

# California Seafood Facts in Brief

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California Seafood Council

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# CALIFORNIA SEAFOOD COUNCIL

## FACT SHEET

**Mission:** To champion the food resources of California waters for the social and economic benefit of the people of California, including consumers, fishermen, and allied industries.

**When Founded:** In 1991, California's fishing industry authorized the establishment of the California Seafood Council (CSC) by referendum. California's Department of Food and Agriculture (CDFA) administers the Council, along with more than 40 commodity commissions, councils and boards in the state. The CSC serves as an advisory body to the Secretary of Food and Agriculture and the Department.

**Membership:** The Council represents commercial fishermen and primary fish handlers. More than 3,000 commercial fishermen and approximately 200 primary receivers who harvest and receive fish in California pay assessments to support Council activities. Assessments are based on an ad valorem rate based on the ex-vessel value of fish and shellfish included in the CSC. The assessment is shared equally by fishermen and receivers.

**California's Fishing Industry:** The economic value of California's fishing industry to the state is estimated at more than \$800 million annually. The industry ranks among the top five seafood producers in the nation in total seafood landed (461.3 million pounds in 1996).

Californians consume more seafood per capita than the national average, making California one of the major seafood markets in the U.S.

**Council Management:** The CSC is directed by a 15-person Board of Directors and their alternates. Non-voting members of the Board include representatives from the CDFA, California Department of Fish and Game (CDFG), California Department of Health Services and the University of California Sea Grant Program.

Diane Pleschner was appointed in September, 1991, as manager and maintains the Council office in Santa Barbara. Pleschner fished commercially and covered the fishing industry for more than 10 years as a journalist prior to becoming manager of the CSC. She also coordinated the development of the Council.

# CALIFORNIA'S FISHING INDUSTRY FACT SHEET

## **Economic Impact:**

California's fishing industry ranks among the top five seafood producing states in the U.S. In 1996 California fishermen delivered more than 461 million pounds of high quality seafood to market. From San Diego in southern California to Crescent City in the north, the fishing industry represents an important source of jobs, from fishermen to fish handlers to allied industries such as boat builders and gear suppliers. In 1997, 9,938 commercial fishermen and 347 fish receivers harvested and marketed California seafood for public enjoyment.

## **Species:**

Approximately 300 varieties of fish and shellfish are native to the Golden State and comprise the California catch each year. California fishermen use a variety of harvesting methods to deliver this catch, following regulations enacted by the Legislature, the California Department of Fish and Game and Fish and Game Commission, and for fisheries operating in federal waters, the Pacific Fishery Management Council.

The major species represented by the California Seafood Council include bonito; California halibut; mackerel; groundfish, including rockfish (commonly called Pacific red snapper), sablefish (also called black cod) soles and sanddabs; sardines; white seabass; sharks; swordfish and tunas. Shellfish species include a variety of crabs, California spiny lobster, Pacific Ocean (pink) shrimp; prawns, and squid.

## **Geographic Area:**

California's coastline extends more than 1,000 miles, from Crescent City in the north to San Diego in the south. Ocean waters near the Farallon Islands off San Francisco and Channel Islands off southern California also comprise important fishing grounds.

The ocean harvest in *northern California* includes sea urchins, Dungeness crab, salmon, pink shrimp, and groundfish. *Central California* coastal waters produce several species of sole and rockfish, as well as squid, swordfish, and albacore tuna. The ocean off *southern California*, beginning at Point Conception north of Santa Barbara, yields mackerel, squid, sardines and bonito. In fact, these "wetfish" often make up more than 50% of the state's commercial catch by weight. Other important southern California fisheries include swordfish and shark, spiny lobster, rock crab, rockfish, California halibut, prawns, sea cucumbers and sea urchins.

## **State of California:**

The California Legislature or the California Fish and Game Commission regulate fishing activity within the state's three-mile limit, based on recommendations of the Department of Fish and Game (CDFG). The CDFG enforces regulations, collects license fees and use taxes on local seafood harvested, and performs research on California fish and fisheries.

## **Pacific Fishery Management Council (PFMC):**

The PFMC was established in 1976 by federal legislation known as the Magnuson Fisheries Conservation and Management Act (FCMA). This act was passed in response to growing concern for unregulated foreign fishing in US waters.

Commercial and recreational fishing interests, as well as state and federal officials make up the PFMC. Biologists, economists, and industry representatives also serve as advisors. Decisions made by the PFMC must be approved by the U.S. Secretary of Commerce.

## ADDITIONAL INFORMATION SOURCES

### Fisheries Issues

California Department of Fish and Game  
L.B. Boydston, Chief of Marine Resources  
1416 Ninth Street, Sacramento, CA 95814  
(916) 653-6281

Pacific Fisheries Management Council  
2130 SW Fifth Avenue Suite 224, Portland, OR 97201  
Larry Six, Executive Director  
(503) 326-6352

U.S. Department of Commerce, NOAA  
National Marine Fisheries Service, Southwest Region  
501 W. Ocean Boulevard, #4200, F/SWO, Long Beach, CA 90802  
William Hogarth, Director (562) 980-4001

### Seafood Issues

Dr. Robert Price  
Sea Grant Extension Program – Food Science & Technology  
University of California, Davis, CA 95616  
(530) 752-2194

California Department of Health Services - Food & Drug Branch  
Stuart Richardson, Chief  
714 P Street, Sacramento, CA 95814  
(916) 445-2264

Department of Health Services - Environmental Management Branch  
Greg Langlois (Shellfish Monitoring Program)  
2151 Berkeley Way Room 118, Berkeley, CA 94704  
(510) 540-3423

Shellfish Information Line – (510) 540-2605

NMFS Western Inspection Branch  
Glenn Kiel, Chief  
5600 Rickenbacker Rd. Bldg 7, Bell, CA 90201  
(213) 526-7412

National Fisheries Institute  
Bob Collette, Western Regional Representative  
1901 Ft. Myer Drive, Suite 700, Arlington, VA 22209  
(703) 524-8882  
Communications – (703) 524-8881

California Fisheries and Seafood Institute  
Rob Ross, Executive Director  
1521 "I" Street, Sacramento, CA 95814  
(916) 441-5560

FDA Seafood Hotline – (800) FDA - 4010

## A BRIEF HISTORICAL OVERVIEW

California's commercial fishing industry has a colorful history, enriched by immigrants from European and Asian nations who settled and established communities up and down the state's coastline. The enterprise of these fishermen and the commercial fishing industry they developed figured importantly in the growth of local economies from Crescent City in northern California to San Diego in the south.

Beginning at the turn of the 20th century, European fishermen brought their methods from the old world and adapted them to California waters. The different nationalities gravitated to different parts of the Golden State, drawn by heritage, fishing specialty, and fish. Portuguese settled in San Diego to catch tuna with hook and line. Purse seine fishermen from Italy and Yugoslavia settled the San Pedro area to fish sardines and squid. Santa Barbara attracted Italians, many from Genoa, who trapped lobster and fished with gillnets and hook and line. Sicilian fishermen introduced the lampara net to Monterey. The San Francisco area fleet also hailed from Sicily, crabbers and a few trollers who operated north to Bodega Bay and south to Half Moon Bay. Finns and Norwegians settled in Fort Bragg. Scandanavian fishermen also settled in Eureka and later, when the harbor was built, in Crescent City.

Asians fished California waters beginning in the mid-1800's. California's squid fishery began in 1863 in Monterey Bay, initiated by Chinese fishermen who rowed the bay at night in sampans. Joined by the Japanese, these fishermen and entrepreneurs dried and exported their catch until the mid-1930's. Sicilians and Yugoslavs set round-haul nets for sardines, as that fishery blossomed after World War I. The Pacific sardine fishery reached its peak in 1936, when the catch weighed in at more than 700,000 tons. Sardines once supported the largest fishery in north America, employing thousands of workers in canneries from San Francisco to San Diego. Sardines vanished along the Pacific coast beginning in the mid-1940's, but now, in this warm-water cycle, are returning to abundance. Sardines are currently harvested under a quota set by the Department of Fish and Game, determined by the size of the biomass.

Records of commercial landings of northern anchovy date from 1916, Pacific herring from 1915, and Pacific mackerel from the 1930's. The highest recorded commercial landing of California halibut was nearly five million pounds in 1919; the average annual catch today is approximately one million pounds. A significant swordfish catch first occurred in 1927. In the early days of the fishery, swordfish were caught by hand-thrown harpoon and the local supply fluctuated wildly. Since the late 1970's, the primary method of catch has been short-length, large-mesh drift gillnets, which have provided a consistent supply, with landings averaging more than 2.6 million pounds per year.

Dungeness crab fishermen first began harvesting crab in 1848; California's oyster fishery got its start in the 1850's when settlers from the east coast arrived for the Gold Rush. These two early fisheries in San Francisco Bay were joined by the commercial industry for Bay shrimp in the early 1860's. Abalone can also be added to this list as one of California's oldest commercial operations.

The failure of historic sardine runs off the southern California coast in 1903 hastened development of California's tuna fishery. In 1907, an experimental pack of 700 cases of albacore led to the development of the U.S. tuna canning industry. The industry expanded quickly: demand exceeded supply. Soon bluefin and yellowfin tuna, as well as the smaller skipjack, were canned as "light meat" tuna became the norm and white-meated albacore, the specialty. California's tuna canning industry recovered from a post-World War II slump to become one of the largest and most profitable in the world. By the early 1980's, California's industry faced rising labor costs, more stringent regulations, and increased competition from abroad. By the mid-1980's, the industry moved processing facilities offshore, sharply reducing California's tuna landings.

Barracuda, a big fishery in the 1950's, lost its appeal as shark gained favor at market. Largely ignored until the early 1970's, sea urchins became one of California's most important coastal fisheries in the 1990's, bringing in \$20 million or more in annual revenues to California fishermen, and representing more than \$80 million in export trade. In 1996 market squid became California's most valuable fishery: landings exceeded 177 million pounds, valued at \$33.3 million dockside. Many fisheries have developed to fill demand from Pacific Rim countries. No longer dominated by a single species, California's fishing industry harvests an amazing variety of local fish and shellfish, with a collective value of more than \$800 million per year.

# MAJOR FISHING GEAR TYPES

## GILLNETS

### What are Gillnets?

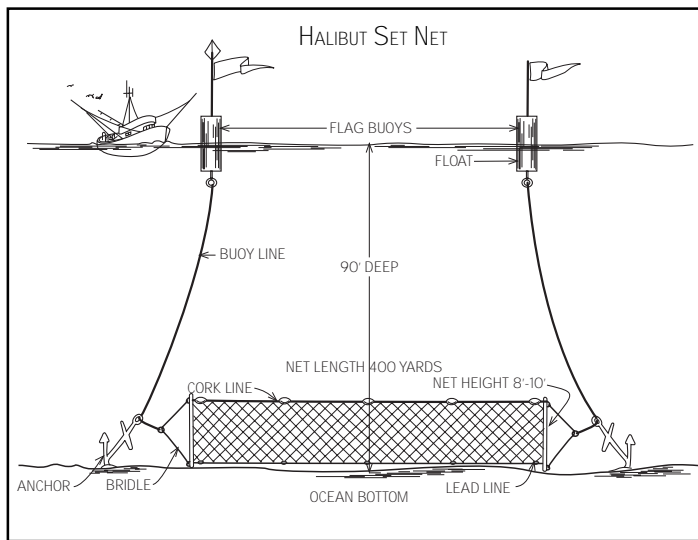
Generally speaking, gillnets are mesh panels of varying dimension deployed to catch fish. (The word gillnet actually is a misnomer: most fish are caught around their midsection, not by their gills.)

Used by fishermen since prehistoric times, the "gillnet" has become a catch-all word describing a multitude of nets -- set, drift, nearshore, offshore, and high-seas. Each type of net is constructed differently and fished differently, targeting different species in different areas. Importantly, in different areas, each net has different effects.

Research has shown gillnets to be among the most size-selective of fishing gears: By regulating mesh size, resource managers can control the size of fish caught. Undersized, juvenile fish pass through the webbing, allowing them to reach maturity before entering the fishery. Gillnets are economically efficient, enabling fishermen to provide a consistent supply of top-quality fish at reasonable cost.

### Set Gillnets

Fishermen use set gillnets primarily to catch California halibut, certain shark species, white seabass, barracuda, white croaker, flying fish, and rockfish. Mesh sizes, seasons, and other restrictions vary by species and area.



Set gillnets are anchored to the bottom of the ocean and typically retrieved 24 hours or less after the set. Fish are usually alive when retrieved and are of top-quality when delivered to market.

**Halibut:** minimum mesh size is 8 1/2" measured diagonally between knots. Available yearlong, halibut landings peak in spring and summer. Virtually all California halibut are caught in water less than 180 feet (30 fathoms) deep. In normal cycles, approximately 75 percent of the state's halibut catch is landed in southern California. Until inshore gillnets were prohibited in 1993, close to 80 percent of the catch was provided by gillnet.

**White seabass:** minimum mesh size is 6". Season runs June 16 - March 15. Fishermen usually deploy nets near the ocean surface in springtime to catch seabass. In late summer and

fall, fish go to the bottom and fishermen set their nets on the bottom. Fishermen also use drift nets submerged under the surface to target white seabass.

