

PACIFIC SAURY

History of the Fishery

In California, interest in fishing Pacific saury (*Cololabis saira*) was initiated in the 1950's, when the decline in abundance of Pacific sardine caused fishermen and processors to look for substitute species which could be used to make fish meal. Sporadic landings of saury were made in San Pedro, where the fish were reduced into oil and meal. In the late 1960's and early 1970's, Japan, the Soviet Union, and the U.S. became interested in harvesting saury off the U.S. west coast because western Pacific stocks had fallen to all-time low levels.

Fishing trials by U.S. researchers and fishermen were conducted north of Monterey, where larger saury were more common. Most of these trials, which involved the use of purse seines and a Japanese fishing method using light attraction together with a type of blanket net (called *bo-uke ami*), were largely unsuccessful. Japanese saury fishing vessels which fished off the west coast around the same time were a little more successful. From 1969 through 1972 they caught 507, 3,600, 1,430, and 77 tons. Japanese vessels were larger than those of the U.S., and used attracting lamps with 50 kilowatts of power. Catches per unit of effort were not considered high enough for economical fishing, however. Rough seas off the Oregon and

Washington coasts, and scarcity of dense concentrations of large saury, were blamed for the low catch rate. The fish averaged just eight to nine inches in length and had a low oil content.

After western Pacific stocks rebounded in the mid-1970's, efforts to harvest saury here were discontinued. Because of its large biomass and good eating qualities, the saury resource will likely be utilized some day off California and elsewhere in the eastern Pacific. However, economics of fishing, handling, and processing, coupled with the present lack of a domestic market make fishery development doubtful in the near term. Export as a food product is also unlikely, because of the large catches in the western Pacific and because the Japanese prefer their own fish, which appear to have a higher fat content. Externally attached copepods also detract from the appearance of eastern Pacific saury.



Pacific saury, *Cololabis saira*.

Status of Biological Knowledge

Pacific saury are slender, silvery fish common throughout the entire temperate north Pacific Ocean. They grow to about 12-13 inches "knob length," the distance from the tip of the lower jaw to the muscular knob at the base of the tail fin (approximately 94% total length). The flesh of saury is firm and rather oily. The fish is widely used in Japan, where it is sold in fresh, frozen, dried, and canned form. The meat yield is around 60 percent, and the oil content varies from three to 10 percent. In addition to its use as food and fish meal, saury is a preferred baitfish in the longline fishery for tuna.

Pacific saury are found in a broad band across the Pacific Ocean, from around 20-25° north latitude to the Gulf of Alaska. Within this broad area, three groups of saury are distinguishable: one in the eastern Pacific, the second in the central Pacific and the major group in the western Pacific. Off the U.S. west coast, saury occur from near shore to perhaps 300 miles offshore, but are most common from 40-100 miles off the coast.

Young fish appear to remain in California waters, while older fish migrate to the north, probably to the southern Gulf of Alaska, when coastal waters warm up in summer. As the water cools in fall and winter, saury again move south to preferred temperatures off California. One study found mean lengths of 7.9, 9.3, and 10.9 inches for saury from California, Oregon, and Washington. No fish greater than 12 inches were found off California and, conversely, all fish caught off Washington were larger than seven inches. Optimum temperature range for saury off California is 57-63° F.

During the day saury are usually found in depths of 100-230 feet, where they feed, but have been found as deep as 750 feet. At night, they usually swim near the surface and are attracted to light. Large numbers often accumulate under the lights of stationary or slow-moving vessels. Fish over 11 inches show poor attraction to light, however, especially during

spawning periods. In California, fishing for adult saury is apt to be most successful in the fall, north of San Francisco, and from 40-120 miles offshore.

Growth rate and longevity of Pacific saury have been subjects of controversy for many years. Interpretations of growth marks on scales and otoliths, as well as results derived from analyses of sizes of fish caught by commercial fisheries, have produced conflicting hypotheses. Various earlier workers in Japan and the Soviet Union felt that western Pacific saury had a life span of three to six years, and that saury were capable of spawning at age two. Females were thought to spawn three times a year, releasing 500 to 2,000 eggs, or perhaps as many as 5,000 eggs depending on their size, during each spawning episode, in a season of around seven months starting in late August. Later Japanese studies indicated that two major groups existed, one spawning in spring and the other in autumn, and that the probable life span was two or two and a half years. More recent studies involving daily growth rings on saury otoliths suggest that most saury in the western Pacific live for only a year, while some may reach two years of age. Fish around 11.4 inches, which are commonly caught in the Japanese commercial fishery, are thought to be nearly a year old. Fish over 12.6 inches, relatively scarce in the catch, may be 1.5 to two years old. Examination of otoliths of larval and early juvenile saury grown from eggs in tanks showed that the growth rings were indeed laid down daily, at least for the first month.

Daily growth rings found on the otoliths of eastern Pacific saury suggest that the growth rate is considerably lower than that of fish from the western Pacific. By the end of the first year, eastern Pacific saury are thought to grow to nine inches, while western Pacific fish attain 12 inches. Some researchers think, however, that eastern Pacific saury reach a length of only 6.5 inches at the end of the first year, and are about 10.6 inches at the end of the fourth year. The largest fish are about 13.4 inches and 6.5 ounces. Fish of this size are rare, and only a few are thought to survive beyond age five. Sexual maturity occurs during the second year, when the fish are around 7.9 inches. Fecundity was estimated at 1,600 eggs for a female of 10 inches, for each of three spawning episodes in a season. Spring- and autumn-born groups were also identified in the eastern Pacific, with the former predominating in fish sampled from California to Washington. Studies on genetics of the two spawning groups revealed no differences.

Spawning occurs primarily in spring off California, and in August, October, and winter off Washington. In California, the highest number of eggs was found in the plankton from Morro Bay to San Diego, mostly from April through June. Although saury spawn at all hours, peak number of eggs are found around midnight, early morning, and mid-afternoon. Eggs normally attach to each other and to floating objects by means of filamentous threads. The larvae hatch out in 10 days at 68° F, and 17 days at 58° F, and are usually found just under the water surface. Juveniles can be found down to depths of 80 feet. Prevailing currents in southern California disperse some larvae to the west as well as northward, but most remain near the spawning grounds.

Pacific saury feed on small zooplankton, particularly copepods, cuphausiids, crab megalops, and other small crustaceans.

Yellowtail, bluefin and albacore tuna, and striped marlin are major predators of saury, as are fur seals, sei whales, some birds and squid.

Status of Population

Although there is some disagreement among researchers, it is generally thought that the eastern and western stocks do not mix, while the central stock mixes with the western and perhaps also to a lesser degree with the eastern Pacific stock. Genetic studies of western saury stocks indicate that they are comprised of perhaps four subpopulations, but exchanges of genes often occur among the groups.

The western and central stocks appear to be indistinguishable genetically; so mixing may be considerable. The eastern Pacific stock may provide recruits to the central area also. Rather large differences in growth rate and longevity suggest that eastern and western Pacific stocks, however, are isolated.

Recent estimates of population size of eastern Pacific stocks of saury are unavailable. In the past, surveys by research vessels showed that the number of eggs and larvae, and by extension the spawning populations, of saury off Mexico and California fluctuated considerably through the years. The estimated quantity of adult saury in the area between central Baja California and San Francisco ranged from 97,000 to 294,000 tons per year, averaging 200,000 tons, between 1950 and 1966. The size of the total population in the northeastern Pacific is probably on the order of 450,000 tons. An annual limit of around 33,000 tons of adult saury, half of the estimated maximum sustainable yield, has been suggested for the entire west coast stocks, including Canada.

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