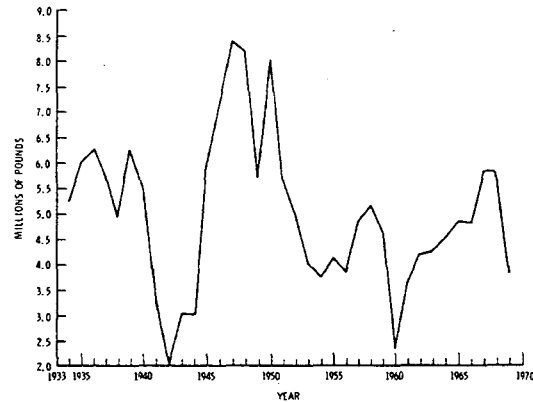
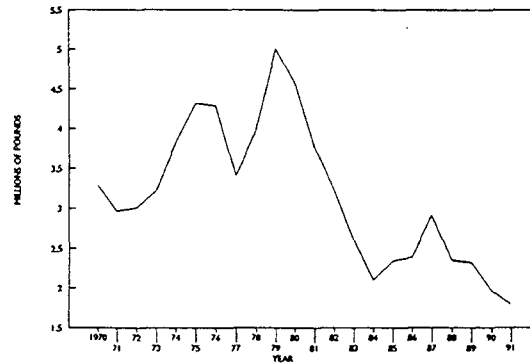


abundant in the landings because they tend to be longer and heavier than the males. Fishing for English sole can be done by relatively small vessels because of the shallow water in which this species is found. Very little is taken by commercial hook and line or by gillnet, and it is not an important species for recreational fishing.



California commercial landings of English sole, 1933-1969.



Commercial landings of English sole, 1970-1991.

ENGLISH SOLE

History of the Fishery

English sole (*Pleuronectes vetulus*) has been commercially important since the introduction of the first trawl net, the paranzella, in San Francisco in 1876. The use of trawl nets made the catch of "sole" species one of the leading categories of fish landed in California, and English sole was the leading flatfish in that group until Dover sole took first place in 1949. Since then, English sole has been second in pounds landed except for 1970-1972, when petrale sole was second. The peak year for English sole was 1929, when 8.7 million pounds were caught off central California and at new fishing areas off Fort Bragg and Eureka. Annual landings during the past 10 years have averaged just under three million pounds, mostly from grounds off the Eureka and San Francisco areas. Little is taken commercially south of Point Conception.

English sole are fished primarily by trawling in water 120 to 900 feet deep on sandy bottoms. They become vulnerable to the commercial fishery at three years of age (10 inches), but four- to eight-year-old fish (11-17 inches) predominate landings because markets request fish of at least 11 inches in order to produce reasonable size fillets. Female fish are often more

English sole is a desirable fish for the market and restaurant trade, primarily as a filleted product, but landings are affected by market demands and abundances of other flatfish and roundfish. Currently there are landings restrictions on certain rockfish and deep-water complexes of fish, and processors may request English sole from the fishermen to supplement total landings. Notwithstanding, landings of English sole have not increased since the implementation of restrictions on other fish. Demand for English sole is also affected by availability and price of imported fish products.

Status of Biological Knowledge

English sole range from San Cristobal Bay, Baja California to northwest Alaska in water as deep as 1,800 feet. Fish tend to move to deeper water in the winter and shallower water in the summer, and fishing effort follows these movements.



English sole, *Pleuronectes vetulus*.

Tagging studies in California, Oregon, Washington, and British Columbia show that, although there is little overall migration, small seasonal north-south movements probably occur, and some fish have been found to move in excess of 200 miles. Analysis of tag returns also suggest that four separate stocks are found in California: south of Point Conception, Point Conception to Bodega Bay, Monterey to Eureka, and Eureka to southern Oregon. The overlap in areas is a result of apparent north-south movement of the stocks. Some seasonal intermingling between stocks probably also occurs.

Female English sole are usually mature at three years (10 to 14 inches), while males mature at two (8 to 11 inches). Spawning occurs over sand and mud-sand bottoms at depths of 200 to 360 feet from September to April, although some spawning probably occurs in all months. In California peak spawning occurs from December through February, with annual variations in timing apparently related to water temperature. Each fish probably spawns only once per year. A three-year-old, 12-inch female releases approximately 150,000 eggs, while a 10-year-old, 17-inch fish will release almost two million. Egg diameter is approximately 0.04 inch. Fertilized eggs are buoyant when first released, but shortly before hatching they begin to sink into the water column.

When the eggs hatch, in four to 12 days, the larvae are approximately 0.1 inch long. Typically the larvae are in the mid-water column but sink deeper as they approach metamorphosis. During development, the larvae can be carried towards shore on upper-level water currents. Spawning and development during times of rapid plankton growth may result in good recruitment. During their pelagic phase of six to 10 weeks, the larvae grow to about 0.75 inch, then settle to the bottom and metamorphose to the adult benthic body form. After metamorphosis, and for the first year of life, juvenile English sole are found in shallow bays and estuaries and feed all the way up to the intertidal zone. Juveniles are found in sand, mud, and eelgrass habitats. The population density of juvenile English sole in estuaries is several times higher than on the open coast; however, it is not known how important estuaries are to survival of juvenile English sole. In southern California the shallow open coast may be more important as juvenile habitat than it is further north. As the fish grow they tend to move to deeper water.

The largest recorded English sole, from British Columbia, was 22.5 inches, and 21-inch fish have been taken in California. The oldest recorded age is 22 years. English sole are aged by counting the annual rings on the interopercular bone.

While in the estuary and nearshore shallow-water environment, juveniles feed on copepods, the palps of segmented worms, siphons of small clams, brittle stars, and other small invertebrates. At the end of their first year of life (about five inches) most juveniles have moved to offshore waters. Adult fish are seldom found in estuaries. They are opportunistic feeders eating shallowly burrowed or surface-active prey such as worms, small crustaceans, clams, and occasionally small fish, crabs, and shrimp. Adults can also dig into the sediment to reach deeper prey.

The English sole is capable of interbreeding with the starry flounder producing an intergeneric hybrid called the hybrid or forkline sole or flounder.

Status of Population

Little information is available to estimate the status of the English sole stock in California. Catch-per-unit-of-effort data exist but are complicated by the multiple species aspect of trawl fishing. Analysis of catch information for the late 1970's suggests that stocks are at levels that produce maximum sustainable yield. Currently there is no quota on the English sole fishery, but landings are monitored and populations continually assessed for signs of biological stress. The fishery is currently managed by the Pacific Fishery Management Council through gear regulations such as mesh size for trawl nets.

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