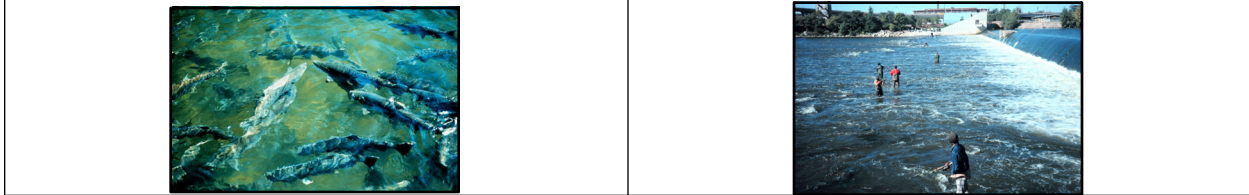


## Chinook Salmon (*Oncorhynchus tshawytscha*)



Left photo: adult Chinook Salmon in river. Right photo: Recreational anglers fishing for Chinooks Salmon in river. Photos courtesy of NOAA Photo Library.

### Life History

There are [five species of Pacific salmon](#) that inhabit the rivers, streams, and ocean along the west coast of the U.S. and Canada. The largest of these five [species](#) is the [Chinook Salmon](#), also known as King Salmon. Like other species of Pacific salmon, Chinook are [anadromous](#), which means they begin their lives in freshwater streams and rivers, migrate to the ocean and spend the majority of their lives there, before they return to their natal waters where they spawn once before dying. Historically, Chinook were found as far south as the Ventura River in Southern California, but their current range is estimated to be from the Sacramento-San Joaquin delta north to the Bering Strait off Alaska. They are also found in the western Pacific along the coast of Siberia south to Hokkaido Island, Japan.

The tendency of these fish to return to their birthplace has led to the evolution of multiple different [stocks](#) or [populations](#) within the species. These stocks are both reproductively and behaviorally isolated. Stocks can further be grouped into “runs,” which are based on the time of the year that they begin their upstream spawning migrations. Some stocks might have four runs, like some of those in California that have fall, late-fall, winter, and spring runs. While other stocks might only have one run. Both the spawning seasons and locations vary among the different stocks. Some stocks return to freshwater environments a few hundred feet from the ocean while other stocks migrate as far inland as Idaho before spawning.

For successful spawning to occur, the water must be clear, water temperatures must be less than 13.3°C (56°F), and suitable gravel [substrates](#) with highly oxygenated water must be present. Females dig a [redd](#) (nest) in the gravel substrate where they may lay 2,000 to 17,000 eggs, which are then fertilized by the male. After fertilization, the female covers the eggs, where the [larvae](#) will develop for 3-5 months before hatching. After spawning the female guards the eggs for up to 25 days. Both parents die before the eggs hatch.

Upon hatching, the salmon begin their lives as an [alevin](#), the first of [five stages](#) of its life. The alevin stage generally lasts a few weeks before the fish emerges from the gravel entering the [fry](#)

stage. The young fry remain in calm waters, but as they grow they move into faster, more open waters and begin to migrate downstream. The next stage is the **smolt** stage in which the physical appearance of the fish begins to change to a silvery color while the gills and kidneys change to be able to handle salt water. The fish may remain in this stage for up to a year before they migrate into the ocean as adults. The ocean stage of a Chinook may last from 2 to 5 years. As adults some stocks may make **extensive migrations** throughout the ocean. Some California stocks have been tracked from central California to Alaska, whereas others remain closer to their natal streams. Adult Chinook then return to the freshwater environments, where their physical appearance and physiology change once again as they enter their final spawning stage. Chinook Salmon may grow up to 147 cm (58 in) and weigh 57.5 kg (127 lbs), but on average they are 91.4 cm (36 in) and 13.6 kg (30 lbs).

## Fishery History

### Commercial Fishery

The first **commercial** Chinook **fishery** began in the early 1850s, which coincided with the massive influx of gold miners arriving in California. By 1860, **gillnet** (See Fishing Gear – Gillnets & Entangling Nets) Chinook fisheries had been established in the lower Sacramento and San Joaquin Rivers and the surrounding bays. The first **cannery** opened along the Sacramento River in 1864. The fishery expanded north along rivers as canneries began to operate elsewhere. By 1880, 20 canneries were operating within the Sacramento-San Joaquin river system. The inshore Chinook fishery continued to thrive, reaching its peak in 1882 with approximately 5,443 t (12 million lbs) **landed**. The fishery soon collapsed due to increased fishing **efforts**, pollution, and the degradation of the rivers due to mining, agriculture, and logging operations. By 1919, the last inland cannery closed and local rivers were soon closed to commercial Chinook fishing.

