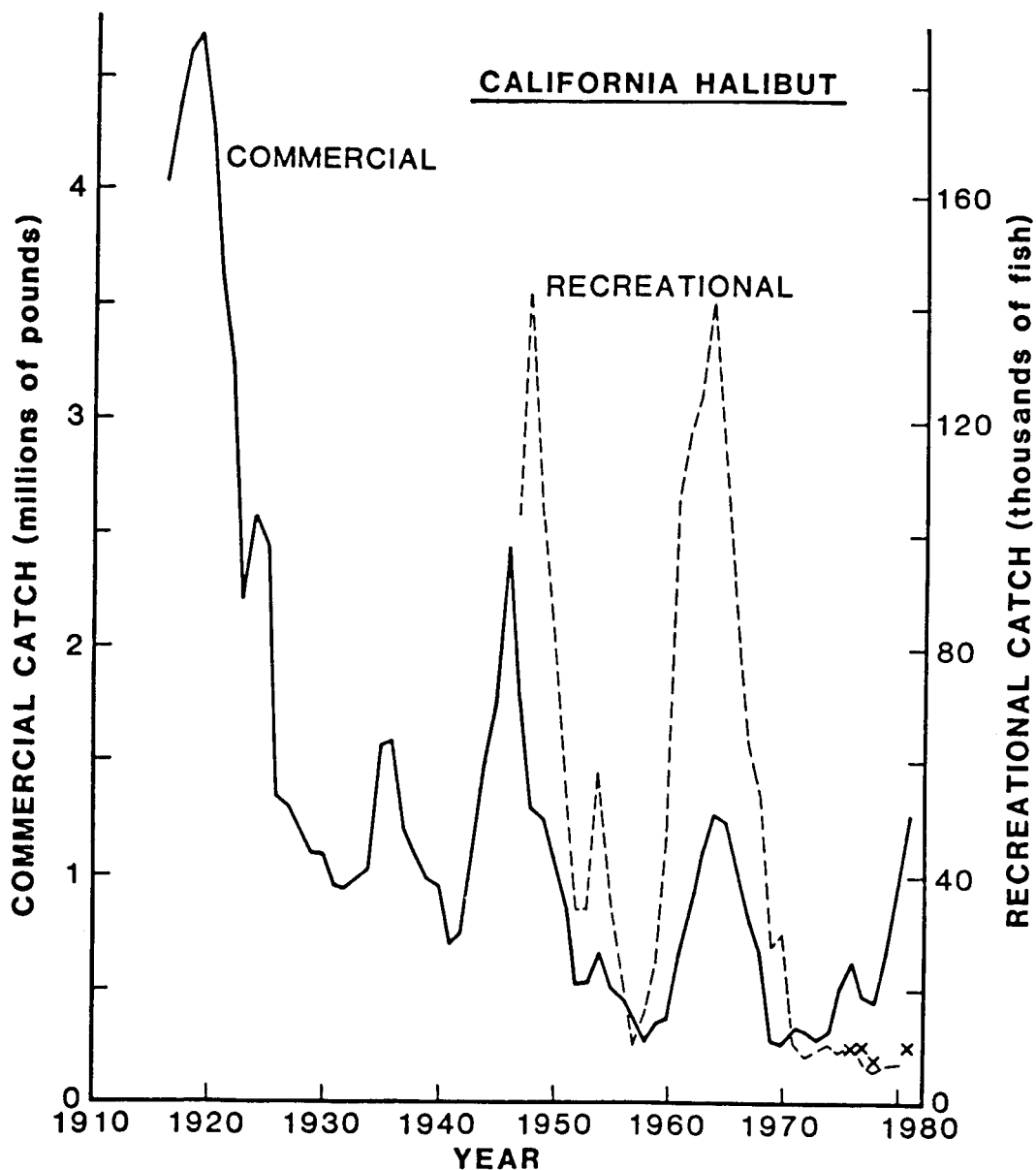


Figure 3. History of the California halibut (*Paralichthys californicus*) fisheries. The solid line is the total harvest by commercial fishermen. The dashed line is the harvest by commercial passenger fishing vessels. The X's are harvests by independent sport fishermen.

from the region nearshore of three miles and a four-pound size limit. Because the preferred habitat of halibut is shallow sandy bottoms, much of the stock was unavailable to the trawl fishery. During the low catch period of the late

1960s, there was interest in increasing short-term catches while allowing gradual improvement of the resource. In 1971, the California Assembly attempted to improve catches by establishing a special inshore halibut trawl ground

that extended to one mile off shore in the Santa Barbara area.