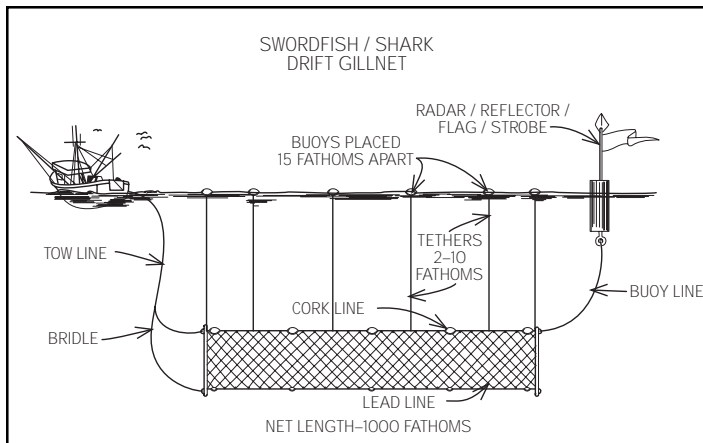
**Rockfish:** Mesh size is 4 1/8" - 5" Nets are set in deep water, sometimes 600 feet deep or deeper, to catch rockfish. Studies indicate that there is virtually no accidental taking of marine mammals in rockfish nets.

**White croaker, bonito, flying fish:** Mesh size is 2 3/4" - 3".

# MAJOR FISHING GEAR TYPES

## Drift Gillnets

Attached to the stern of the fishing boat, drift gillnets are usually deployed at night to drift below the ocean surface. These nets are retrieved at dawn.



Nearshore drift gillnet fisheries include:  
White seabass: minimum mesh size 6". Fishermen drift for white seabass in springtime.  
Barracuda: mesh size 3-3 1/2".

With super-wide mesh size of 18-22", California's limited-entry shark drift net fishery operates seasonally, August 15 - December 15. Broad areas of southern California are closed to drift nets during summer to provide an exclusive zone for swordfish harpoon fishermen. Fishermen have cooperated with the Legislature to enact additional seasonal closures to protect marine mammals and conserve the thresher shark resource.

California's swordfish drift net fishery \* is among the most valuable fisheries in the Golden State. From 1981 to 1991, California swordfish landings averaged 2.76 million pounds per year, valued at approximately \$40 million wholesale. Fishermen deploy super-wide mesh nets no more than one mile in length for both swordfish and thresher shark. These nets are completely different from large-scale, small-mesh foreign high seas drift nets, which may be up to 15 - 20 miles long and fish at the surface, where most interactions with non-target marine life occurs.

California's drift net swordfish and shark fisheries are the most strictly managed net fisheries in the world, with numerous seasonal and area closures implemented to provide exclusive areas for other fisheries and to conserve marine resources. The swordfish fishery is open May 1 - August 14 outside 75 miles of the mainland coast. From August 15 - December 15, both swordfish and shark fisheries are open with sub-area closures and restrictions. The drift net fisheries are closed within 25 miles of the mainland December 15 - January 31 to protect gray whales.

## Gillnet Interactions:

During the years 1980-1987, the California Legislature enacted 17 bills regulating the use of gillnets in California. Ten bills implemented gillnet closures in nearshore waters from Point Reyes to Point Sal in central California to protect marine mammals and seabirds. Gillnet fishermen cooperated with the Department of Fish and Game to close sensitive areas.

Despite biological studies indicating that marine mammal populations were healthy and expanding in the presence of gillnet fisheries, in 1990 voters passed a controversial ballot initiative, Proposition 132, which prohibited gillnets in state waters of southern California beginning January 1, 1994. In southern California, coastal gillnets interact primarily with California sea lions and harbor seals.

California gillnet fisheries classified as Category 1 under the Marine Mammal Protection Act ("frequent" unintentional taking of marine mammals) have carried observers since 1990. Fishermen continually seek ways to reduce interactions with marine mammals.

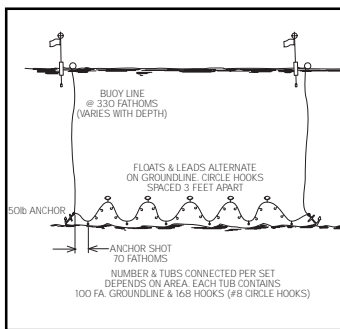
As one example, swordfish fishermen helped to fund a study testing the effectiveness of acoustic "pingers" on drift nets to alert whales and dolphins to the net's presence. The experiment was so successful that the National Marine Fisheries Service mandated pingers on California-Oregon shark and swordfish driftnets, effective in 1996. Observer data indicates that by using acoustic pingers, fishermen are reducing accidental takings of cetaceans in these nets to a rate near zero.

## MAJOR FISHING GEAR TYPES

### Hook & Line:

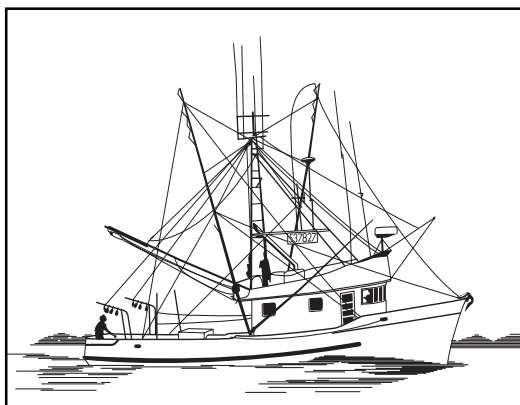
"Hook-and-liners," as these fishermen are sometimes called, are an historic and important part of California's fishing industry. Commercial hook-and-line gear dates back to the 1800's in California and encompasses trolling, jigging, the traditional horizontal longline, and a vertical longline that is also called Portuguese longline or "buoy gear."

Typical of buoy gear, the **vertical longline** employs a 300-pound test monofilament gangion and circle hooks spaced about 12 inches apart, attached to the gangion with monofilament leader. A weight is tied to the bottom end of the gangion. At the other end is a length of 1,000-pound test seine twine just long enough to put the first hook on the bottom. The buoy, tied to the seine line, holds the gangion vertical in the water. Wind and waves jiggle the buoy, which wiggles the line while the baited hooks attract fish. Especially in southern California, fishermen use buoy gear to catch a variety of rockfish.



The traditional **longline** consists of a groundline run horizontally across the ocean bottom. Anchors hold the line in place, and buoys and a radar reflector mark its position on the surface. Floats and leads alternate with hooks on the line. In California, these longlines are often housed in galvanized tubs (called tub gear). Each tub holds about 168 hooks, which are spaced three feet apart on the groundline. The hooks are meticulously stuck around the tub rim while the line is coiled inside. Fishermen sometimes string 20 tubs of gear in one set, covering two miles of bottom. Longline fishermen may bait 10,000 hooks or more in a day, beginning at 4 AM and working until dark or until the last string of gear is pulled and reset. In northern California, fishermen use longline gear to catch black cod (sablefish) and rockfish.

**Troll gear**, typically used to catch salmon, consists of up-to-6 stainless steel main lines unwound from hydraulic gurdies, or spools, mounted on the fishing vessel. The wires are suspended from outrigger poles on either side of the boat, which helps spread out the gear. Monofilament leaders with hooks attached are clipped onto the main wires, usually at three-fathom intervals (18 feet). The number of leaders on each main line varies with the depth and fishing conditions. For example, if fish are near the surface, only a few leaders may be clipped to each line; conversely, a line may carry as many as 10 hooks if fish are deep or scattered in the water column. Each wire line, with its series



of leaders, is held in place at a particular depth by a lead cannonball clipped to the bottom of the line. Trollers sometimes also clip a float onto the line at the surface to help regulate its depth and spacing relative to the other lines fishing. Herring or anchovy bait, or spoons, plugs, or hoochies, called "hardware," are fastened to the hooks, and the gear is trolled slowly through the water. Running the gear, fishermen unclip the leader from the main line, pulling hooked fish to the boat by hand. The fish are then gaffed or netted aboard. Albacore trolling employs a similar concept, although the lines are fished solely at the surface.

Species caught with hook and line gear include king and coho salmon, rockfish, black cod (sablefish), albacore tuna, California halibut, and lingcod.



## MAJOR FISHING GEAR TYPES

### Trawl:

Trawl fishermen employ three basic types of trawl nets in California to catch a variety of species. The advantages of the trawl net are its economy of scale and consistency of supply. Trawl fishermen provide the largest volume of popular table fish, such as fillet of sole and Pacific red snapper.

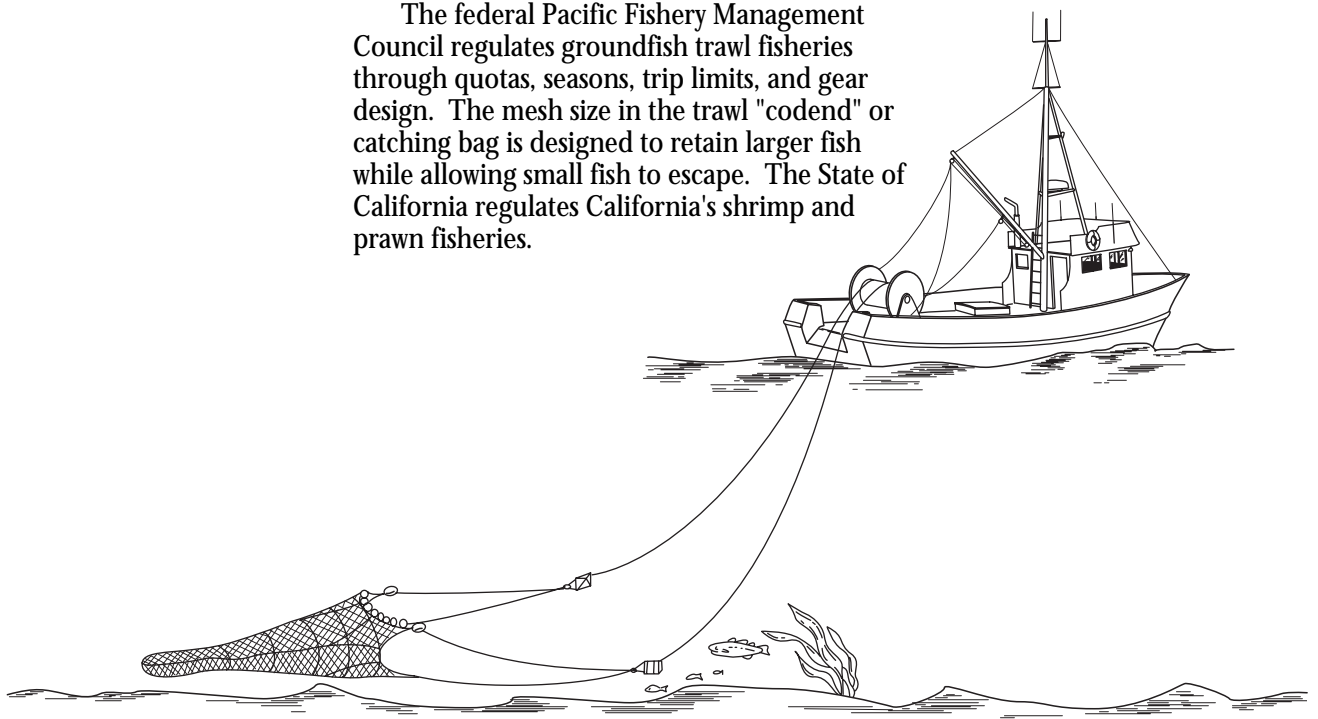
Bottom trawl nets skim the ocean floor in depths from 50 to 4,000 feet. **Bottom trawlers** in southern California fish the Santa Barbara Channel for California halibut, sea cucumbers, spot prawns, and ridgeback prawns. In central and northern California, trawlers fish for a complex of groundfish species including flounder, lingcod, rockfish (commonly called Pacific red snapper), blackcod (sablefish), several varieties of sole, and thornyhead (also called channel rockfish).

**Midwater trawlers** tow nets through the water column for Pacific whiting (hake), the single largest biomass of fish on the Pacific coast.

In northern and central California, **shrimpers** use small-mesh trawl nets to fish for Pacific pink shrimp. Many shrimp vessels are double-rigged to tow two nets, one on each side of the boat. The nets are pulled through the water about 18 inches above the ocean floor during a shrimp season that runs April 1 through October 31.

In northern and central California ports, trawlers land the largest volume of fresh local seafood delivered to market. Trawl groundfish is often processed into fillet form: fillet of sole, Pacific red snapper, and lingcod are three local seafoods typically provided by trawlers. Trawlers delivered more than 54 million pounds of fresh seafood into the northern California ports of Crescent City, Eureka, and Fort Bragg in 1991 -- nearly 85 percent of all fish landed.

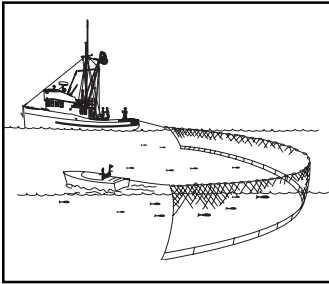
The federal Pacific Fishery Management Council regulates groundfish trawl fisheries through quotas, seasons, trip limits, and gear design. The mesh size in the trawl "codend" or catching bag is designed to retain larger fish while allowing small fish to escape. The State of California regulates California's shrimp and prawn fisheries.