While the inland cannery industry for Chinook was thriving, a commercial ocean **troll** (See Fishing Gear – Hook & Line) fishery for Chinook also was developing in Monterey Bay in the 1880s. Initially small sailboats using two rods, one deployed off of each side of the boat, with one hook per rod were used to catch the fish. Around 1908, fishermen from the Sacramento River began using small powered **gillnet boats** (See Fishing Vessels – Gillnetters) in Monterey Bay, leading to a significant expansion in the commercial trolling fishery. By 1916, approximately 200 boats were fishing along the coast from Monterey to Crescent City. Fishermen improved their methods for catching Chinook by increasing the number of lines being fished as well as the number of hooks on a line. By the 1930s, it was estimated that 570 **trollers** (See Fishing Vessels – Line Vessels) were actively fishing for salmon. These boats were using anywhere from 4-9 lines with 5 or more hooks per line. Technological advancements, like the development of power **gurdies** (mechanical means of pulling in the lines) and better boats, as well as rebounds in Chinook populations caused the Chinook fleet to double to 1,100 vessels by 1947.



# Fishery Basics – California Fisheries

Due to varying state regulations on Chinook and continuing increases in fishing efforts along the Pacific coast, the **Pacific Marine Fisheries Commission (now the Pacific States Marine Fisheries Commission, PSMFC)** was established in 1947 to manage the shared marine resources of its member states (California, Oregon, Washington, Idaho, and Alaska). The PSMFC implemented a minimum size limit of 66 cm (26 in) and set opening (April 15) and closing dates (September 30) for the commercial Chinook fishery. No further interstate regulations would be mandated until the development of the **Pacific Fishery Management Council (PFMC)** (See National) in 1976 when the **Magnuson Fishery Conservation and**

**Management Act** was implemented. The 1977 **Salmon Fishery Management Plan (SEMP)** was the first **Fishery Management Plan** developed by the newly formed council. By this time the ocean Chinook fleet had grown considerably to 5,000 vessels.

Landings remained relatively high and consistent throughout the 1960s and 1970s in California. However, in the following decades landings varied considerably. A record high of 7,516 t (16.5 million lbs) in landings in California was recorded in 1988, which was followed by a low of 850 t (1.8 million lbs) in 1992, an El Niño year. In the 1980s, the ocean fisheries were becoming more regulated as well, with the implementation of area closures and **quotas**. In 1980, a moratorium on the distribution of permits to new participants wishing to be a part of the fishery was created. By 1983, the PFMC established a **limited-entry** program for the ocean Chinook fisheries, limiting the number of commercial Chinook vessels to just over 4,600. By 1994, the Sacramento River winter-run Chinook was **listed as endangered** under the **Endangered Species Act**.

The consistently lower numbers of landings throughout the remainder of the century and the beginning of the 2000s lead to increased management efforts of the Chinook fishery in recent years. Drought conditions, which caused poor water flow in the Klamath River, lead to a decline in the Klamath River fall Chinook (KRFC) populations from 2001 to 2005. **Escapement** levels for the 2006 season were projected at 25,000 natural spawners, which were 10,000 less than the minimum escapement of 35,000 required by law. These factors lead to a 2006 closure of the ocean fishery from Pt. Sur, California to Cape Falcon, Oregon (Klamath Impact Zone). Continued low landings as well as the failure of the Sacramento-San Joaquin River fall-run Chinook Salmon to meet the FMP conservation objective lead to a statewide closure of the California ocean Chinook fisheries in 2008 and 2009 and a 8-day season in 2010.

## Ocean Recreational Fishery

**Recreational** fishing for Chinook has existed since the arrival of the first settlers to the west coast. However, ocean sport fishing for Chinook did not become popular until the development of the **commercial passenger fishing vessel (CPFV)** industry after World War II.



# Fishery Basics – California Fisheries

With the rapid development of the recreational fishery, the [California Department of Fish and Game](#) began to monitor dockside landings in 1962. Between 1947 and 1990, 17% of the total Chinook catch annually in California was attributed to **recreational anglers**. The primary method of catching Chinook during this time was the use of trolling. During the 1990s, the annual landings of the recreational fishery increase to 31% of the total Chinook landings in California and a new technique for catching salmon, known as **mooching**, developed. Mooching is a method used to catch Chinook when they are feeding on **forage fish** in nearshore waters. The bait is set to drift in the water, in order to resemble dead or wounded prey, instead of being dragged through the water like trolling. Once the Chinook strikes the bait the line is fed out encouraging the Chinook to swallow the bait. Although effective, mooching resulted in more fish being **gut-hooked** when caught, particularly fish that did not meet the minimum size regulations.

Therefore, in 1997 regulations declared that **circle hooks** (See Fishing Gear – Hook & Line) must be used when mooching.

During 1995, the recreational fishery saw it's highest number of catches, totaling close to 400,000 individual fish caught. However, the total number of catches steadily declined in the following years. Similar to the commercial fishery the recreational fishery saw a complete closure in 2008 and 2009, with a shortened season for 2010.

## *Tribal Fisheries*

Indigenous tribes fished for Chinook long before the arrival of the first European settlers on the Pacific coast. Chinook were not only a source of food, but also a means of trade with neighboring tribes. Annual **ceremonies and rituals** were created to honor the importance of the fish because the fish played such a significant role in the livelihood and spiritual lives of the native people. Gillnets, dip nets, **fishing spears** (See Fishing Gear – Grappling & Wounding Gear) and communal fish dams were the traditional methods used to catch Chinook in rivers.