To allow gradual improvement of the stock, special regulations were placed on trawling in this region. The season was closed from March 15 to June 15 and a minimum mesh size of 7.5 inches was required in the cod end of the trawls. The closed season was designed to protect the nearshore fish during the spawning season. The mesh-size limitation was designed to permit undersized fish to escape through the mesh (Schott 1975). At the same time, a 22-inch size limit was established for the recreational fishery to balance the regulatory impact between the commercial and recreational fisheries. The biological impact of opening the nearshore region to trawling was balanced against the increased protection of the young fish.

The legislation that established the halibut trawl grounds also required that the effect of the legislation be evaluated. Schott (1977) found that the mesh-size regulation was effective in greatly reducing retention by trawls of fish less than 22 inches (about four pounds). Compliance with the recreational size limit initially was poor but now is improving. In 1975 to 1976 greater than 43% of the halibut landed by the independent sport fishery were smaller than legal size but, by 1981, this figure had declined to less than 29% (Wine 1979b, 1982). Although an attempt to detect a recovery in the stock was inconclusive (Karpov 1981), the commercial catch increased greatly in 1981 after the report was prepared.

The current status of the California halibut resource is uncertain. It may be true that the increased protection of the small fish is responsible for the recent increase in commercial catch. It is equally possible that another natural cycle in halibut abundance is underway, similar to the cycles that seem to have occurred over several decades (Fig. 3). A third possibility is that the shift from trawls to gill nets (see below) has changed greatly the availability of the stock to fishery. The failure of the recreational fishery to recover may also indicate that the gear availability change is the important factor. However, the recreational fishery is now under control of a size limit that certainly is reducing catch and may be reducing interest and effort. Proper evaluation of the effect of the halibut trawl-ground legislation will require monitoring the stock throughout the present cycle of catch, perhaps longer.

During the 1970s, there was a complete change in the relative importance of otter trawls and entangling nets in the halibut commercial fishery. In 1971, 83% of the commercial catch was by otter trawl. In 1981, this proportion had decreased to 21%. Set gill nets and trammel nets had become the dominant commercial fishing gear. This shift probably has two major causes. One likely cause is the set of restrictions placed on the commercial trawl fishery (area closures, season closure in the special trawl ground). The other is the high cost of trawling relative to fishing with entangling nets from small boats. Entangling nets are effective and efficient and their current use for halibut is largely unregulated. Less than 10 years after the California Assembly enacted the halibut trawl ground legislation to improve management of the halibut fishery, the nature of that fishery has changed in such a way as to nullify the effectiveness of the regulations. Information on the fishing power of entangling nets of various mesh sizes will be required before equivalent regulations can be established.

#### White Seabass

The white seabass has probably the longest and most complicated history of management of any marine species in California (Collins 1981, Vojkovich and Reed Ms.). The commercial and recreational fisheries for seabass are 100 years old; the first regulations were enacted in 1931. Commercial fishermen have used purse seines, various entangling nets, and hook and line to harvest seabass. The early fishery was conducted primarily with purse seines but this became uneconomical as abundance declined. Purse-seine fishing for white seabass was prohibited in 1939, and today's fishery is primarily by set gill net.

