Fishery Basics – California Fisheries

Sole (Family Achiridae)

Left photo courtesy of the Pacific Fishery Management Council (Petrale Sole). Right photo courtesy of NOAA (Yellowfin Sole).

Life History

Soles are a type of **flatfish** belonging to the **family Achiridae**. These right-eyed flatfish are found in the waters along both coasts of North and South America. Although some species occur in freshwater environments, most occur in marine environments. Eleven species of sole constitute the majority of soles **landed** along the west coast of North America. The majority of the sole landed in the U.S. are the **Yellowfin Sole (*Limanda aspera*)** and **Rock Sole (*Lepidopsetta bilineata*)**, which are predominantly fished in the Bering Sea and Aleutian Islands region of Alaska. Four **species** of sole comprise the majority of species landed in California:

1. **Dover Sole (*Microstomus pacificus*)**
2. **English Sole (*Parophyrs vetulus*)**
3. **Petrale Sole (*Eopsetta jordani*)**
4. **Rex Sole (*Errex zachirus*)**

In general, soles are found on the **soft sediments** (See Biology & Ecology – Ecosystems Where Fish Live) of the seafloor from Baja California to Alaska, with some species preferring muddy habitats and others preferring sandy habitats. Dover Sole are the longest living of the four species reaching 50 years of age and a body length of 76.2 cm (30 in). Spawning generally occurs in deeper waters during the fall and winter months, with the peak occurring between December and March. However, Rex Sole has been collected in spawning condition throughout the year. Egg production depends on the size of the female, with large females producing more eggs. Large females can release between 54,000 and 238,000 eggs depending on the species.

Upon hatching, the **larvae** at first have the physical morphology (characteristics) of a **finfish** before morphing into the adult **benthic** flat-body form. The timing of this transition from round to flat is species and size dependent. As **juveniles**, some species spend time in the shallows of **estuaries and bays** (See Biology & Ecology – Ecosystems Where Fish Live), while others spend

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time at depths greater than 120 m (400 ft) along the **continental slope** (See Biology & Ecology – Ecosystems Where Fish Live).

Fishery History

With the introduction of the first **trawl net** (See Fishing Gear – Trawl Nets) in San Francisco in 1876, flatfish became one of the leading categories of fish landed in California. However, initially not all species of sole were regarded as desirable catch. Initially, many sole species were only caught as **bycatch** and thus they were discarded. Both English and Petrale Sole were considered highly desirable by the end of the 1800s, while Rex and Dover Sole did not become desirable until the end of World War II. Increased market demand and advances in fish handling and **processing** led to increased interests in the Rex and Dover Sole. Eventually the demand for Dover Sole would surpass that of the previously highly valued Petrale Sole.

Advancements in trawl technologies developed after the war resulted in **directed fisheries** for some species of sole. With increased pressures from larger fleets and more efficient gears, **populations** of sole declined over the next 30 years. In 1982, the **Pacific Fishery Management Council (PFMC)** (See National Management) implemented the first **Pacific Coast Groundfish Fishery Management Plan (PCGFMP)**. The PCGFMP includes over 90 species that live on or near the seafloor, including rockfish, **flatfish**, **roundfish**, sharks, and skates. As some **groundfish** stocks continued to decline, the PFMC implemented a **limited entry** program for the groundfish **fishery** in 1994. By 2000, regulations were implemented to restrict the size of the **footropes** on trawl nets to minimize damage to the habitats where sole and other groundfish were being fished.

Current Fishery

Sole continue to be federally managed by the PMFC under the PCGFMP. Various measures have been taken to manage groundfish. **Harvest guidelines**, **quotas**, landing limits, **seasonal closures**, area restrictions, and gear restrictions are all used in the efforts to manage the many species of groundfish that are targeted. The west coast groundfish fishery now has **four components**:

1. Limited entry trawl and **fixed gear**
2. **Open access**
3. Recreational
4. Tribal

A new **trawl rationalization program** was implemented for the trawl sector of the groundfish fishery in January 2011. The intent of the trawl rationalization program is to increase the economic efficiency within the groundfish fishery, as well as reduce the amount of bycatch of **overfished** groundfish species. The program includes **individual fishing quotas (IFQs)** for the shore based trawl fleets and a cooperative program for the at-sea catcher/processor trawl fleets.

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Current Challenges in Fishery

Most groundfish fisheries are unable to fish to the **optimum yield** of a specific species because of management efforts and requirements to reduce the bycatch of threatened rockfish and other species in the groundfish management complex. This contributes to the belief that the groundfish trawl fishery is not economically **sustainable** in the eyes of some participants and observers of the fishery. In an effort to more effectively manage the groundfish fishery, several amendments have been added to the PCGFMP. The recent implementation of **Amendment 20** created the trawl rationalization program.

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