## MAJOR FISHING GEAR TYPES

### Round-haul:

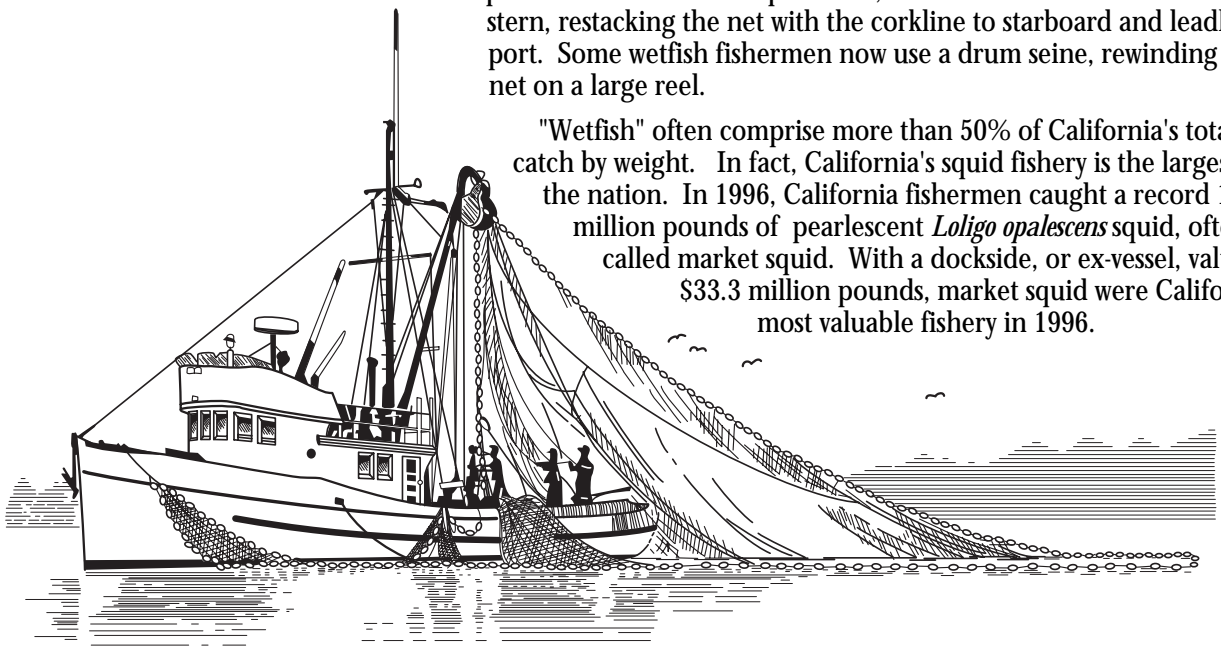
Round-haul nets such as the purse seine have seen use in California since the mid-1800's, when Chinese fishermen rowed Monterey Bay at night in sampans, carrying baskets filled with burning fat pine in the bow -- torches to attract squid. The Chinese surrounded the squid schools with small seines and pulled the nets by hand, requiring the effort of 10 to 12 men. In the early 1900's immigrant Sicilian fishermen introduced the lampara, a type of round-haul net used successfully in the Mediterranean, to catch squid and sardines in the new world. The enterprise of these immigrants largely built the fishing ports of Monterey and San Pedro.



Today, California fishermen employ updated versions of the old purse seine and lampara nets to catch a variety of "wetfish", so called because these fish are packed in the can with minimal pre-processing and cooked at high temperature in a retort. Anchovy, mackerel, and sardines are typically called wetfish. California's round-haul fleet also lands squid, bonito, and tuna with round-haul nets. Squid are fished in the Half Moon Bay - Monterey area and in southern California. Bonito and tuna are primarily caught in southern California. Round-haul fishermen also fish Pacific herring with purse seine nets in San Francisco Bay.

Round-haul nets like purse seine and lampara work on the same general idea -- to encircle fish in a bag of webbing. Today a motor skiff quickly deploys the net around a school of fish. The lampara has a large central bag of webbing and short wings of larger mesh, hung so the leadline at the bottom of the net is pulled in advance of the corkline at the top. With both wings pulled simultaneously, the leadline closes, drawing the net into a scoop. In the purse seine, the landing bag, with its smaller mesh, is at the end of the net and purse lines strung through rings at the bottom of the net draw the seine closed, much like the action of a drawstring purse. The purse rings are then bunched and boomed aboard, and the net is "dried up," the wings pulled aboard with a power block. In some operations, four or five crewmen stand at the stern, restacking the net with the corkline to starboard and leadline to port. Some wetfish fishermen now use a drum seine, rewinding the net on a large reel.

"Wetfish" often comprise more than 50% of California's total catch by weight. In fact, California's squid fishery is the largest in the nation. In 1996, California fishermen caught a record 177 million pounds of pearlescent *Loligo opalescens* squid, often called market squid. With a dockside, or ex-vessel, value of \$33.3 million pounds, market squid were California's most valuable fishery in 1996.



## MAJOR FISHING GEAR TYPES

### Trap or Pot:

California fishermen use pots in northern California to catch Dungeness and rock crab, as well as sablefish; in central and southern California waters fishermen deploy traps for spot prawns, which are delivered to market alive. Also in southern California, fishermen use traps to catch spiny lobster, one of the southland's most valuable fisheries, and a variety of crabs, including spider crab and three species of rock crab.

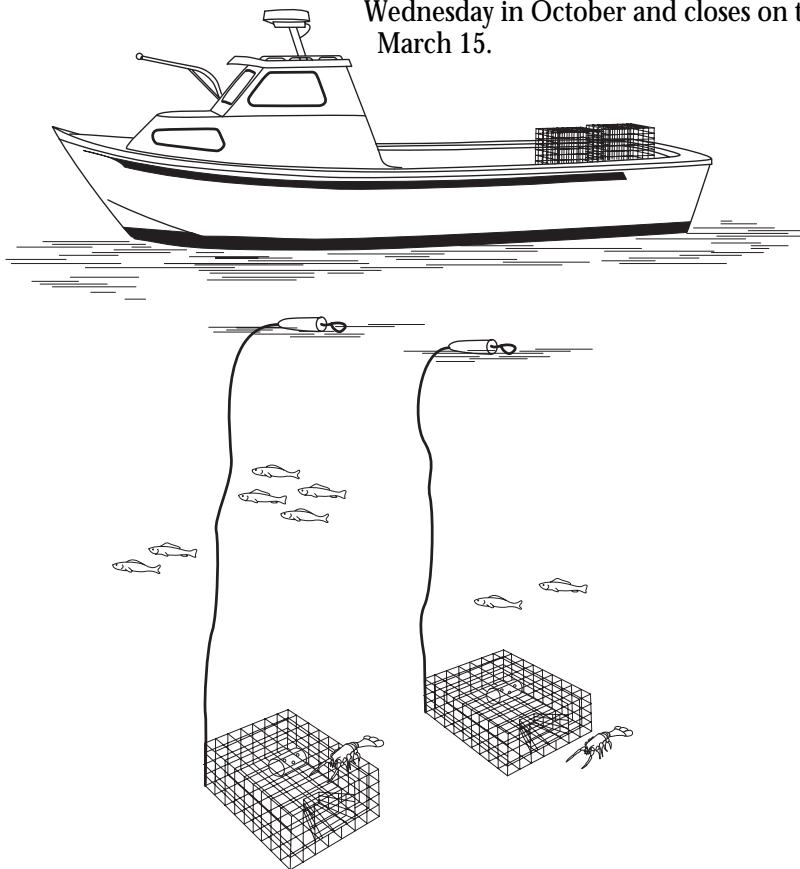
Traps or pots are typically constructed of galvanized wire, sometimes vinyl-coated. Escape ports or rings are an integral feature of these traps, a conservation measure designed to release undersized species. Trap doors are also fastened with bare metal crimps that dissolve in seawater, freeing the catch if the trap is lost.

Brightly painted buoys marked with the fishermen's license number signal the presence of traps in the ocean. Fishermen typically deploy strings of traps, spaced according to the physical characteristics of an area and fishing conditions. Generally traps are set shallow in early fall, then moved deeper with the onset of winter storms.

Fishery seasons of note:

**Dungeness crab** season in the San Francisco Bay area opens on the second Tuesday in November. The bulk of California's Dungeness crab harvest comes from the northern coastal ports of Crescent City, Eureka, and Fort Bragg, where the season opens on December 1 and extends through July.

**California spiny lobster** season opens on the first Wednesday in October and closes on the first Wednesday after March 15.

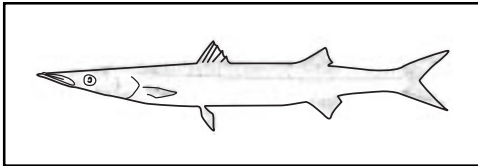


# MAJOR FISH SPECIES NATIVE TO CALIFORNIA

California seas are blessed with an amazing variety of fish and shellfish. California fishermen and seafood suppliers deliver approximately 300 species to market each year. While the state's fishing industry once was dominated by sardines, and later by a tuna fishery that accounted for 70 percent of the industry's ex-vessel revenues as recently as 1980, now a mix of species contributes both to the volume and value of the California catch.

In 1996 the Golden State's top revenue-generating species were California market squid, sea urchins, tunas, Dungeness crab, groundfish species such as sablefish, rockfish and soles, roe herring, swordfish, king salmon, spiny lobster and pink shrimp. Following is a synopsis of California's major species: where they are found, and how they are caught. Please contact the Council for more information on these species or on others that may not be included in these pages, or consult the reference book credited at the end of this list.

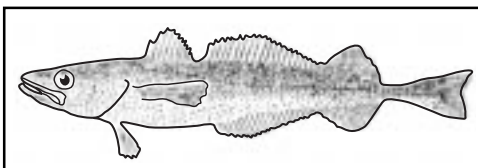
## Barracuda



California barracuda are nearshore, epipelagic, schooling fish found from Cabo San Lucas, Baja California, to Kodiak Island, Alaska. Thin and toothy, an axe handle with jaws, Pacific barracuda are smaller than their Atlantic relatives, and undeserving of the fierce image conjured by their name. However, the California variety is a fighting fish on a sportsman's line. Barracuda became a popular game fish after World War II. The catch has historically centered in southern California and northern Baja.

Barracuda figured prominently in the development of California's purse seine fishery in the early 1900's. Landings peaked in the early 1940's, then declined, while a series of state regulations supplanted the purse seine in favor of gillnets and hook and line. A popular market fish during the fishery's heyday, barracuda fell out of fashion -- out of sight, out of mind -- as the public taste turned to shark. Barracuda have returned to abundance, awaiting rediscovery as Californians increasingly value the health benefits of Omega-3-rich seafood.

## Hake (Pacific whiting)

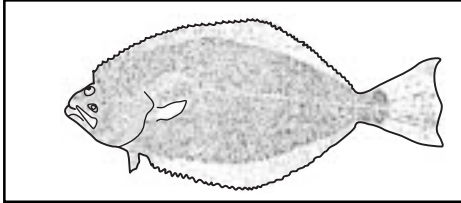


Pacific hake, the single largest biomass of fish in the Pacific, are found from the Gulf of Alaska to the Gulf of California. The largest of four major stocks, the "coastal stock" is managed by the Pacific Fishery Management Council. Pacific whiting was considered an underutilized species until 1991, the first year that the entire quota was caught and processed by the U.S. fishing industry. (Although a small domestic fishery for hake has continued since the late 1800's, beginning in 1966 foreign fleets, and later joint ventures, with foreign processing vessels served by U.S. catcher boats, harvested hake.)

A delicate, white-meated fish, Pacific whiting are now processed into surimi by both sea-going factory trawlers and shoreside processing plants. Surimi, highly refined minced fish, is used in the production of imitation crab, scallop, and shrimp products. Shore-based plants in northern California, Oregon, and Washington process whiting.

## MAJOR FISH SPECIES NATIVE TO CALIFORNIA

### California Halibut

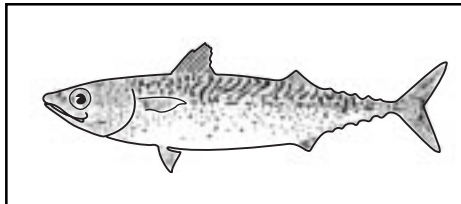


These bottom-dwelling flatfish are yearlong residents in sand and mud-bottomed coastal waters, found from the surf zone to about 300 feet deep, from Washington State to Baja California. The area of greatest abundance is southern California and northern Baja. California halibut, with a maximum length of 60 inches and weight to 72 pounds, are smaller than Pacific halibut. Ambush predators with both eyes usually located on the left side of the head, California halibut are non-schooling, unpredictable, elusive fish -- the "bread and butter" fish of California's nearshore groundfish fishery.

Twenty-two inches is the minimum legal length for commercial sale of California halibut. In the last decade, California fishermen have provided an average 1.1 million pounds of this mild-flavored, white-meat fish to consumers. In normal ocean cycles, more than 70% of the catch originates in central and southern California waters. Because of their economy of operation and consistent ability to catch fish, gillnets historically provided most of California's halibut catch.\* California halibut is also caught with hook and line and large-mesh trawl in designated areas.

*\* Proposition 132 prohibited the use of gillnets in state waters by 1994.*

### Pacific Mackerel



Pacific mackerel, also called blue mackerel, occur worldwide in temperate and subtropical coastal waters. In the eastern Pacific they range from Chile to the Gulf of Alaska but are most abundant south of Point Conception, the demarcation point of southern California. These fish form dense schools as a defense against predators and are often found with other pelagic species, including jack mackerel and sardines.

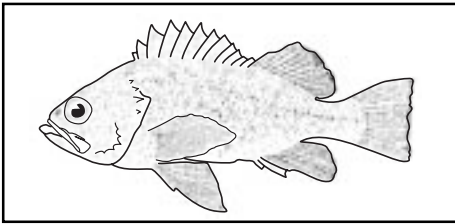
Pacific mackerel supported one of California's major fisheries during the 1930's and '40's, and again during the 1980's and early 90's. A "wetfish," along with anchovies and sardines, mackerel are so called because they are canned with minimal pre-processing (wet from the ocean). The canning of Pacific mackerel began in the 1920's, paralleling the development of California's sardine industry. During the 1930's, mackerel was second only to Pacific sardines in total annual landings. From 1984 through 1991, Pacific mackerel ranked first in volume of finfish landed in California.