The commercial catch of white seabass declined steadily during the 1920s and 1930s (Fig. 4). San Francisco was the principal early port of landing but, as catches declined, the northward limit of catches retreated southward. There was no further decline during the next two decades. Then, during the warm-water period of 1958 to 1960, there was a tremendous increase in the catch in U.S. waters. The entire population apparently shifted northwards, because catches in Mexico were at record low levels and white seabass were captured as far north as Alaska. Immediately following the warm-water period, the catch in U.S. waters returned to its former



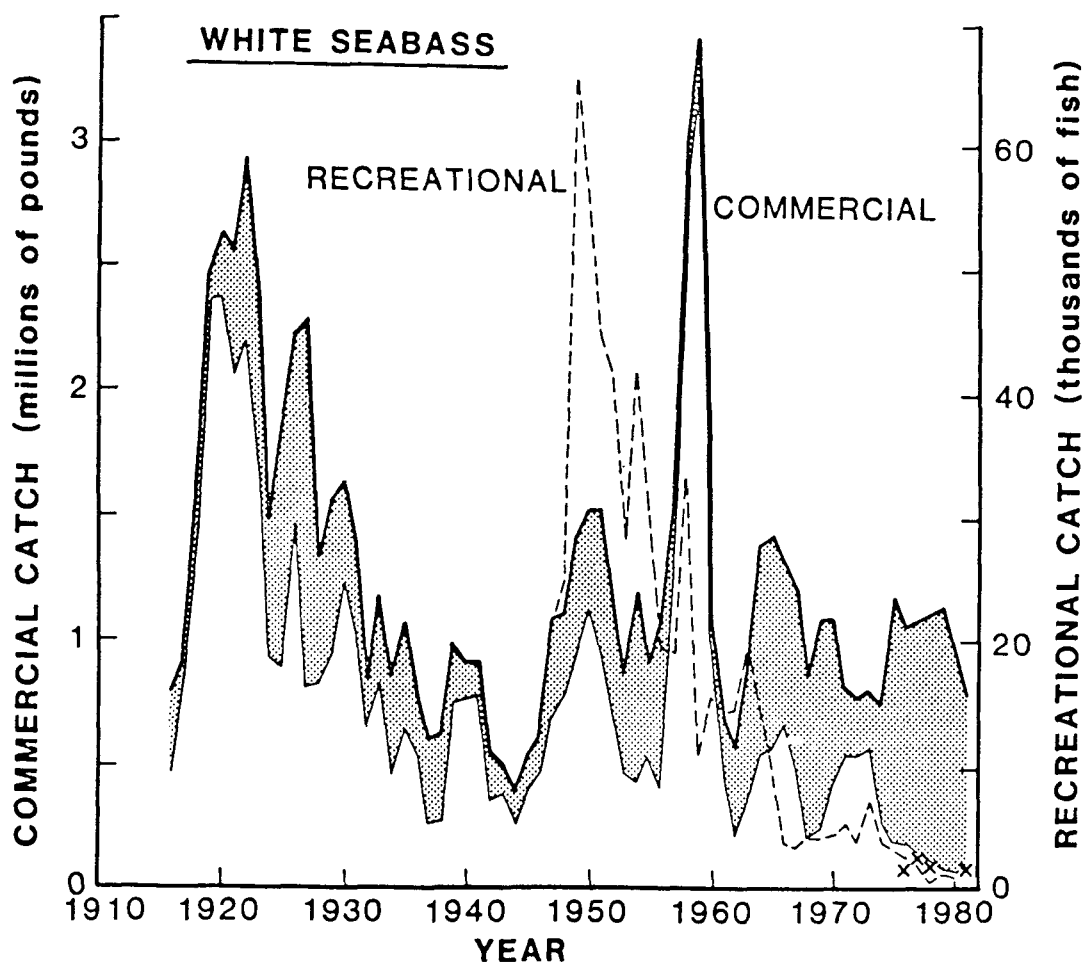


Figure 4. History of the white seabass (*Atractoscion nobilis*) fisheries. The solid line is the total harvest by commercial fishermen. The dashed line is the harvest by commercial passenger fishing vessels. The X's are harvests by independent sport fishermen. The shaded region indicates the portion of the U.S. commercial harvest made in Mexican waters.

level, then continued to decline slowly during the 1960s. The commercial harvest by U.S. fishermen in Mexican waters exceeded their catch in U.S. waters during the 1960s and 1970s. The catch in U.S. waters declined steadily during the late 1970s and is now at the lowest level since record-keeping began.

