

JACK MACKEREL

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HISTORY OF THE FISHERY

The early history of the jack mackerel fishery is at best obscure. Records are scanty for the years prior to 1926 and often mention simply "mackerel"—meaning either jack or Pacific or both.

Records of the State of California commence in 1916, but through 1925 do not distinguish between Pacific and jack mackerel. During this period the total catch of the two did not exceed 1,000 tons, and probably consisted mostly of Pacifics.

Commencing in 1926, landings of Pacific and jack mackerel were segregated in the catch statistics. The Los Angeles region has been the dominant area of landing throughout the entire history of the jack mackerel fishery, but substantial landings have been made on occasion also at Monterey and Santa Barbara.

From 1926 through 1932 the state-wide catch did not surpass 350 tons. Landings increased in 1933 and 1934 and then rose sharply to nearly 5,000 tons in 1935, virtually all of which was delivered in the Los Angeles regions.

After 1935, landings dropped considerably, falling to a low of 717.5 tons in 1940. During the next six years, catches were much more substantial, surpassing 7,500 tons in 1946. It was in 1947 that the fishery experienced its tremendous expansion. Landings reached nearly 65,000 tons, of which 56,500 were delivered in the Los Angeles region. It has been of major importance since; in 1950, the peak year, nearly 67,000 tons were landed state-wide.

Records of catch by gear are not available for early years; however, it is assumed from statements made by various researchers that the bulk of the commercial catch has always been taken with encircling nets—lamparas, ring nets, and purse seines.

Jack mackerel have always been taken in limited numbers by rod and reel anglers fishing off Southern California. From 1947 until 1952 the number of jack mackerel caught by sportfishermen ranged between 200 and 4,500 (Table 8).

Only during 1950 and 1951 were fewer than 2,400 reported. In 1953, quantities of large jack mackerel appeared in the inshore waters off Southern California and they became a much sought-after species. As a result, nearly 200,000 were caught on hook and line. In 1954, the catch dropped about 20,000 but rose to around 40,000 in 1955. These fish are all large, ranging in length from 18 to 30 or more inches and in weight to five pounds. They appear in quantity

TABLE 8

JACK MACKEREL SPORT CATCH

Year	Number	Best month
1947	4,500	September
1948	2,400	August
1949	2,900	August
1950	600	July
1951	200	July
1952	4,400	May
1953	196,300	August
1954	19,400	June
1955	39,600	May

in the inshore waters only for a month or two each summer and the season is accordingly short. They are excellent fighters and the flesh is of fine flavor.

In the very early years of the commercial fishery, jack mackerel commanded a slightly higher price per pound than Pacifics. All were sold on the fresh-fish market. Since the advent of canning and the attendant increase in jack mackerel landings, they have usually ranged in value somewhere between the prices paid the fishermen for Pacific mackerel and sardines. The price climbed rather steadily from \$6 per ton in 1935-36 to \$60 in 1947. Since 1947, the price has fluctuated rather widely, both between and within seasons. Jack mackerel have never brought more than the \$80 per ton realized for a short time during the 1953 season.

In general the Southern California fishing grounds for jack mackerel have been the same as those for Pacifics and sardines; the mainland coast from Point Conception to the Mexican boundary and offshore to include the Channel Islands. At Monterey, most of the catch has been made within the boundaries of the bay and delivered to canneries at Monterey and Moss Landing.

Most of the fish in the commercial catch since 1947 have measured from about 8 to 15 inches in total length. These sizes are almost identical to those given for fish taken in the early 1890's. On rare occasions catches are made which consist entirely of extremely large individuals ranging upward to 30 inches in total length. The distribution of adult jack mackerel appears to correspond closely to that given for eggs and larvae. For that and other reasons it is thought that the fishery is exploiting only an inshore margin comprised of the younger age groups of the jack mackerel population.

Adult jack mackerel have been taken along the mainland coast of North America from British Colum-

bia south to Cape San Lucas. Juveniles have been captured south of Cape San Lucas at the Revillagigedo Islands by departmental research vessels and at Acapulco and in the Gulf of Tehuantepec, Mexico, by others. Although the occurrence of the species at localities south of Cape San Lucas is unquestionable, there is considerable doubt that jack mackerel have ever occurred in commercial quantities any great distance south of Magdalena Bay, Baja California. Offshore, adult jack mackerel have been captured in quantity around all of the various islands and near-shore fishing banks and to a lesser extent in much of the area 600 miles and more from the nearest point of land off Southern California.

Routine sampling of the commercial catch commenced in July, 1947. This phase of the work provides information as to the sizes and ages of the fish entering the commercial catch. The otoliths (ear bones) have been found satisfactory for age determination. Examination of several thousand sets of otoliths shows that the commercial fishery is almost entirely dependent upon fish less than six years of age. The sport-fishery generally captures larger fish and some of these have been aged reliably at over 30 years.

Fifty percent of the female jack mackerel 250 mm long (to the fork of the tail) are sexually mature. These fish are two years old. Not until age three (length, 350 mm) are 100 percent of the female jack mackerel mature. Although spawning takes place from March through October, peak spawning does not occur until May and June. Individual females spawn more than once during a season.

FOOD

In carefully conducted food studies on juvenile and adult jack mackerel it was found that over 90 percent by numbers of the identifiable items consisted of three types of animals: euphausiids, large copepods, and pteropods. All are small crustaceans found in the upper layers of the ocean. It was determined by these studies that the jack mackerel, unlike the sardine, is a selective feeder, that is, the food is taken by a definite act of capture on the part of the jack mackerel. General observations of fish sampled at the cannery unloading docks indicate that at times jack mackerel feed heavily and almost exclusively upon juvenile squid and anchovies. On the other hand, the stomachs of large jack mackerel taken considerable distance offshore were found to be filled with lantern fishes, which live at some depth in the ocean. These mackerel were attracted to a bright light suspended from the stern of a vessel at night and probably had eaten the lantern

fish (also attracted to the light) at the surface rather than at depths. The sport-caught jack mackerel are usually taken on hooks baited with large, adult anchovies.

RESEARCH UNDER WAY

Routine Sampling of the Commercial Catch

This is a continuous study carried on throughout the fishing season when fish are being caught. Considerable information is obtained from the fishermen at the time of sampling and measurements, weights, and sex determinations are made on the fish in the sample. Otoliths are saved from some specimens for use in age determinations.

Compilation of Catch Statistics

This is a continuing project carried on by the Department's statistical unit. Annual catches are compiled by boat, by locality, by date, by gear, etc.

Age Composition of the Commercial Catch

Otoliths are on hand for all seasons from 1947 to the present. Over half of these have been aged and when the remainder have been determined publication of the results can be made.

Relationship of the California Jack Mackerel to Those Found in Other Areas and Oceans of the World

As material becomes available an attempt is being made to determine whether and/or how *Trachurus symmetricus* can be distinguished from the dozen or more species of *Trachurus* known throughout the world.

Vessel and Plane Surveys

Departmental research vessels and planes are used throughout the year to survey the fishing areas and other inshore waters in an attempt to evaluate the quantity of jack mackerel available to the fishery. Samples are taken of the schools encountered and these data enter into the measures of population density.

Sampling Device Evaluation

Every effort is being made continuously to improve sampling techniques, particularly from aboard the Departmental research vessels. The entire success or failure of a population estimate depends upon the adequacy of the sampling program. To insure best results requires continual evaluation and refining of established methods and searching for or developing new or improved techniques, gear, etc.