Mackerel is still an important catch for California's traditional purse seine fleet, which operates yearlong in the southern California Bight, occasionally traveling to offshore banks and the Channel Islands. Monterey's round-haul fleet also lands mackerel. Mackerel have a cyclic and seasonal pattern: fish tend to move offshore and out of range of the coastal fishery from January through May, then become increasingly abundant inshore until late fall. California's harvest is also governed by a quota that varies with the estimated biomass; this biomass is influenced by natural oceanic cycles.

Commercially harvested Pacific mackerel seldom exceed 16 inches in length and two pounds. Currently most of the Pacific mackerel catch is canned for human consumption and pet food, with a small amount sold to the fresh market.

## MAJOR FISH SPECIES NATIVE TO CALIFORNIA

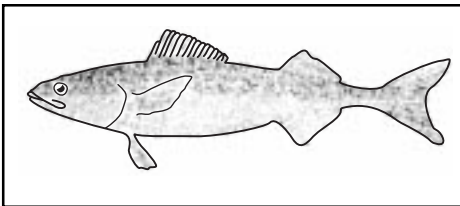
### Rockfish



Rockfish belong to the family Scorpaenidae, or scorpionfishes. One of the most important fish families in California waters, the rockfish group encompasses 59 species, most of them desirable at market. State law allows 13 species to be called Pacific red snapper. These include widow, bocaccio, chilipepper, vermilion, yellowtail, black, and olive rockfish, to name several. However, none of these fish is a true red snapper, which is an Atlantic species not found on the West Coast.

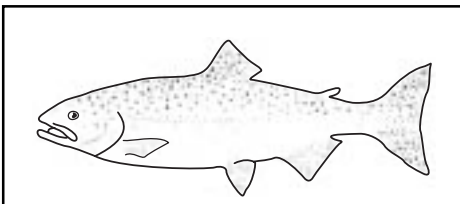
Many rockfish species range from Baja California to British Columbia, and some extend to Alaska. Adults of most species are found at depths to 1,200 feet. Rockfish are basically non-migratory fish. Recognized by the sharp spines on their dorsal fins, rockfish vary in length from 20" to 37" and may weigh up to 30 pounds. The species mix varies by area and fishing method: fishermen use hook and line (a category that includes both troll and longline), gillnets, and trawl nets to catch rockfish. Gillnet and trawl catches, which produce the largest volume at a reasonable price, are often processed into fillets for restaurants and retail sale, although some of this fish is also marketed whole. Hook and line rockfish are usually marketed in whole form, with a growing number delivered alive. Considered premium quality by Oriental markets, the hook and line catch receives top price.

### Sablefish



Sablefish range from the Asiatic coast of the Bering Sea to northern Baja California. Dark gray to black in color, sablefish are sometimes called blackcod, although not a member of the cod family. They have long been an important component of the California catch. In the 1930's sablefish livers, rich in vitamin A, commanded a higher price than the meat. In recent years, most of the sablefish caught in California, as well as elsewhere on the Pacific coast, have been exported to Japan, where the velvet-textured, oily, white-meated fish is highly prized. The high oil content of the flesh produces an excellent smoked product. Many experts regard sablefish as one of the best flavored of all fish. Fishermen employ longlines, trawl nets, and traps to catch sablefish.

### Salmon



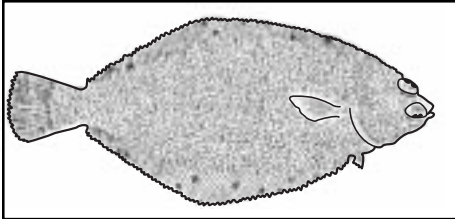
All Pacific salmon are anadromous, beginning life upstream, migrating to the ocean, then returning to their natal stream to spawn and die. King salmon, the largest of five Pacific salmon species, spawn in suitable rivers from the Sacramento - San Joaquin system northward.

California's commercial salmon fishery has endured since the mid-1800's. King salmon is the primary catch, although fishermen also occasionally land pink salmon. (Coho, or silver, salmon has been a prohibited catch for several years.) In its earliest days, the fishery operated in the lower Sacramento and San Joaquin Rivers, stimulated by the canning industry. The first salmon cannery on the Pacific coast began operating on the Sacramento River in 1864. Peaking in 1881-82, the industry later collapsed; the last cannery closed in 1919.

The ocean troll fishery began in the 1880's in Monterey Bay, the first trollers going to sea in small sailboats. Today's fishermen still use the basic techniques developed in the 1920's and '30's -- including powered gurdies and four to six main trolling lines. Today, entry to the fishery is limited. A fleet that numbered approximately 2,900 trollers in 1992 fish in a season that extends from May 1 through September 30, south of San Francisco. North of San Francisco Bay, the season is highly regulated to conserve Klamath River salmon stocks.

## MAJOR FISH SPECIES NATIVE TO CALIFORNIA

### Sole

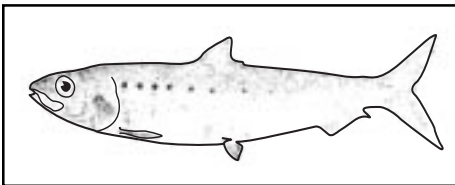


Dover, English, Petrale, and Rex sole are all highly popular flatfish species caught by California's trawl fleet. Until the emergence of the Pacific whiting fishery, these sole species were the most abundant groundfish in the California catch. The sole family is caught jointly with other marketable groundfish such as sablefish and thornyheads. Eureka, followed by Fort Bragg, Crescent City, Monterey, San Francisco, Morro Bay, and Port San Luis are the primary ports producing sole.

Generally speaking, soles spawn in deep water during wintertime and, shortly after spawning, move inshore through spring and summer months. However, tagging studies found that many mature Dover sole remain in deep water yearlong. Petrale tend to move shoreward and northward in summer.

Also varying by species, the sole family ranges from Baja California to northwest Alaska or the Bering Sea. Dover can be found on mud bottoms to depths of 4,800 feet. English and Petrale sole extend as deep as 1,500 - 1,800 feet. Petrale prefer sand bottom and have been known to move great distances. Petrale are larger than most California flatfish, and are the premium sole at market. Rex sole, which occur to about 2,100 foot depths on muddy-sandy bottom, are generally not filleted because their thin body does not allow for efficient recovery. Rex are highly prized by connoisseurs for bright, white flesh and a sweet, distinctive taste.

### Pacific Sardine



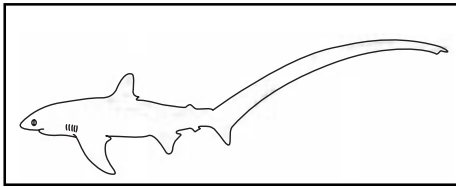
Small pelagic fish often found in association with mackerel and anchovy, Pacific sardines are a member of the herring family. The principal stock ranges from northern Baja California northward as far as Alaska. Historically this population migrated extensively, moving north as far as British Columbia in summer and returning to southern California in the fall. In the 1930's and '40's, Pacific sardines provided the source for the largest fishery in North America; the sardine industry centered in California. More than 100 canneries and reduction plants from San Diego to San Francisco employed thousands of workers to process sardines. At its peak in 1936-37, this industry encompassed more than 350 boats, which produced 726,000 tons of fish. About 70% of the catch was reduced for fishmeal and 30% went for food -- three million cases of canned sardines.

Beginning in the late 1940's, sardines vanished -- first from the Pacific Northwest, then from Monterey, and in the 1950's from southern California. Scientists now recognize that, beyond fishing pressure, a change in oceanic cycles, reflected in an extended period of below-normal water temperatures, greatly influenced the decline.

In this current warm-water oceanic cycle, sardines have returned to abundance and fishing is regulated by quotas determined by the size of the spawning biomass. Today a much smaller wetfish fleet fishes sardines. In Monterey, sardine fishing peaks in summertime, when the fish are larger. In southern California, the sardine fishery begins in January. A federal management plan for coastal pelagic species, including sardines, anchovy, and mackerel, is under development by the Pacific Fishery Management Council.

## MAJOR FISH SPECIES NATIVE TO CALIFORNIA

### Thresher Shark

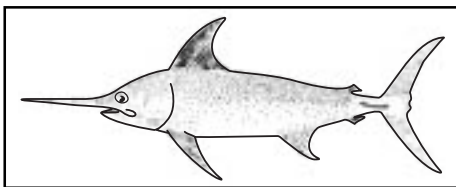


Found in temperate waters, thresher sharks inhabit the Atlantic Ocean from the Gulf of Maine to the Gulf of Mexico. In the Pacific, they range from British Columbia to southern California. These fish move with the season and water temperature; big fish tend to swim north in summer and south in winter. Reaching 25 feet in length, the thresher is identified by its small mouth and a tail that measures almost half of its total body length, which is used to stun prey.

California's commercial thresher shark season is open August 15 to December 15 inside 25 miles of the coast. Most thresher are caught within 25 miles of the mainland in an area extending from central California to the Mexican border. California fishermen with special permits employ super large-mesh (18"-22") drift gillnets to catch thresher, fishing at night and retrieving the catch at dawn. The fishery is closed in spring and early summer to protect breeding populations. Thresher are slow-growing sharks that give birth to live young, usually two to four pups a year.

Shark has become increasingly popular dining fare in the last decade. The primary shark harvested in California, thresher possesses firm texture, mild flavor, and pinkish colored flesh. A popular meat for grilling, it is also excellent when broiled, baked, or steamed. Other mild-flavored, equally tasty shark species landed in California include mako, also called bonito shark, and nearshore shark species such as angel, leopard, and soupfin shark.

### Swordfish



Swordfish are found in tropical and temperate oceans worldwide. In the Pacific, swordfish range from Asia to the Americas and from northern waters off Alaska to the southern reaches of South America. Preferring warmer climes, swordfish characteristically surface at night and move to the depths in daylight. These broadbills congregate in areas where food is abundant, along frontal zones where ocean currents meet to create turbulence and sharp temperature breaks. There are five such zones in the Pacific, and this is where most fishing occurs. Swordfish are fished by many Pacific Rim countries: the top swordfish harvesting nations in the Pacific are Japan, Chile, and the Philippines, in order. California ranks fourth, representing about 10% of Pacific swordfish landings.

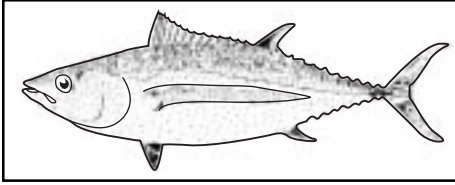
California swordfish fishermen are the most strictly regulated of all Pacific Rim fleets. Most California swordfish are caught with super-wide-mesh drift gillnets (18"-22" mesh) in a season open from August through January. \* The regulated use of these nets insures a consistent catch in all water conditions. Often enduring dangerous ocean conditions, California fishermen may range from north of San Francisco to the Mexican border and up to 200 miles offshore in search of swordfish. The men and women of California's swordfish fleet work hard to deliver a top-quality product to market. One of the most popular seafoods, swordfish steak is moderate flavored and can be easily broiled, baked, or grilled.

*\* Please refer to additional information sheets published by the California Seafood Council describing the operation of drift gillnets, California's swordfish fishery, and the important differences between California's drift gillnets and the unregulated small-mesh high-seas drift nets used by foreign fleets.*



## MAJOR FISH SPECIES NATIVE TO CALIFORNIA

### Albacore Tuna

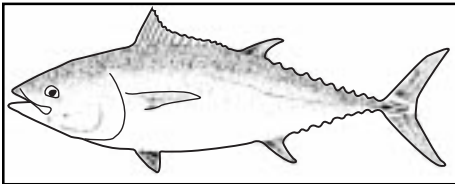


Albacore is the only tuna species allowed to be marketed as white meat tuna. Traditionally the premium canned tuna, this highly migratory species is gaining prestige in the finest white-tablecloth restaurants and sushi bars for its mild, delicate flavor.

A cosmopolitan fish, albacore range in subtropical and temperate oceans worldwide. In the Pacific, juvenile albacore embark on well-defined migrations between eastern and western shores. Research suggests that at least two subpopulations inhabit the North Pacific, each with different migration patterns. Spawning adults, more than six years old, make shorter journeys than their offspring.

Off the North American coast in summer and fall, albacore run from Baja California northward to Canada's Queen Charlotte Islands. California albacore fishermen troll feathered jigs at the ocean surface to catch these swift-swimming fish. Several members of the fleet also travel to the South Pacific to fish albacore during wintertime.

### Bluefin Tuna



Bluefin spawn between Japan and the Philippines in the spring and summer and migrate across the Pacific in their first or second year of life, the journey taking seven months or less. These fast-swimming fish may grow to several hundred pounds. Bluefin are rarely encountered south of Cabo San Lucas, Baja California, or north of Point Conception, California. Purse seiners targeting mackerel and sardines occasionally spot the herring-bone pattern of bluefin schools in the Santa Barbara Channel in summer and fall. In the fall of 1988, seiners landed nearly 1,000 large bluefin in a three-month period. Most of the fish were flown to Japan, where this ruby-red-meated fish is prized as sashimi and brings a high price.

### Yellowfin Tuna

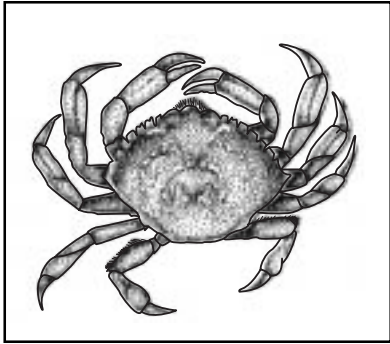
Yellowfin tuna are found throughout the tropical Pacific. The world's single largest biomass of yellowfin inhabits the Eastern Tropical Pacific Ocean (ETP), ranging from Chile to southern California. Tagging studies indicate that the ETP stock is a single population, with seasonal coastal migrations but no large-scale movement to the central or western Pacific. In the daytime, mature yellowfin associate with dolphins to some degree in all the world oceans. However, the relationship with dolphins is well-developed in the eastern Pacific. ETP tuna stocks have been regulated by the Inter-American Tropical Tuna Commission since 1966.

