Jack Mackerel

History of the Fishery

The jack mackerel (*Trachurus symmetricus*), originally known as horse mackerel, was reported in the commercial catch as early as 1888, and was a minor component of the coastal pelagic species (CPS) fishery until 1947. The CPS fishery uses encircling nets (purse and drum seine, and lampara nets) to target market squid, Pacific sardine, Pacific mackerel, northern anchovy, and jack mackerel in the waters off California. Much of the catch between 1926 and 1946 was taken incidentally 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 annually and comprising less than three percent of the CPS landings each year.

In 1947, jack mackerel landings increased almost tenfold to 65,000 tons as the canning industry turned to jack mackerel in the face of the collapsing sardine fishery. The U.S. Food and Drug Administration authorized changing the common name from horse mackerel to jack mackerel in 1947 to increase consumer appeal. Between 1947 and 1979, jack mackerel landings ranged from 800 to 73,000 tons, comprising six percent to 65 percent of the annual CPS landings.

The recovery of the Pacific mackerel population in the late 1970s shifted effort away from jack mackerel. The CPS fleet prefers Pacific mackerel, because jack mackerel occur farther from port and tend to aggregate over rocky bottom where there is increased chance of damage to the encircling nets. The recovery of the Pacific sardine and increased demand for squid worldwide have also contributed to the decline in jack mackerel landings in California.

Since 1991, jack mackerel has been caught primarily from December through April, with landings low during the remainder of the year. Landings have averaged less than 2,000 tons each year, comprising only two percent of the CPS landings. Most of the catch occurs in southern California.

The CPS fleet catches 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. The unpredictable availability of jack mackerel also plays a part in the erratic catches, since there are times when the fleet cannot find jack mackerel schools for several months.

Large, adult jack mackerel were taken incidentally in the Pacific whiting (hake) trawl fishery off California in the 1970s and 1980s. Because of this, jack mackerel was included in the Pacific Fisheries Management Council's (PFMC) Pacific Coast Groundfish Fishery Management Plan (FMP). The allowable biological catch (ABC) and equivalent quota for jack mackerel was set at 13,230 tons from 1983 to 1990 for the fishery which occurs north of 39° latitude (Point Arena). The fishery south of 39° is not regulated. In 1991, the ABC was raised to 57,990 tons and the quota to 51,530 tons where it remained throughout the 1990s.

Since much of the trawl-caught jack mackerel is discarded at sea, total catch is not available. Estimates of jack mackerel caught by Pacific whiting trawlers has ranged from less than 500 tons to over 2,000 tons in the 1970s and 1980s. After a US-USSR survey of jack mackerel conducted in 1991, an experimental fishery was attempted off California. Large factory trawlers from Alaska came south searching for jack mackerel, but found few fish and the fishery never developed.

In the early 1990s, southern California fishermen and processors became concerned over the possible expansion of the jack mackerel fishery and lobbied heavily for Federal management of the CPS fishery. In 1999, the Coastal Pelagic Species Fishery Management Plan (CPS FMP) was adopted by the PFMC and jack mackerel was included in the plan as a monitored species and dropped from the Pacific Coast Groundfish FMP. The CPS FMP sets the ABC at 52,910 tons with a quota of 34,170 tons based on the portion (65 percent) of the population in US waters. Should the jack mackerel catch exceed the quota for two consecutive years, the PFMC would have to decide whether to change the fishery to active status, resulting in a need for an annual biomass estimate and subsequent harvest guideline.

In addition to the whiting trawl fishery, a few adult jack mackerel are also taken in the northern California salmon troll fishery. Landings from the salmon fishery are a small portion (less than one percent) of the total jack mackerel landings.