Central Coast and North Coast tribes found a great abundance of Chinook in the Sacramento-San Joaquin river systems, as well as the Eel, Klamath, Smith, and Trinity Rivers. Chinook was a highly valued resource, which was used to supplement other food sources when they were in short supply. However, the Chinook fisheries began to decline as non-Indian settlements developed during the nineteenth and early twentieth centuries. By the 1920s, the inland fisheries began to close and by 1933 most inland tribal fisheries on the Smith and Klamath Rivers were closed.

In 1969, the state's jurisdiction over tribal commercial fishing was challenged when a fisherman belonging to the **Yurok Tribe** had his gillnets confiscated for fishing on the lower Klamath River. The case remained in the lower courts until 1975, when the Federal District Court of Appeals found that the right of a tribal member to fish on a reservation was created by



# Fishery Basics – California Fisheries

presidential executive order. Therefore, tribes fishing on a reservation were not subject to state law. The [Bureau of Indian Affairs \(BIA\)](#) took over management of tribal reservation fisheries and opened the lower Klamath River to tribal commercial and **subsistence** fishing using gillnets. In 1993, the Department of Interior recognized the federally reserved rights of the Yurok and [Hoopa Valley Indian](#) and granted these two tribes the right to **harvest** 50% of the total available harvest of Klamath Basin Salmon. Currently, the Yurok and Hoopa Valley tribes are the only federally recognized tribes in California with commercial fishing rights.

## Current Fishery

Chinook are currently managed by three agencies in California. The PFMC manages both the commercial and recreational fisheries that operate in **federal waters** (See Where do we Fish? - Federal) under the council's SFMP. [California Department of Fish and Game \(CDFG\)](#) (See State – California Management) manages the commercial fisheries that operate in **state waters** (See Where do we Fish? - California) as well as the recreational components in the state's ocean waters and **inland waters** under the legislation set forth by the [California Fish and Game Commission](#). The SFMP varies every year based on the estimated number of Chinook present in a stock. The SFMP has two primary components:

1. Conservation objectives, which are annual goals that allow for a set number of spawning Chinook to return to their natal waters to spawn,
2. Allocation provisions, which allow for different groups of fishermen (i.e., commercial, recreational, tribal, various ports, ocean, and inland) to harvest a set number of salmon.

The SFMP must also abide by whatever regulations are set forth in the Endangered Species Act.

Trolling is the primary method of catching Chinook in the commercial fisheries. Vessels are limited to use a maximum of 6 lines when trolling for Chinook and are required to use **barbless hooks** (See Fishing Gear – Hook & Line). Based on legislation enacted in 1979, the [salmon stamp program](#) requires vessel operators and crewmembers to purchase a commercial Chinook stamp and a basic commercial fishing license to participate in the Chinook fishery. The fees paid by fishermen for the salmon stamp are matched by state funds. The revenue generated by the program is used to fund **hatchery** programs, educational programs, habitat and restoration work, and research. In 2007, 1,359 Chinook vessel permits and 2,174 commercial salmon stamps were issued in California.

For a list of general regulations for the 2011 commercial fishery click [here](#).

For a list of general regulations applicable to the 2011 recreational fishery click [here](#).

## Current Challenges in Fishery

The PFMC identifies that the **primary challenge** in the management of Chinook, as well as other **salmonid** species, is accurately assessing population sizes.



# Fishery Basics – California Fisheries

Another challenge, for both the fishery and the scientists who study salmon, is estimating the effects of environmental changes on Chinook populations. Factors contributing to these environmental changes include: deteriorating ocean conditions due to agricultural run off, stagnant water in spawning grounds, increased temperatures in both the ocean and freshwater systems, and freshwater **habitat degradation** due to agricultural operations and the construction of dams. While research efforts have displayed some promise in understanding these factors, further research is still needed.

The **constructions of dams**, in the rivers that Chinook spawn, have created numerous impacts on Chinook populations all along the west coast. One of the primary reasons dams have had such an impact on Chinook is that they block passage to the natal spawning grounds of the salmon. To help Chinook reach their spawning grounds, **fish ladders** have been constructed next to dams, but have not always proven effective. Dams also contribute to poor water conditions, particularly in dry seasons, when water is diverted to agriculture operations. The water diversions limit the amount of water flow in the rivers, thus causing the water to become stagnant and often causing the temperature to rise creating less than ideal conditions for the development of Chinook eggs.

The removal of dams is a complex process, as they deal with a multitude of environmental and economic impacts that affect the surrounding communities that have come to rely on the benefits of having dams. However, successful efforts have been made to remove dams like the **Marmot Dam** in Sandy, OR. Current efforts are underway for the **removal of several dams in the Klamath River**, which was once the third most productive Chinook fishery in the west.

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