Tuna was first canned in California in 1903; by 1907 the industry was well established, packing primarily albacore. By the late 1920's, the volume had shifted to yellowfin and the smaller skipjack. The development of brine refrigeration in the late 1930's led to the fishery's expansion far southward. In 1957, the introduction of strong, light-weight nylon netting and the power block spurred the traditional bait boat fleet to convert to purse seines, a more efficient and effective way to catch tuna.

The U.S. tuna fleet based in southern California grew to become the largest of its kind in the world. From 1982 through 1984, the major canneries in southern California relocated outside the U.S., unable to compete with foreign labor rates and increasing competition from imported, lower-priced water-packed tuna. The relocation of industry, and increasingly rigid marine mammal protection policies, are primary reasons why most U.S. tuna vessels now fish in the Western Pacific (many vessels also were forced to reflag or went bankrupt). California's tuna fleet is now a distant-water fleet that delivers its catch to canneries in Asia, American Samoa, South America and Puerto Rico.

## MAJOR SHELLFISH SPECIES NATIVE TO CALIFORNIA

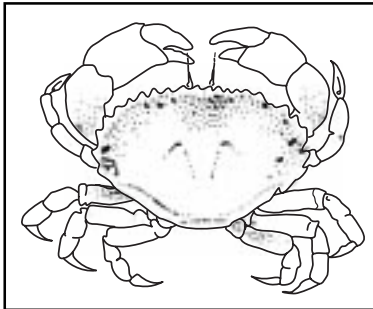
### Dungeness Crab



The largest edible true crab on the West Coast, Dungeness are fished from Alaska to central California and are generally found on open sandy bottom or near rocky reef-type substrate. Fishermen deploy circular crab pots to catch Dungeness, leaving them submerged on the ocean bottom overnight or longer, depending on fishing conditions. The central coast season opens the second Tuesday in November; Dungeness are a Thanksgiving tradition in the San Francisco Bay area. The northern California season opens December 1 (coinciding with Oregon and Washington) and extends to July 15. Northern ports of Crescent City, Eureka, and Fort Bragg account for as much as 95 percent of statewide landings.

The seasons are established to allow harvesting when crab are in prime market condition. Regulations prohibit commercial harvest of female crab and set a minimum size limit on males of 6 1/4" measured across the back. Dungeness are generally sold in whole, cooked form, although some are marketed alive, even shipped overseas. This popular seafood is often served in salads, in cioppino, or simply cracked on the plate, accompanied by drawn butter and crusty sourdough bread.

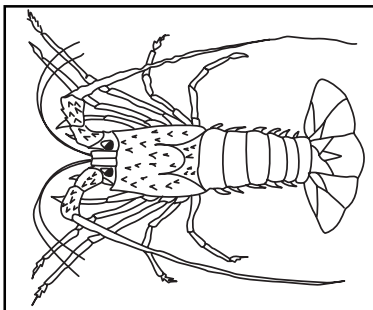
### Rock and Spider Crab



California fishermen harvest three distinct species of rock crab -- all cousins of the Dungeness. Most of the catch comes from the Santa Barbara region, where rock crab are available yearlong. These members of the Cancer family are noted for the flavorful meat in their legs and claws; unlike Dungeness, there is little meat in the body.

Spider crab, also known as sheep crab, range from Cordell Bank (Marin County) south to Baja California in depths of 20 to 410 feet. They are caught in traps primarily in southern California. These knobby, long-legged crab are an uncommon treat: connoisseurs say the delicate flavor and firm texture of spider crabs' plentiful leg and body meat surpasses that of snow crab. Spider crab are sometimes called California king crab.

### California Spiny Lobster

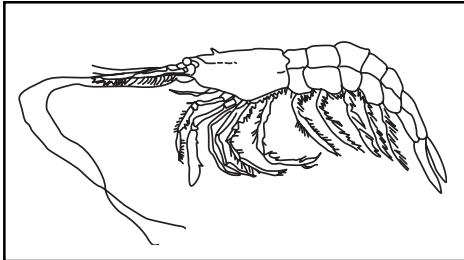


California spiny lobster range from Monterey Bay to Mexico, but most of the catch comes from the southern California coast and Channel Islands. Female lobster migrate to the shallows to spawn during spring and summer; in fall the population moves offshore to mate. Larval lobster drift in the ocean for 18 months and molt 12 times before they settle on the bottom. Adult lobster shed their shells once a year. Typically found in rocky habitat ranging from the intertidal zone to more than 240 feet deep, lobster are nocturnal, hiding in the rocks by day and foraging widely at night.

California lobster fishermen set rectangular traps for lobster. Trap regulations require an escape port for undersized lobster, and trap doors are fastened with bare metal crimps that dissolve in seawater over time. Open season extends from the first Wednesday in October to the first Wednesday after March 15. Minimum legal size for the commercial catch is 3.25" carapace length; these lobster reach legal size in 7 to 11 years. California spiny lobster lack the large pincer claws characteristic of east coast lobster; thus the sweet, tender meat is concentrated in the tail. California spiny lobster's fine texture and sweet flavor are prized in Asian markets.

## MAJOR SHELLFISH SPECIES NATIVE TO CALIFORNIA

### California Prawns



A confusing turnabout in gastronomic appellation, the California spot prawn is really a shrimp, and the ridgeback shrimp is a true prawn. Without a doubt, both are delicious.

Spot prawns are aptly named for the four bright white spots on their bodies. Commonly found from Alaska to San Diego, spot prawns inhabit rocky and adjacent areas at depths from about 150 to 1,600 feet. These prawns begin life as males then change sex to female after about two years, as they near spawning age. Spot prawns live about six years, reaching six inches in length. Monterey fishermen trap spot prawns yearlong; southern California trawlers fish for spot prawns during summer, and switch to ridgebacks in winter.

Ridgebacks, sometimes called Santa Barbara shrimp, are found from Monterey to Baja California and are fished primarily in the Santa Barbara Channel. The ridgeback's life span is about 4 years, and the sexes remain separate. With their sharp, spiny shells, "ridgies" are the dickens to peel but may be the sweetest tasting prawn on the West Coast.

### Pacific Ocean Shrimp

Pacific Ocean shrimp, also known as pink shrimp, are found from Unalaska in the Aleutian Islands to San Diego, California, at depths from 150 to 1,200 feet. In California, the species generally inhabits depths of 240 to 750 feet. Concentrations of shrimp usually remain in well-defined beds from year to year. These areas are associated with green mud and muddy-sand bottoms. Ocean shrimp tend to move toward the surface at night to feed on plankton. Like spot prawns, pink shrimp are hermaphrodites, beginning life as males, then transforming to females as they approach maturity. Mating takes place in September and October, and peak hatching occurs during late March and early April.

California's trawl fishery for pink shrimp began in 1952, after the Department of Fish and Game found commercial quantities during a research cruise. In 1981 uniform regulations were set for the Pacific coast: these regulations set open season April 1 through October 31, prescribe a minimum trawl mesh size of 1 3/8" measured inside the knots and a maximum count per pound of 160 shrimp. California's shrimp fishery is divided into three regulatory areas: Crescent City - Eureka, Fort Bragg - San Francisco, and Half Moon Bay to the Mexican border. An average of 63 vessels participated in the fishery from 1983 to 1990, and California landings averaged 3.7 million pounds from 1952 through 1990. The Crescent City - Eureka area has consistently produced the highest landings.

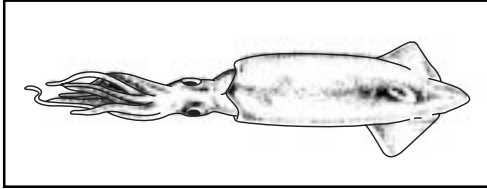
### Sea Urchins

Spiny echinoderms, sea urchins once were considered pests, blamed for decimating kelp beds. In the early 1970's, a diving fishery was begun to harvest urchins and export them to Japan, where sea urchin roe, or "uni," is a delicacy. By the late 1980's, with favorable exchange rates, the price of uni rose and divers flocked to the underwater gold rush. At the advice of industry leaders, the Department of Fish and Game has since enacted increasingly restrictive seasons and size limits to conserve the resource. And divers have assessed themselves several million dollars for research and management of the fishery.

In 1989, sea urchins became California's most valuable coastal fishery, with production exceeding 50 million pounds, valued at more than \$21 million. Landings and value in 1996 were 20 million pounds and \$18.7 million ex-vessel, topped only by squid. Sea urchins are cracked and processed; the gonad or "roe" is hand-packed into wooden trays and airshipped to Japan, where the auction price approaches \$100 a pound during the Christmas holiday season. The export value of California's urchin fishery is estimated at \$80 million annually.

## MAJOR SHELLFISH SPECIES NATIVE TO CALIFORNIA

### California Market Squid



California market squid range from southeastern Alaska to Baja California. This pelagic mollusk grows to 12 inches in length, including its eight arms and two feeding tentacles. Its elongated body, or mantle, houses an internal shell, called a pen. A pair of fins, along with a siphon, propel the squid as it darts through the water. Squid are among the most intelligent of invertebrates, capable of instant camouflage or jet propelled flight in any direction. Several species have been used extensively in neuro-physiological research to study how nerves work.

Historical evidence as well as recent catch data indicate that the biomass of market squid is large. Spawning squid tend to congregate in semi-protected bays, usually over sand bottom with rocky outcroppings. In the Monterey area, spawning usually begins in late April and extends through October. In southern California waters, spawning starts in October and ends around April. Adults typically spawn between 12 and 18 months of age and die after spawning. California's round-haul fleet fishes spawning populations in limited areas around Monterey and southern California. Other fishable concentrations of squid have occasionally been found along the coast from central California to British Columbia, but the only sustained fishery is California's.

Immigrant fishermen from Sicily introduced the round-haul net method for catching squid at the turn of the 20th century. The enterprise of these fishermen contributed importantly to the development of the fishing ports of Monterey and San Pedro. Following the spawning cycle, Monterey's squid fishing season begins in May and extends into fall. Southern California's fishery begins in late October and extends until spring. Fishing usually takes place at night, and squid schools are attracted to the surface with bright lights. Squid are caught by encircling schools with a round-haul net, such as the purse seine or lampara. The net is drawn closed and hauled back, then the catch is brailed aboard the boat and quickly brought to shore for packing.

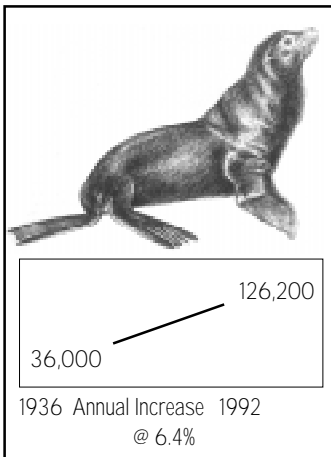
California's squid fishery is the largest in the U.S. In 1996, fishermen caught 177 million pounds of pearlescent market squid, valued at \$33.3 million ex-vessel.

*For more detailed information on these and other species found in California, a highly recommended source is "California's Living Marine Resources and their Utilization," published by the Sea Grant Extension Program, Department of Wildlife and Fisheries Biology, University of California, Davis, CA 95616. Originally published in 1971 and updated in 1992, this book is widely referenced by educators, industry, researchers, and policymakers. This primer has relied on it extensively as an accurate source of information.*

# MARINE MAMMAL POPULATIONS IN CALIFORNIA

California's coastal waters harbor species from three of the four orders of marine mammals. The Order Pinnipedia includes sea lions and seals; Cetacea includes whales, dolphins and porpoises; and Carnivora includes sea otters.

## California Sea Lion (*Zalophus californianus*)

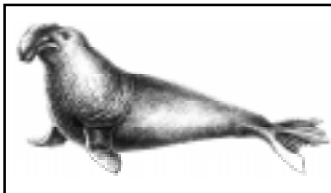


The California sea lion is the most abundant pinniped species found in California. Its breeding range extends from San Miguel Island in the Southern California Bight south to Isla Margarita on the Pacific coast of Baja. During nonbreeding season, male California sea lions migrate as far north as British Columbia. The returning southward migration begins in early spring. California sea lion numbers have increased dramatically on mainland haul-out sites, for example the harbor breakwall at Monterey and Pier 39 in San Francisco, where the mammals represent both a tourist attraction and a nuisance.

Opportunistic feeders, California sea lions prey on a variety of fish: sea lions have learned to take fish directly off fishermen's hooks, wreaking economic loss on recreational fishermen and commercial salmon fishermen. At the Ballard Locks in Seattle, California sea lion predation has contributed to the threatened extinction of a run of steelhead.

**Population trend:** In 1986, scientists estimated the total west coast population at approximately 177,000, with about 87,000 sea lions in California. Per capita growth rate is estimated at 6.4 percent annually. At that rate, the California sea lion population in 1992 may have exceeded 126,000 animals in California. Annual pup production in 1990 exceeded 25,000. In ocean cycles like the recent El Nino, elevated population levels resulting from total protection intensify competition for limited food resources, causing starvation and stranding of pups, eventually leading to population die-offs.