The recreational fishery developed later than the commercial fishery and peaked in the late 1940s (Fig. 4). Abundance probably was relatively high at that time because the commercial fishery also had a minor peak during the late 1940s. Recreational catches declined precipitously after the peak. There was little increase in recreational catch during the warm-water years. Catches are at an extremely low level today.

Management of the white seabass has a long history. Several types of restrictions have been applied to the commercial and recreational fisheries (Collins 1981, Vojkovich and Reed Ms.). In the 1930s, a 28-inch size limit was established, the season was closed to net fishing during the spawning season, and other gears had trip limits imposed. The latter restrictions were substantially removed in 1939 when purse seining was outlawed and gill nets were required to have a minimum mesh size of 3.5 inches. Year-round commercial trip limits were reimposed in 1953 and, in 1980, the spawning season (March 15 to June 15) was closed both to commercial and recreational fishing. Bag limits for sport fishermen were set at 15 fish per day in 1937,

then reduced to 10 per day in 1949, and to three per day in 1980.

The earliest regulation imposed on the fishery was the minimum size limit of 28 inches. Since its enactment in 1931, the only aspect of this limit that has changed is the allowable retention of undersized fish by sport fishermen. In 1949, five undersized fish were allowed. The allowance declined to two fish in 1957, none in 1971, one in 1973, and back to none in 1978. At current low levels of recreational catch, any allowance for undersized fish negates the effectiveness of the size limit because anglers rarely catch more than one seabass per day.

Enforcement of the size limit on the recreational fishery has been difficult because private anglers typically cannot identify juvenile white seabass. In 1976-1977, only 6.6% of the independent sport fishermen's seabass catches were of legal size (Wine 1978) and 22% of the interviewed fishermen could not correctly identify adult white seabass (Hartmann 1980). Identification of juveniles was even more of a problem. Fortunately the sublegal catch by independent sport fishermen has been declining in recent years. The problem is much less severe on CPFV where the experienced crew assist in identification. Clearly, if size and bag limit regulations are to be effective the public must be educated. The California Department of Fish and Game is preparing an education program to improve identification of sport fishes.

The recreational and commercial fisheries differ greatly in the size of fish captured. The commercial fishermen typically use set gill nets with large (6.5-inch) mesh and capture large fish that are in highest demand in the market. Sport fishermen in the same area rarely capture large fish and typically capture many sublegal white seabass (Vojkovich and Reed Ms.). It is not known whether the size distribution in the recreational harvest indicates the true relative abundance of large and small seabass or if some behavioral characteristic makes the large fish less available to the sport fishermen. It is interesting that the recreational fishery, which is based on small fish, has declined recently much more than the commercial fishery based on large fish. This pattern is opposite that expected in a typical overfished resource: one expects older fish to disappear first. Collins (1981) speculates that the large fish in California waters may migrate from Baja California and that all of them may not be the progeny of local spawn. If true,

this may explain the only minor increase in recreational catch during the warm-water years, 1958 to 1960. The fish that moved north, and enhanced the California commercial fishery, may have been too large to be completely available to the sport fishermen. More information on migration along shore is clearly necessary if white seabass in California are to be managed properly. Cooperation with Mexican scientists and the Mexican fishery is a necessary step towards obtaining this information.

Three studies have been conducted in response to perceived declines in white seabass abundance. Clarke (1930) studied age at first maturity; it was on the basis of this work that the 28-inch size limit was established. Following the decline in recreational catches during the 1950s, a study of ages of fish in the catch and status of the stock was conducted (Thomas 1968). The study concluded that the stock was in good health but the harvests continued to decline. Collins (1981) points out that most of the data were collected during the abnormally warm years, 1958 to 1960, when the stock was shifted north and availability was high. The misreading of the true status of the stock by the Thomas study (*op. cit.*) should serve as a warning against uncritical reliance on short-term studies to evaluate the effect of changes in management. The five-year period usually established by the California Assembly for such evaluations is too short and will be heavily influenced by the particular environmental events occurring during that period. If evaluation of management must occur within five years, then monitoring of stock levels is insufficient. Detailed and extensive studies of the processes involved (age-specific mortality, growth, reproduction, and migration) will be necessary to evaluate the changed fishery regulations.