Large jack mackerel have occasionally contributed to the commercial passenger fishing vessel (CPFV or partyboat) sport fishery. In 1953, a run of large fish was encountered in southern California, which contributed 13 percent of the CPFV catch in southern California and 8.6 percent

Jack Mackerel, *Trachurus symmetricus*
Credit: DFG

statewide. That was an exceptional year and, since then, jack mackerel have been of minor importance in the CPFV catch. Smaller jack mackerel are caught at times from fishing piers in southern and central California. Since 1980, recreational landings have been highly variable, ranging from an estimated 5,000 fish to over 350,000, based on data collected by Pacific States Marine Fisheries Commission samplers. These data are expanded from direct observations and information collected from anglers. For minor recreational species, such as jack mackerel, these expansions may greatly over-estimate the catch. Live bait landings of jack mackerel in the 1990s have been negligible due to a preference for Pacific sardine and northern anchovy as bait by sport anglers.

Status of Biological Knowledge

Jack mackerel are actually members of the jack family, Carangidae, and are not true mackerel. They are widely distributed throughout the northeastern Pacific Ocean, where young fish (up to six years and 12 inches fork length) are found schooling 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 (16 years and older and 20 inches fork length) are found offshore and farther north, east of a line that goes from Cabo San Lucas to the eastern Aleutian Islands, and includes the Gulf of Alaska. The offshore segment of the population does not form the dense, shallow-water schools observed in young fish. The distribution of jack mackerel between six and 15 years is not well known. The movement of the larger fish into the Gulf of Alaska appears to be related to summer warming of the surface waters. Not all of the large fish migrate north, since some large jack mackerel are caught off southern California and Baja California waters throughout the year.

Jack mackerel spawn in the offshore waters (60 - 300 miles) between Punta Eugenia and Point Conception from March through July. The center of offshore spawning activity moves north as the season progresses. There is little production in the inshore waters (up to 80 miles) of the Southern California Bight until July, presumably when the young fish begin to spawn. Little is known about the seasonal and geographic limits of the offshore and northern spawning areas. A 1955 survey found jack mackerel eggs and larvae offshore (100 - 1,000 miles) off Oregon and Washington in August. A second survey in October 1972 found an area of spawning jack mackerel 200 to 600 miles off Washington.

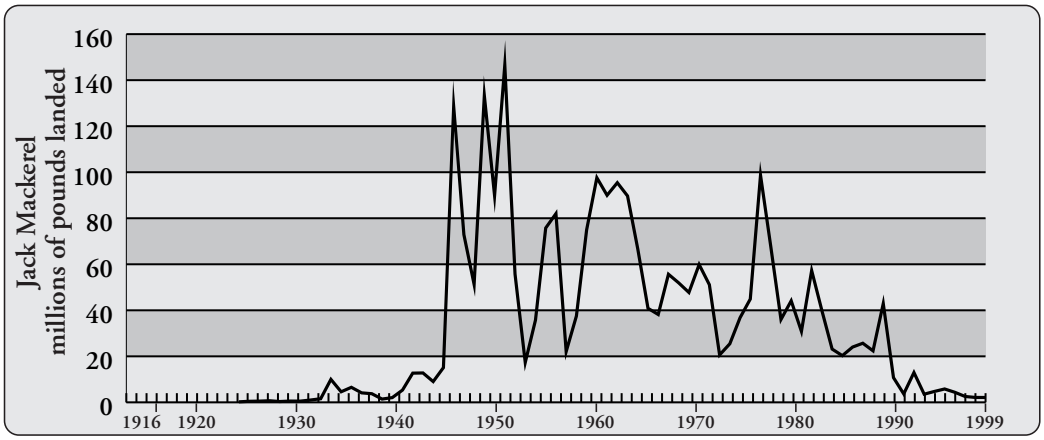
Like anchovy and Pacific mackerel, jack mackerel appear to be multiple spawners, with females spawning on average every five days and 25 times per year. Batch fecundity (number of eggs per spawning event) changes over time with females producing almost 104,000 eggs during the first spawning event and 73,000 during subsequent events. Most (70 percent) female jack mackerel from the southern California fishery become mature around their first birthday. By their second birthday, 90 percent of the females are spawning. Most of the eggs are spawned in 57° to 61° F water. Eggs are about 0.04 inches in diameter and float free in the ocean for three to five days before hatching, depending on the water temperature.