## Northern Elephant Seal (*Mirounga angustirostris*)



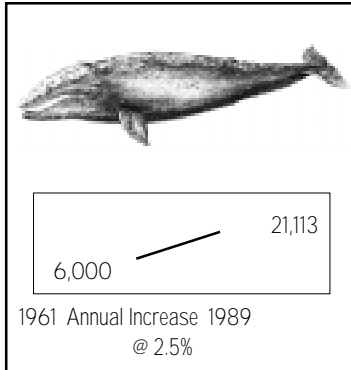
The northern elephant seal's recovery from near extinction is a well-documented success story. From a remnant population at the turn of the century, the species has reoccupied traditional rookeries and hauling grounds, and may have expanded its range beyond historic limits. Mainland rookery sites now occupied may not have been available 100 years ago due to predation by wolves and grizzly bears, which are no longer present.

Nonbreeding elephant seals range as far north as the Gulf of Alaska and are seasonal visitors in Oregon and Washington. Original rookery grounds extended from Cabo San Lazaro, Baja California, northward to Point Reyes, in northern California. The species now breeds at several islands in Mexico, as well as throughout the Channel Islands, Ano Nuevo Island and Point, the South Farallon Islands, and Pt. Reyes.

**Population trend:** Growth rate is estimated at 8.75 percent per year. A 1988 population estimate found a minimum of 60,000 elephant seals in U.S. waters.

## MARINE MAMMALS IN CALIFORNIA

### Gray Whale (*Eschrichtius robustus*)

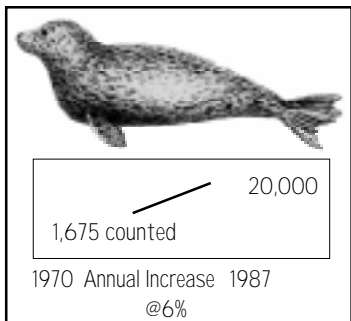


Another California success story is the recovery of the gray whale. The eastern stock of gray whales, sometimes called California gray whales, migrates annually between summer feeding grounds in the Bering and Chukchi Seas and winter breeding grounds along the west coast of Baja California. The southern migration begins in early October, arriving in California by late November. The northward migration in California waters generally begins in mid-February for whales without calves, and March continuing through May for cows with calves.

A baleen whale growing to 46 feet in length, most gray whales calve in Mexican waters. The young are born underwater and are able to swim on their own immediately, although they depend on a milk diet for at least 6 months. Gray whales grub along the bottom for tiny crustaceans, the staple of their diet.

**Population trend:** The most recent population estimate, which is based on the 1987-88 migration census, is 21,113 gray whales. Thought to have surpassed historic population levels, gray whales were removed from the Endangered Species List in 1992.

### North Pacific Harbor Seal (*Phoca vitulina*)

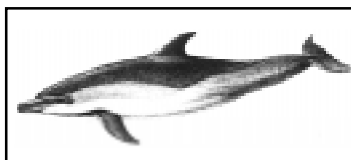


The harbor seal is found from the Bering Sea in Alaska along the west coast to southern California. The species is abundant throughout the coastal and estuarine areas of Washington and Oregon. In California, harbor seals are abundant along the entire coast. Their smaller size, chunky shape, lack of external ears, and spotted coat distinguish harbor seals from sea lions.

Harbor seals feed opportunistically on fish, squid, and octopus. In Oregon, harbor seals congregate in bays and estuaries to gorge on salmon and steelhead runs. In California at certain times of year, harbor seals prey heavily on fish caught in nets. Early in the year, gillnetters for California halibut in many areas may lose up to 80% of their catch to harbor seals.

**Population trend:** Surveys in 1987 placed the California harbor seal population at about 20,000 animals. Harbor seal abundance is increasing at 6% per year.

### North Pacific Common Dolphin (*Delphinus delphis*)



Common dolphins are a pelagic species distributed worldwide in temperate to tropical waters (12° - 28°C). In the northeastern Pacific, the primary range of the common dolphin is the California-Oregon border to Costa Rica. Two stocks of common dolphins identified in California waters are the northern temperate, found offshore from about Isla Cedros north, and the Baja neritic, found close to the coast from San Diego south.

**Population trend:** The common dolphin is the most abundant cetacean in California, often observed riding the bow wave of boats and "porpoising" out of the water. The Eastern Tropical Pacific may harbor over 5 million common dolphins, one of several species inhabiting that area. In California the largest herds are seen from summer to autumn - more than 57,000 dolphins estimated in 1983. According to research by the Inter-American Tropical Tuna Commission, the population is stable.

## MARINE MAMMALS IN CALIFORNIA

### North Pacific Harbor Porpoise (*Phocoena phocoena*)



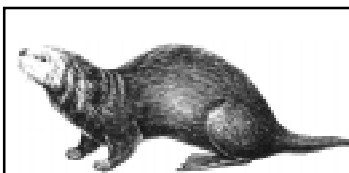
In the Pacific, harbor porpoise range from Alaska to central California. Their Atlantic relatives, a familiar species around the British Isles, were the first to be given the name "porpoise", derived from the Latin *Porcus piscis*, or "pig fish." In Great Britain porpoise are also called "herring hogs" for their practice of robbing herring nets.

Reaching 6 feet in length, harbor porpoise, as their name suggests, frequent bays, harbors, and other inshore waters, occasionally traveling up rivers. These porpoise usually feed on bottom-dwelling fishes, sometimes on squid, and occasionally on clams or crustaceans.

**Population trend:** Surveys conducted in the mid-1980's estimated harbor porpoise abundance from Washington to central California to be about 50,000 animals, with nearly 12,000 in northern and central California.

Department of Fish and Game (CDFG) observations of the halibut set net fishery in the San Francisco Bay area during the 1980's recorded unintentional taking of harbor porpoise. The fishing industry cooperated with CDFG and the Legislature to enact gillnet closures inside 40 to 60 fathoms from Point Reyes to the northern edge of Monterey Bay, and within three miles around the Farallon Islands. The closures curtailed the halibut gillnet fishery in the area; however, harbor porpoise mortality in the nets also declined sharply. Per capita growth rate for harbor porpoise is estimated at about 7 percent per year. The west coast population may be near its optimum level.

### Sea Otter (*Enhydra lutris*)



*(Sea otters in California rarely haul out on land; most often they're found rafting on their backs in the kelp. They occupy a narrow zone of shallow, littoral water off the central California coast, but have been known to range over a mile from shore.)*

The historic range of sea otters extended from northern Japan across the Aleutian archipelago to Alaska and down the west coast to Baja California. By the early 1900's, intensive fur hunting had eliminated the species from most of its range, leaving remnant populations in a few Alaskan outposts and one small colony in California. In a remarkable comeback, sea otters have recolonized most of their Alaskan range. "Northern" sea otters are considered to be at their optimum sustainable population (OSP). In California the primary sea otter range extends from Point Año Nuevo, south of San Francisco, to Santa Barbara County, stretching over 200 miles along the central coast.

The California sea otter recovery has sparked a controversy unparalleled in the annals of wildlife management. Scientists disagree on whether California sea otters are genetically distinct or the same as their Alaskan counterparts. An isolated population in any case, California's "southern" sea otters were listed as "threatened" under the Endangered Species Act in 1977 (the U.S. Fish and Wildlife Service classified them as a separate subspecies). Protective laws mandate the recovery of the California otters to OSP. However, fishermen protest that sea otters decimate valuable shellfish resources.

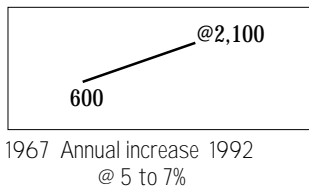
Indeed, the one point of agreement is the sea otter's voracious appetite. Lacking blubber, sea otters must consume 25 percent or more of their body weight daily to survive the ocean's chill. That's 10 to 15 pounds of shellfish a day for an average otter: the menu includes sea urchins, abalone, crab, clams, and spiny lobster. In a compromise designed to recover otters and conserve valuable shellfisheries, Congress passed a special law to translocate a colony of otters to San Nicolas Island in southern California, and at the same time, establish an "otter-free" management zone throughout the remainder of southern California, from which sea otters must be removed by all feasible non-lethal means.

(More)

## MARINE MAMMALS IN CALIFORNIA

### Sea Otter

**Population trend:** In 1938, the media heralded the "discovery" of a colony of about 50 sea otters at Bixby Creek, 15 miles south of Monterey. By the early 1940's, abalone divers were complaining about the loss of abalone in the sea otter range. By 1967 the herd was estimated at 600 animals, and a central coast abalone fishery that had sustained production averaging two million pounds a year since the early 1900's was on the wane. Commercial abalone diving on the central coast between Monterey and Morro Bay ceased in the early 1970's, as sea otters recolonized their central coast range.



In the early 1980's, sea otter population growth stalled. Sea otter mortality likely increased as the result of the 1982-83 El Nino: the warm-water cycle and winter storms uprooted kelp and caused abalone and urchin die-offs. Juvenile animals appeared emaciated; many likely starved. Moreover, CDFG observations on the gillnet halibut fishery operating on the central coast between Monterey and Morro Bay reported sea otters caught in the nets. The fishing industry worked with CDFG and the Legislature to enact a series of gillnet closures along the central coast. Nets are now prohibited inside 30 fathoms, and the closures have preempted the halibut fishery in the area. By 1988, sea otter numbers were again on the rise. The 1992 spring sea otter census counted 2,101 animals in the central coast range, including 291 pups. Growth rate is estimated at 5 to 7 percent per year. At that rate, scientists theorize that sea otters may recolonize the area between Point Conception and the Oregon border in approximately 22 years. Northern California waters harbor important fisheries for Dungeness crab and sea urchins, as well as a recreational diving fishery for abalone.



# SEAFOOD AND GOOD HEALTH

*The following is based on information provided by FDA findings; Anne M. Fletcher, M.S., R.D., a nationally known nutrition writer and consultant and former editor of the Tufts University Diet & Nutrition Letter; the Mayo Foundation for Medical Education and Research; and the National Fisheries Institute.*

## Eat seafood at least twice a week.

- low in calories
- low in saturated fat
- low in total fat
- high in protein, vitamins and minerals
- it can be included in low-cholesterol diets
- it's a good source of Omega-3 fatty acids

## Benefits of a seafood-rich diet:

- reduces the risk of heart disease
- may prolong life after a heart attack
- usually lowers blood triglycerides (fats)
- may improve function of the heart and reduce damage from heart disease
- can lower blood pressure
- may improve symptoms of certain inflammatory diseases, arthritis and psoriasis, according to preliminary research

## Low in calories and low in fat:

Seafood is low in saturated fat, rich in vitamins, minerals, and protein, and low in sodium. Because fish has little connective tissue, its protein is easier to digest than other muscle meats.

Type	Calories*	Protein	Fat
Halibut	116	22 g (49% RDI)	2.4 g
Lingcod	90	19 g (42% RDI)	1.1 g
Mackerel	167	21 g (47% RDI)	8.4 g
			2.4 g saturated
Perch	97	21 g (47% RDI)	1.0 g
Pacific rockfish	100	20 g (44% RDI)	1.7 g
King salmon	191	21 g (47% RDI)	11.1 g
			2.7 g saturated
Shark	139	22 g (49% RDI)	4.8 g
			1.0 g saturated
Sole	100	21 g (47% RDI)	1.3 g
Swordfish	129	21 g (47% RDI)	4.3 g
			1.1 g saturated
Bluefin tuna	153	25 g (56% RDI)	5.2 g
			1.3 g saturated
Dungeness crab	91	19 g (42% RDI)	1.0 g
Spiny lobster	119	22 g (49% RDI)	1.6 g
Shrimp	113	22 g (49% RDI)	1.8 g
Squid	156	27 g (60% RDI)	2.4 g
			0.6 g saturated

*\*Per 3-oz. cooked serving  
RDI is recommended dietary intake*

## SEAFOOD AND GOOD HEALTH

### **Omega-3's, "good fats":**

Although fish and shellfish are generally low in fat, the small amount of fat they do contain is beneficial. Found almost exclusively in seafood, Omega-3 fatty acids present in fish may play a protective role against heart disease. Omega-3's help keep arteries open by discouraging the build-up of plaque in blood vessels, studies are showing. Preliminary research indicates that Omega-3's can prevent platelets -- cell fragments that help blood to clot -- from sticking together. The result: reduced chance for heart attack or stroke due to blockage in an artery. Omega-3's also are linked to anti-inflammatory effects; early studies indicate that reduced inflammation is more dramatic in the elderly than in younger individuals.

Oilier fish, such as salmon, tuna, mackerel and sardines, contain higher amounts of this "quality fat," but even the lowest-fat fish contain small amounts of these healthy oils.

*A medically-supervised study among people who had suffered a heart attack revealed that those who ate about 10 ounces of fat-rich fish per week lived longer than those who did not. Earlier studies have indicated that eating fish two or three times a week and maintaining a low-fat diet extends life.*

### **Seafood's low-fat advantage for extending life:**

High-fat diets have been linked to 5 of the 10 leading causes of death in the United States, including heart disease and cancer of the colon, breast, and prostate. In California, 36,000 premature deaths and \$5 billion in health care costs in 1986 were attributed to the typical high-fat, low-fiber American diet, noted State Health Director Molly Coye, MD, MPH, announcing a statewide 1993 program to reduce dietary fat, California Project L.E.A.N. (low-fat eating for America now). A 3-ounce serving of seafood provides approximately half of the recommended daily intake of protein, yet contains the lowest level of saturated fat in any muscle meat available.