The third study was conducted during the 1970s. By then, the recreational catch was so small that collection of sufficient specimens for biological studies was difficult (Maxwell 1977). The recommendations from that study were to prohibit sport fishermen from keeping any undersized fish, to close the commercial fishery during the spawning season, and to raise the minimum size of 32 inches. The first measure has been enacted, the second was modified and enacted, and the third is under consideration, pending evaluation of the effect of the first two measures.

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The white seabass resource in U.S. waters is badly depleted at present. It is too early to evaluate the effect of efforts to eliminate the recreational harvest of sublegal fish. However this stricter regulation has little chance of succeeding unless the public first learns how to identify juvenile seabass. U.S. commercial fishermen were not permitted to fish in Mexican waters during 1982. If this situation continues, and that fishing effort disappears, the effect on the total stock should be beneficial. If that effort is merely diverted into U.S. waters the local effect could be disastrous.

The great increase in U.S. catch during warm-water years (1958 to 1960) and the anomalous size distributions mentioned by Collins (1981) suggest that white seabass occurring in U.S. waters are but the fringe of a larger and perhaps healthier stock in Mexico. Whether U.S. fish originate largely in Mexican waters has a great influence on needs for further restrictions on U.S. harvests. More biological information on migration needs to be collected.

#### Summary

Four of California's nearshore fish species, having different biological and managerial histories and problems, have been discussed. Several basic problems stand out: great natural fluctuations in stock levels, the transboundary distribution of most of these stocks, excess effort in the commercial fishery, and poor knowledge of species identification and fishing regulations among sport fishermen.

The problems of fluctuations in stock abundance and the transboundary distribution of the stock are intimately confounded. Changes in oceanographic conditions that affect natural survival and reproduction also affect movements of the stock along the coast. The possible interactions are complex. Warm water may cause a larger portion of a stock to move into U.S. waters while being detrimental to reproduction of the bulk of the stock residing in Mexican waters. Thus, biological information collected in U.S. waters would indicate an increasing stock when, in fact, poor reproduction is leading to a decrease in stock abundance. A problem of this type may have occurred with white seabass during the warm-water event of 1958. In general, natural fluctuations in stock abundance complicate evaluation of changes in management. When stocks are declining, public pressure to restrict the fisheries increases. By the

time new regulations are enacted, the stock may be in a natural recovery and evaluation of the new regulations is difficult. The fact that regulations typically apply only to U.S. fishermen while in U.S. waters is a sufficient problem. The situation is even more difficult because most of the biological information for monitoring the fishery also comes only from U.S. waters. Establishment of international teams of scientists should be encouraged and their recommendations should guide further management efforts.

The problem of excess fishing effort varies among the four species examined here. The chub mackerel fishery is most strictly regulated by an annual catch quota that is a proportion of the stock size. Restrictions on the fisheries for California halibut, bonito, and white seabass include outlawing certain gear, restricting other gear, and size limits on the commercial and recreational fisheries. A problem with specific gear restrictions is the difficulty of balancing the regulatory impact among all users. As regulation of the halibut trawl fishery increased, the effort shifted to the relatively unregulated gill-net fishery. Size limits and associated gear restrictions that reduce the take of young fish by the commercial fishery are workable regulatory measures. Whether they will be sufficient to halt the decline of white seabass and bonito remains to be seen. Compliance with size-limit regulations among independent sport fishermen has been poor. Public education in species identification seems a useful approach.

#### Acknowledgments

Robson Collins of the California Department of Fish and Game provided helpful discussions and access to preliminary data. Alec MacCall of the National Marine Fisheries Service reviewed an early draft of this manuscript.

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Richard Methot is a fisheries biologist with the National Marine Fisheries Service at La Jolla, California. Dr. Methot's academic background includes a B.S. degree in fisheries from the University of Washington in 1975 and a Ph.D. in biological oceanography from Scripps Institution of Oceanography, University of California, San Diego in 1981. Dr. Methot has worked on growth and mortality of larval fishes, population dynamics of Dungeness crab, and is now working on anchovy population dynamics and management.