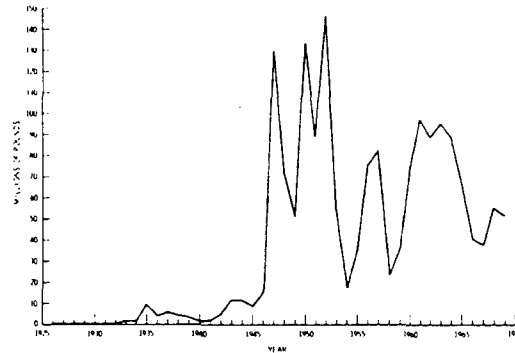
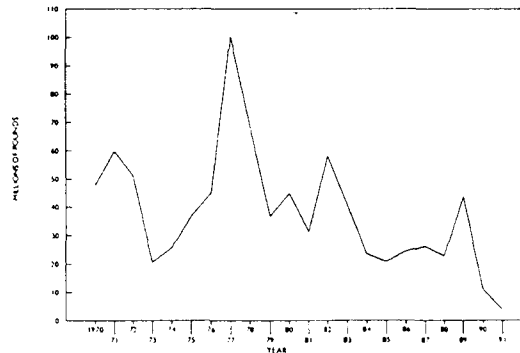


name jack mackerel for use on all labeling in 1948. This name had more consumer appeal than horse mackerel, and jack mackerel has been a major contributor to California's commercial landings ever since.

Over 90 percent of the jack mackerel landed have been caught in southern California waters by purse seine and lampara vessels. Sporadic catches also occur off Monterey, to the north, as well as Ensenada, Mexico. Jack mackerel are fished throughout the year by the southern California fleet, nearshore from Point Conception to San Diego and offshore as far as San Nicholas Island and Tanner and Cortez banks.



California commercial landings of jack mackerel, 1926-1969.



Commercial landings of jack mackerel, 1970-1991.

JACK MACKEREL

History of the Fishery

The jack mackerel (*Trachurus symmetricus*) was reported in the commercial catch as early as 1888, but was of minor importance before 1947. Commercially, it was less significant than the better known, more profitable, and more abundant Pacific sardine and the more desirable Pacific mackerel. Much of the catch between 1926 and 1946 was taken in schools mixed with sardine and Pacific mackerel and was sold at fresh fish markets where it did not spoil as quickly as Pacific mackerel. Landings were low, varying between 200 and 15,000 tons. During those years it was referred to as "horse mackerel" and had relatively little appeal as a canned product. During the 1947-48 season, the canning industry, after being hit hard by poor sardine landings, turned to jack mackerel as a substitute for sardines and the fishery landed approximately 71,000 tons. The U.S. Food and Drug Administration authorized the common

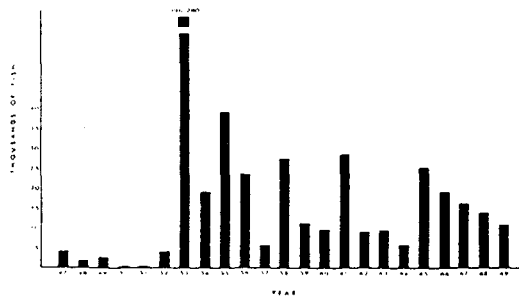
In the early days of the fishery, shortly after 1947, the monthly catches were closely related to the activity of the fleet searching for sardines and Pacific mackerel. Fleet activity was most intense in the fall, when fishermen were searching for sardines, and slowest during the spring, when the sardine season closed and Pacific mackerel were scarce. Landings were highest in the fall and lowest in spring and summer. This seasonal trend soon disappeared when jack mackerel were found to be available throughout the year. In the 1970's landings were slightly higher in the summer when the anchovy fishery was closed and anchovy fishermen sought jack mackerel.

Jack mackerel landings have fluctuated widely. Many of these fluctuations were related to changing market demand and

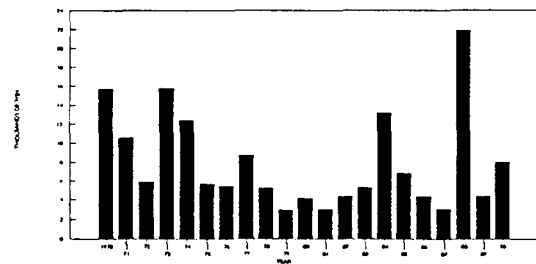
the ability of the fleet to fish for other species which were more profitable or more available. More fishing effort was directed toward jack mackerel when alternative species were unavailable. This happened with the decline of Pacific sardines in 1947 and of Pacific mackerel in 1966. When the Pacific mackerel population started to recover in 1978, the focus of the purse seine fleet's effort soon shifted back to that species, and jack mackerel became a secondary target.

The availability of jack mackerel also plays a part in the erratic catches, since there are unpredictable times when seiners cannot find jack mackerel schools for several months. Purse seiners can catch jack mackerel only when the young fish, less than six years old, form schools near the surface. As jack mackerel grow older, their behavior changes and they inhabit deeper waters farther offshore. There is currently no directed fishery for these older jack mackerel, but they are caught incidentally from California to Alaska, nearshore by salmon trollers, bottom and midwater trawlers, and offshore by albacore trollers.