*Recent research indicates that eating a low-fat dinner, such as seafood, sharply reduces the risk of a heart attack the following morning. Studies suggest that high-fat meals put the blood into a hypercoagulation state within six or seven hours, raising the risk of dangerous, artery-clogging blood clots, the cause of many heart attacks. Fatty meals activate a blood-clotting substance called factor VII. The higher the level of factor VII, the greater the probability of clotting. Most heart attacks occur in the early morning, and doctors theorize that a possible cause could be hyper-coagulation of the blood. Another study revealed that individuals who switched from a high-fat to a low-fat diet reduced their factor VII activity significantly. This research reconfirms a finding that low-fat diets reduce cholesterol deposits over the long term and reduce the risk of blood clots -- and heart attacks -- almost immediately.*

A comprehensive study among more than 88,000 women concluded that a high intake of animal fat increases the risk of colon cancer. The study recommended substituting fish and chicken for diets high in fat.

## SEAFOOD AND GOOD HEALTH

### Cholesterol and shellfish:

"Shellfish and marine animals such as lobster, crab, shrimp, clams, oysters, scallops, and abalone have little or no effect on the plasma cholesterol concentration because they are low in fat." *American College of Physicians, 1988.*

Saturated fat -- not dietary cholesterol -- is the main culprit in raising blood cholesterol. Saturated fat is what turns the body on to making cholesterol. High levels of cholesterol in the blood can lead to blocked arteries, heart attacks, and strokes.

Shellfish received an unfair reputation for high cholesterol because of outdated scientific methods that detected cholesterol-like substances as well as cholesterol. The resulting readings were falsely high.

A serving of most any shellfish is well within the 300-mg daily intake level recommended by major health organizations, including the American Heart Association and National Academy of Sciences. Although crustaceans such as shrimp, lobster, and squid, are higher in dietary cholesterol than mollusks such as clams, oysters, mussels, and scallops, they are extremely low in saturated fat, and doctors see no reason to avoid them.

Prominent heart experts no longer place limitations on specific shellfish for their patients with high blood cholesterol levels as long as portion sizes are not excessive and patients watch their saturated fat intake.

#### *Content of 3.5 oz (100 g) portions of raw shellfish*

	<i>Calories</i>	<i>Saturated Fat</i>	<i>Cholesterol</i>
<i>Mollusks</i>			
Clams	74	.09	34
Octopus	82	.23	48
Oysters (Eastern)	69	.63	55
Scallops	88	.08	33
Squid	92	.36	233
<i>Crustaceans</i>			
Dungeness Crab	86	.13	59
Lobster (Spiny)	112	.24	70
Shrimp	106	.33	152

*Source: U.S. Department of Agriculture, Human Nutrition Information Service Handbook 8-15.*

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## SEAFOOD AND GOOD HEALTH

### **Pregnant women and young children:**

For the best growth and development of children, pregnant and nursing women need adequate amounts of Omega-3's. Preliminary studies suggest that Omega-3's may be important for optimal visual development early in life.

**Doctors recommend that the general population, including pregnant and nursing mothers, eat seafood two or three times a week.**

Pregnant women need more protein, and seafood is an excellent low-fat protein source. Women may boost their calcium intake by eating sardines and mackerel canned with bone in. Clams, mussels, and oysters are higher in iron than red meat. Oysters, crab, and lobster are good sources of zinc, another mineral required in greater amounts during pregnancy and lactation.

"If a pregnant or breastfeeding woman consumes commercially harvested seafood, I see no cause for concern, particularly if she eats a variety." Robert Price, PhD., seafood safety expert, University of California at Davis.

Other experts concur with Dr. Price, finding seafood to be a great source of nutrition for pregnant and breastfeeding women.

FDA officials have testified that pound-for-pound, fish is by far the safest source of muscle protein available.

*During pregnancy and breastfeeding, it makes sense to take a few common-sense precautions. Following are suggestions that appeared in the National Academy of Sciences 1991 report, Seafood Safety.*

- *Avoid eating raw and undercooked fish and shellfish.*
- *Keep fish and shellfish refrigerated or frozen until ready to use.*
- *Eat a variety of all types of foods including fish and shellfish.*
- *Pregnant and breastfeeding women should limit consumption of shark, swordfish and fresh tuna to once a month.*
- \* *Pregnant women, nursing mothers, and young children in particular, heed advisories that accompany sportfishing licenses not to eat certain species of recreationally-caught fish from inland waters because of chemical concerns.*

# TIPS ON SELECTING AND HANDLING SEAFOOD

## Selecting Quality Seafood

Recognizing quality in seafood is easy when you follow a few simple rules. The first rule: 'The nose knows!' *Seafood should smell fresh as the ocean air.* If fish smells "fishy," pass it by. Observe these simple guidelines to insure premium quality:

### Fresh whole or dressed:

Freshness is easiest to gauge when the fish is whole. Look for these signs of quality in both whole and "dressed" fish:

- Appearance is bright and shiny.
- Scales are bright, most of them intact and adhering closely to the skin.
- Eyes are bright, clear, and full and often protrude.
- Gills are red – an indicator that oxygen is present and the fish is very fresh. Gill color fades with time to light pink, then gray, and finally to greenish or dull brown.
- Fish odor is fresh and mild, not "fishy".
- The flesh is firm and elastic, not separating from the bones.

### Fresh processed:

Fish is often presented in processed forms, including fillets, steaks, and meat or chunks. Look for these signs of freshness in pre-cut fish:

- Odor is fresh and mild.
- Flesh is moist, firm, and elastic and has a fresh-cut appearance without traces of browning or drying around the edges.
- Pre-packaged steaks and fillets are in tightly wrapped packages, with little or no air space between fish and wrapping material and no liquid in the package.

### Frozen:

Here's what to look for in frozen seafood:

- Flesh is solid and there is no discoloration or freezer burn on the surface.
- Odor is fresh and mild, not "fishy".
- Wrapping material is moisture and vapor proof, fits closely around the product, and is undamaged.
- Package does not contain ice crystals, or have water stains or other indicators that the product may have been previously thawed.
- Packaged frozen seafood may have an expiration date stamped on the label – always use the seafood before the expiration date.

### Raw:

Make sure that the shellfish you select was harvested in certified growing waters. Bivalves that remain open when stored should be discarded. As with any seafood, shellfish should have an ocean-fresh smell. Nutritionists recommend using frozen seafood for raw dishes such as sashimi, sushi, or ceviche. The consumption of raw seafood, as with raw or rare meat or raw eggs, carries a degree of risk.

# TIPS ON SELECTING AND HANDLING SEAFOOD

## Storing fresh seafood

Keep it cold! Seafood will stay fresh only if it's kept cold. Never leave seafood in a hot car, since this speeds spoilage and may make seafood unsafe to eat. Follow these guidelines once you get your seafood home.

- Unwrap, rinse under cold running water, pat dry with paper towel and place in an airtight container. Store in the coldest part of the refrigerator.
- For optimum flavor, texture, and nutritional value, store fresh seafood no longer than two days before use.
- For optimum quality, it's best to use fresh seafood in its fresh state. If it's necessary to freeze fresh fish, freeze it quickly and use it as soon as possible.
- Refrigerate live clams, oysters, mussels, crabs, lobsters, and crayfish in well ventilated containers. Cover container with a damp cloth or paper towel.
- **Do not** store live shellfish in airtight bags or containers. Storing live shellfish in salt water shortens shelf life. Storing live shellfish in fresh water kills them.

## Storing frozen seafood:

- Store frozen seafood products in the freezer immediately when you get home from the store. Store them in their original moisture and vapor proof package.
- Frozen seafoods packaged in over-wrapped trays should be repackaged in cling wrap, plastic freezer wrap, freezer paper, or other moisture and vapor proof material before storing them in the freezer.
- Keep frozen seafood at 0°F or below until ready to use.

## Thawing frozen seafood:

- Many frozen seafood products do not need to thaw before being cooked. Follow the processor's directions for preparing frozen seafoods (frozen seafoods generally require double the cooking time recommended for fresh fish).
- Thaw frozen seafood in the refrigerator (about 18 hours per pound) or under cold running water (about one hour per pound).
- **Do not** thaw frozen seafood at room temperature or under warm running water. Thinner parts of the seafood thaw faster than thicker parts, and the outer edges may start to spoil before the center has thawed.

## Handling and preparation:

- Don't cross-contaminate! Food poisoning and spoilage bacteria can spread from raw and live seafood to cooked seafood. Handle raw and cooked seafood products separately.
- Thoroughly wash and rinse knives, containers, and cutting boards between handling raw and cooked seafoods. Keep raw and cooked seafoods from coming into contact with each other.
- **Treat your fish like ice cream: let it be the last item in your cart and the first item in your refrigerator when you return home.**

## WHAT'S IN SEASON & WHEN

Californians are fortunate to have access to a wide variety of fresh fish and shellfish yearlong, as fishermen deliver to market each year more than 300 species from our coastal waters. Following is a short seasonal list of California seafood.

### **February, March, April**

Deep-water fish such as petrale, rex, and English soles; rockfish, 13 species have been given the common market name Pacific red snapper; rock crab; California spiny lobster (season ends mid-March); and in April, California halibut become plentiful.

### **May, June, July**

California squid, commonly called calamari, appear in Monterey Bay; California king salmon season opens May 1; white seabass season opens June 15; surfperch; angel shark; sablefish; barracuda; rockfish; soles; spot prawns; abalone; and Pacific Ocean (pink) shrimp.

### **August, September, October**

Shark season opens August 15 within 25 miles of the coast; California swordfish; mackerel; sardines in Monterey Bay; albacore; bluefin and other tunas; spiny lobster season opens mid-October; ridgeback prawn season also opens in October.

### **November, December, January**

California spiny lobster; swordfish; thresher and mako shark; California squid appear in southern California; rockfish; tunas; soles; ridgeback prawns; spot prawns (above Point Conception); Dungeness crab season opens mid-November in San Francisco, December 1 in northern California; market demand peaks for sea urchins; southern California's sardine season begins in January.

This is only a representative sample of the variety of local seafood available to California consumers. Please contact representatives of the CSC for a more detailed list.

# SEAFOOD SAFETY IN CALIFORNIA

"The Food and Drug Administration and the Centers for Disease Control agree, based on estimates of acute disease occurrences, not just those reported, that on a per-weight-consumed basis, **fish is by far the safest source of muscle protein available.**"

Frank E. Young, MD, Ph.D., Commissioner  
U.S. Food and Drug Administration  
June 5, 1989 testimony before Congress

Dr. Young's 1989 testimony holds true today in California, as the State takes a lead role in seafood safety. California's fishing industry is routinely monitored, inspected, and regulated by numerous state and federal agencies to insure that seafood is wholesome and safe to eat.

Agencies responsible for monitoring the environment, regulating industry, or both, include:

- California Department of Health Services (CDHS),
- Department of Fish and Game,
- California Environmental Protection Agency,
- Water Quality Control Board,
- U.S. Food and Drug Administration (FDA), and
- National Marine Fisheries Service (NMFS), a branch of the U.S. Department of Commerce.

## Environmental Monitoring

- **Mussel Watch Program** California's Mussel Watch program has operated since 1977 under the authority of the California Water Control Board. Tests are performed under contract with the Department of Fish and Game.

Designed to measure inorganic contaminants in coastal waters, the basic Mussel Watch procedure samples mussels at 150 stations statewide each January, testing for inorganic toxins. Routine tests are conducted for more than 50 different chemicals, including toxic heavy metals, chlorinated pesticides, and hydrocarbons. In addition to routine testing, special studies are conducted at specific sites, such as the Diablo nuclear power plant.

- **Shellfish Sanitation Program** The Environmental Management Branch of CDHS certifies and regulates shellfish growing areas according to standards mandated by the National Shellfish Sanitation Program. All harvesters and growers of bivalve shellfish (e.g. oysters, clams, mussels) must obtain a certificate from the CDHS prior to harvest.

The Environmental Management Branch monitors state waters, testing for the presence of biotoxins occasionally found in natural "blooms" of marine algae. Biotoxins assimilated in bivalve shellfish can cause illness such as paralytic shellfish poisoning (PSP). Domoic acid, a toxin recently identified on the west coast for the first time, can cause amnesic shellfish poisoning (ASP).

(More)



## SEAFOOD SAFETY IN CALIFORNIA

- California's six commercial shellfish growing areas are tested weekly for marine biotoxins.
- A total of 24 other sampling stations statewide are tested for biotoxins up to 18 times each year.
- California officials, the U.S. Food and Drug Administration, and the U.S. Department of Commerce are developing an expanded, coordinated plan to address natural toxins in seafood. California fishermen are cooperating with state and federal officials to expand knowledge of marine biotoxins and their effects on California's seafood supply. (Please refer to the fact sheet on the CSC SeaSentry Program.)

### Monitoring Seafood

California's Department of Health Services, Food and Drug Branch, regulates seafood processors and has primary responsibility for seafood safety in the state.

- The Food and Drug Branch requires mandatory registration of all California seafood processors and conducts a **mandatory inspection** annually for sanitation, packaging, proper temperature control procedures, and other public health concerns. A similar mandatory inspection is required at the retail level, with inspections performed by county health department inspectors at least annually, and often several times throughout the year.
- CDHS validates Hazard Analysis Critical Control Point (HACCP) programs (identifying and controlling critical processing and handling points) and works closely with the voluntary federal inspection program established by the FDA and NMFS, in which California seafood processors, wholesalers, and retailers participate. These seafood handlers contract with the program for sanitation and actual product inspection at their own expense.
- CDHS maintains strict requirements for California food-processing canneries, including mandatory licensing and inspection of all cooking processes. Each lot must be inspected and tested for size, water content, time and temperature, and can condition, insuring against leakage, before the lot receives approval for sale. No case of botulism has been reported from California's commercial cannery pack for several decades (since the mid-1950's).