Larval jack mackerel feed primarily on copepods. Juvenile 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 are preyed upon by large fish like tuna and billfish. Smaller fish and marine birds are unlikely to feed on jack mackerel, except young-of-the-year and yearlings, because they are too large to be eaten. A study of the diet of the California sea lion in the northern Channel Islands from 1981 to 1995 found that jack mackerel ranked as the fourth most frequently occurring species. The importance of jack mackerel in the diet of other marine mammals is not well known.

Status of the Population

The most recent estimate of total biomass was made more than 17 years ago, in 1983. Total biomass was estimated at 1.63 to 1.99 million tons with spawning biomass accounting for 1.50 million tons. These estimates must be viewed as tentative approximations of the population because of two factors. First, at the time, the spawning frequency of jack mackerel was not known, and estimates were based on the spawning frequencies of northern anchovy (15 percent of females spawn each day during the peak spawning months) which has similar gonad morphology and a protracted spawning season like jack mackerel. Second, estimates were derived from plankton surveys for eggs and larvae in the Southern California Bight, which did not cover the entire range of the spawning population, and assumptions were made for the contribution of older jack mackerel outside the survey area. A recent study estimated the spawning frequency for jack mackerel at 20 percent of the spawning population. Using a spawning frequency of 20 percent would have yielded a lower biomass estimate in 1983. Although we now have an estimate of spawning frequency, no other biomass estimates have been produced since 1983.

There has been a decrease in the percentage of older fish (three to six years) in the catch since the 1960s, which has caused some concern. It is unclear whether this change



Commercial Landings 1916-1999, Jack Mackerel
Data Source: DFG Catch Bulletins and commercial landing receipts. Jack mackerel were aggregated as unclassified mackerel prior to 1926.

is due to a decrease in the number of older fish or to a change in the distribution of these fish.

Management Considerations

See the Management Considerations Appendix A for further information.

Jan Mason
National Marine Fisheries Service

Revised by:
Traci Bishop
California Department of Fish and Game

References

Blunt, C. E., Jr. 1969. The jack mackerel *(Trachurus symmetricus*) resource of the eastern North Pacific. Calif. Coop. Oceanic Fish. Invest. Rep. 13:45-52.

MacCall, A. D., H.W. Frey, D.D Huppert, E.H. Knaggs, J.A. McMillan, and G.D. Stauffer. 1980. Biology and economics of the fishery for jack mackerel in the northeastern Pacific. NOAA Tech. Memo., NOAA-TM-NMFS-SWFC-4.

MacCall, A. D., and G.D. Stauffer. 1983. Biology and fishery potential of jack mackerel (*Trachurus symmetricus*). Calif. Coop. Oceanic Fish. Invest. Rep. 24:46-56.

Macewicz, B.J., and D.N. Abramenkoff. 1993. Collection of jack mackerel, *Trachurus symmetricus*, during 1991 cooperative US-USSR cruise. NOAA Admin. Rep. NOAA-NMFS-SWFSC-LJ-93-07.

MacGregor, J.S. 1966. Synopsis on the biology of the jack mackerel *(Trachurus symmetricus*). U. S. Fish and Wildl. Serv., Spec. Sci. Rept. Fish. 526 1-16.

Mason, J.E. 1991. Variations in the catch of jack mackerel in the southern California purse seine fishery. Calif. Coop. Oceanic Fish. Invest. Rep. 32:143-151.

Pacific Fishery Management Council. 1998. Draft amendment 8 of the coastal pelagic species fishery management plan. 306 p.

Pacific Fishery Management Council. 1999. Amendment 11 to the Pacific coast groundfish fishery management plan, including final environmental assessment/regulatory impact review. October 1998.