In the first decade of the southern California fishery, the catch was mostly fish of age three to age six. Since 1965 the catch has been primarily fish of age zero, one, and two; fish older than age two have composed less than 20 percent of the catch. The reasons for the change in the age composition of the catch are not known. Because the purse seine fleet catches primarily age zeros, ones, and twos, the fishery depends on just three seasons' spawning production. If three seasons occur together which produce few young fish there will be very few jack mackerel available to the fishery.

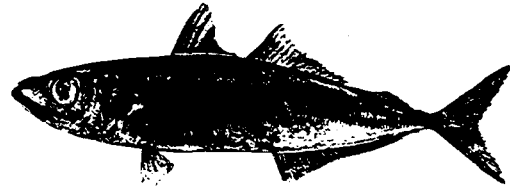


California commercial passenger-carrying fishing vessel (CPFV) landings of jack mackerel, 1947-1969.



California commercial passenger-carrying fishing vessel (CPFV) landings of jack mackerel, 1970-1990.

Large jack mackerel have occasionally contributed to the partyboat sport fishery. In 1953, a run of large fish was encountered in southern California which contributed 13 percent of the partyboat catch in southern California and 8.6 percent statewide. That was an exceptional year and, since then, jack mackerel have been of minor importance to the party boat fleet. Smaller jack mackerel are caught at times from fishing piers in southern and central California.



Jack mackerel, *Trachurus symmetricus*.

Status of Biological Knowledge

Jack mackerel are actually members of the jack family, Carangidae, and are not true mackerel. There are two different behavior patterns during their life. Small fish are found over shallow rocky reefs, generally less than 200 feet deep, and along rocky shorelines of the coast and islands off southern California and Baja California. Large fish, more than 16 inches in length, are found offshore and farther north; they do not form the dense, shallow water schools observed in young fish, but are either solitary or in loose aggregations. The older jack mackerel extend to the Gulf of Alaska and as far west as 162° W longitude. Their movement into the Gulf of Alaska appears to be related to summer warming of the surface waters. Not all the larger fish migrate north, since some large jack mackerel are caught off southern and Baja California waters throughout the year.

Like anchovy and Pacific mackerel, jack mackerel appear to be multiple spawners, but it is not known how frequently a female spawns during a season. Most (70%) female jack mackerel from the southern California fishery become mature near or just after their first birthday in July. By their second birthday, 90 percent of the females are spawning. Very young spawners produce fewer eggs and reach reproductive condition later in the season than do older spawners. Most of the eggs are spawned in 57° to 61° F water. Eggs are about .04 inch in diameter and float free in the ocean for three to five days before hatching, depending on the water temperature.

Jack mackerel spawn offshore from Punta Eugenia to Point Conception from March through August. Their eggs and larvae are uncommon within eighty miles of shore, and often are found as far as 400 miles offshore. This indicates the important contribution of eggs from the large offshore fish. Spawning extends to northern California waters and closer to shore in the Southern California Bight from July through September. Larvae have been taken 100 to 1,000 miles off Oregon and Washington in August and October; they feed primarily on copepods. Juvenile jack mackerel appear to move inshore to concentrate over shallow rocky reefs in the southern California

Bight and along the Baja California coast, for few young fish are found elsewhere.

Young jack mackerel seem to prefer copepods, pteropods, and euphausiids, although at times they feed almost exclusively on juvenile squid and anchovies. Food habits of the older offshore fish are unknown. Jack mackerel, in turn, may be quite important food for billfish. They also contribute to the diet of seals, sea lions, some porpoises, yellowtail, white seabass, bonito, bluefin tuna, striped marlin, angel, and blue sharks.

Status of Population

The most recent estimate of biomass was made in 1983. Spawning biomass was estimated at 1.50, and total biomass at 1.63 to 1.99 million tons. These estimates must be viewed as tentative approximations of the population because of two factors. First, the spawning frequency of jack mackerel is not yet known, and so estimates were based on the spawning frequencies of other pelagic species. Second, estimates were derived from CalCOFI egg and larval surveys which did not cover the entire range of the spawning population, so assumptions were made for the contribution of older jack mackerel outside the CalCOFI area. The occurrence of only young fish in the fishery leaves the age structure of the rest of the population unknown, and it is uncertain how much the reproduction of these older fish contributes to the population of young fish in the Southern California Bight.

There has been a decrease in the percent of older fish in the catch since the 1960's, which has caused some concern. It is unclear whether this change is due to a decrease in the number of older fish or to a change in the distribution of the three to six year old fish. The population can probably continue to support the current level of fishing exploitation from the purse seine fleet, but it is difficult to predict the effects of increased exploitation, due to the limited knowledge of the composition and behavior of the older segment of the population and to the limited knowledge of reproduction and recruitment in jack mackerel.

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