In addition to state regulations, the U.S. Federal Drug Administration also inspects California processors and wholesalers twice a year.

### **The California Seafood Council supports national seafood inspection.**

The California Seafood Council members are working with the National Fisheries Institute (a non-profit trade association representing the U.S. seafood industry) and regulatory agencies to implement and improve a national seafood inspection program.

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## SEAFOOD SAFETY IN CALIFORNIA

### Sport or Recreational Fishing ... What the Experts Say

According to the report **Seafood Safety, National Academy Press 1991**, which reviewed seafood-borne illness reported by the Centers for Disease Control in the 10-year period 1978-1987:

- "One-fifth of the fish and shellfish eaten in the United States is derived from recreational or subsistence fishing, and these products are not subject to health-based control; there is need to improve protection for consumers ... by regulating (recreational) harvest and by education ..."

- Also according to Seafood Safety, consumers of recreational fishery products are the second largest constituency at risk of suffering seafood-borne illness. (Those who eat raw molluscan shellfish are at the greatest risk.)

### FOR MORE INFORMATION ON SEAFOOD SAFETY ISSUES IN CALIFORNIA:

- **California Department of Health Services, Food and Drug Branch**  
Chief - Stuart Richardson Telephone: (916) 445-2264
- **CDHS, Environmental Management Branch**  
Greg Langlois (PSP program) Telephone: (510) 540-3423
- **CDHS Shellfish Information Line** Telephone: (510) 540-2605
- **NMFS Western Inspection Branch**  
Chief - Glenn Kiel Telephone: (213) 526-7412
- **Department of Commerce**  
Lou Kissel (voluntary inspection) Telephone: (301) 713-2355
- **National Fisheries Institute**  
Bob Collette (Western region) Telephone: (703) 524-8882
- **California Fisheries and Seafood Institute**  
Jane Townsend Telephone: (916) 441-5560
- **West Coast Seafood Processors Association**  
Rod Moore Telephone: (503) 227-5076
- **California Sea Grant - Food science**  
Dr. Robert Price Telephone: (916) 752-2194

# OFFICE OF SEAFOOD

## U.S. FOOD AND DRUG ADMINISTRATION

Reflecting consumers' growing interest in seafood, the U.S. FDA established its Office of Seafood in March 1991 to strengthen the agency's domestic and imported seafood programs. Seafood has the distinction of being the only food overseen by the FDA accorded its own office, and at the time of its establishment, Dr. David Kessler, FDA Commissioner, indicated that seafood is to be the litmus test for food safety standards in the United States. Responsibilities of the office include:

- *overseeing seafood inspection programs;*
- *researching and testing methods to detect and evaluate the effects of contaminants in fish;*
- *administering the National Shellfish Sanitation Program, which works to maintain safety of shellfish;*
- *participating in programs to increase industry awareness of FDA seafood regulations and enforcement;*
- *overseeing development of seafood safety inspection programs for inspectors.*

In 1991, the FDA initiated a special inspection of the nation's seafood processing plants and other seafood establishments and launched a new inspection program, in cooperation with the National Marine Fisheries Service, applying Hazard Analysis Critical Control Point (HACCP) methods to identify and control critical processing points. California processors participated in the voluntary inspection program established by the FDA and NMFS.

### **H.A.C.C.P. in Brief**

The Hazard Analysis Critical Control Point (Hass-ip) program is a state-of-the-art food safety program originally developed for astronauts to ensure safe food in space. A HACCP program identifies critical control points during a processing or handling operation for a food where a hazard, such as cross contamination, might be introduced.

Critical control points could include:

- the point of receipt,
- the thermal processing stage of the canning process,
- cook and post-cook stages of preparation processes,
- final packaging or storage conditions.

HACCP mandates that seafood handlers identify key stages in seafood processing and handling where problems might occur. Companies are required to develop a monitoring system at these "critical control points" to safeguard against potential problems. The goal of the program -- and the motto of California's seafood industry -- is "keep it cold, keep it clean, and keep it moving." As part of the HACCP program, seafood processors are required to keep detailed monitoring records of their procedures for review by state and federal inspectors. Companies must also practice strict sanitation standards and maintain monitoring records, both on facility cleanliness and worker hygiene.

HACCP-based programs are now being considered for other foods, including meat and poultry.

In addition to inspecting domestic seafood handlers, the Office of Seafood established a new import strategy that includes closer cooperation with state and local agencies to identify imports that reach the retail market; initiation of civil and criminal actions against importers who violate FDA regulations; short-term targeted inspection surveys of specific product categories; and education.

• *In October 1992, the FDA began a toll-free **Seafood Hotline** for consumers. The hotline was created to answer questions about seafood, such as buying, handling, and storage for home consumption.*

The hotline number - **800 FDA 4010** - may be used in all 50 states and Puerto Rico, except in the Washington DC metropolitan area, where the number is (202) 205-4314.

FDA seafood specialists are available between the hours of 10 AM and 2 PM Eastern time, Monday through Friday, to answer specific questions. However, the Hotline is available 24 hours a day through a computerized information retrieval system accessed with touchtone telephone. Callers may request FDA publications, listen to pre-recorded seafood safety messages, and gain access to other information.

• *In March 1993, FDA Commissioner David Kessler, MD announced FDA plans to implement a mandatory HACCP quality control program throughout the seafood industry.*

- All U.S. Seafood Processors were required to have HACCP plans in place by December 18, 1997.

## CONSERVATION POLICIES

California's commercial fishermen are conservationists who proactively support the protection of water quality and marine habitat to insure the long-term viability of the fishing industry. One of the clearly-stated goals of the California Seafood Council is to safeguard the consumer supply of California seafood.

Industry policies and CSC programs include:

### **Fishermen's Oil Response**

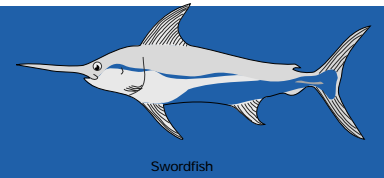
Fishermen's Oil Response programs have organized a network of commercial fishermen to assist in oil-spill clean-up. Modeled after the Fishermen's Oil Response Team (FORT) established by Ventura County commercial fishermen, the program trains fishermen to handle clean-up equipment. Names of trained fishermen and their vessel capabilities are then compiled in a computerized database, on call in emergency. The FORT program has trained and registered more than 100 fishermen from the Ventura, Santa Barbara, and Morro Bay areas.

Oil spill workshops are conducted by oil industry clean-up cooperatives stationed along the coast, and the fishermen's oil response team is mobilized by a coordinator and works under the direction of the cooperative during a spill. The FORT team was called to action in August 1992, following a spill in Avila Bay. Commercial fishermen provided invaluable assistance in the clean-up of that spill. Currently, three fishermen's oil response networks have been organized in different areas of California. More groups are planned.

### **Fishermen Involved In Saving Habitat**

F.I.S.H. is a national coalition of fishing groups, fish-related business enterprises, scientists, and environmental groups whose goal is to establish national policies and priorities to protect, conserve, enhance, and restore the quality and diversity of aquatic ecosystems essential to fish. Founded in 1988, the F.I.S.H. coalition is a non-profit association directed by a six-person executive committee. Local, regional, and international F.I.S.H. chapters have formed. A habitat education program stressing the importance of protecting wetlands and water quality are among the activities advocated by this coalition.

# fish facts



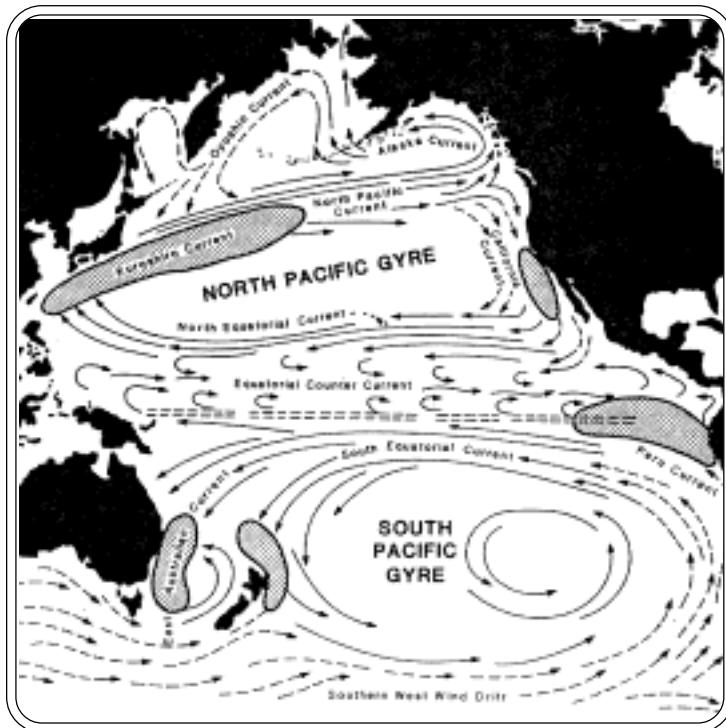
## SWORDFISH

### BIOLOGY:

The broadbill swordfish (*Xiphias gladius*) is a worldwide fish, found in all tropical to temperate oceans. In the Pacific, swordfish range from Asia to the Americas and from northern waters off Alaska to the southern reaches of South America.

Swordfish prefer water temperatures of 64° to 72°. Juvenile fish, especially, like warm water and are found only in tropical regions. Adults have a greater temperature tolerance and range widely over the Pacific, spawning in the tropics and feeding in temperate regions.

Swordfish concentrate in areas where food is abundant, along frontal zones where ocean currents meet to create turbulence and sharp temperature breaks. The Pacific Ocean has five major frontal zones where swordfish congregate, and these are where most fishing occurs.



*Swordfish abundance is related to oceanic cycles, and cycles are influenced by climatic conditions. Water temperature, availability of food, and fish migration patterns all play a role, influencing fishing success.*

### FISHERY:

Swordfish are fished by many Pacific Rim countries, and fishermen use a variety of harvesting methods, including longline, drift gillnet, and harpoon. Japan, Chile, Mexico, and Peru, as well as California, employ gillnets to capture swordfish.

(Both Japan and Taiwan also operate a Pacific-wide longline fishery for swordfish and tunas.)

In 1988 (the most recent year compiled) the Pacific Ocean swordfish harvest totaled 25,624 metric tons (mt), or about 56.5 million pounds, according to the Food and Agriculture Organization of the United Nations (FAO).

Scientists consider Pacific Ocean swordfish stocks to be in good condition and able to withstand increased catches. (Bartoo and Coan, 1989)

The top swordfish-harvesting nations in the Pacific in 1988:

<u>Country</u>	<u>Catch</u>
Japan	29.8 million pounds
Chile	9.8 million pounds
Philippines	8.9 million pounds
USA, California	2.4 million pounds* (*dressed weight)

California's swordfish fishery has a small impact on Pacific swordfish stocks, yet California fishermen are the most strictly regulated of all Pacific Rim fleets.

In fact, swordfish is one of California's most important fisheries. California swordfish fishermen work hard, often enduring dangerous ocean conditions, to provide high-quality local swordfish for consumer enjoyment.

(Please turn the page for more information on California's swordfish fishery.)



# CALIFORNIA'S SWORDFISH FISHERY

## HISTORY

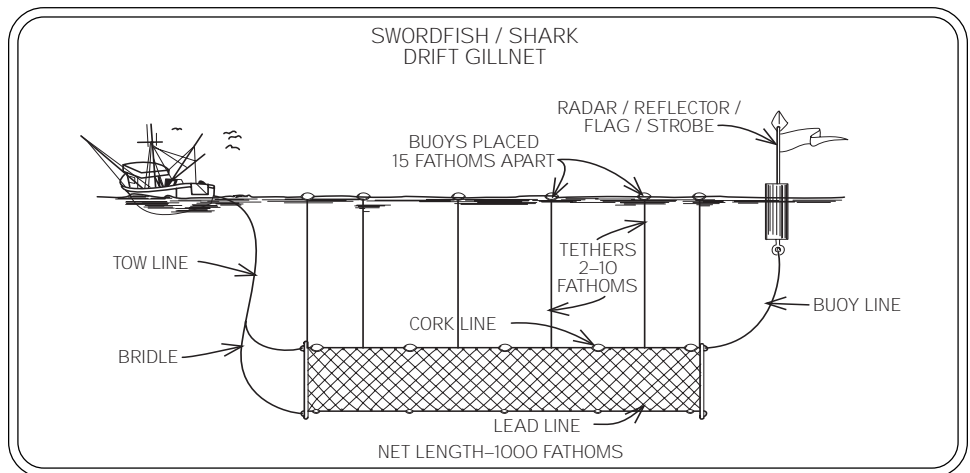
The oldest U.S. fishery for Pacific swordfish is California's harpoon fishery. Beginning at the turn of the 20th century, fishermen wielding harpoons scanned the ocean during fair weather in summer and fall, hunting for sign of swordfish -- a pair of fins slicing the water.

Swordfish characteristically surface at night and move to the depths in daylight, but sometimes, when conditions are right, they bask at the surface. At these times the prized billfish are vulnerable to harpooners.

California's swordfish fishery grew in response to consumer demand: but harpoon catches varied widely year-to-year, influenced by oceanic cycles and the billfish's inclination to "fin." Harpoon landings peaked in 1978 at 2.6 million pounds (dressed weight). That year, swordfish were unusually abundant off California.

By 1978, pioneering gillnet fishermen, experimenting with short-length drift nets designed to catch thresher shark, discovered that large-mesh nets set at night also caught swordfish. In 1979, the Legislature authorized the incidental take of swordfish in the thresher shark fishery. In 1982, following biological studies on the gear, the Legislature passed another bill, which allowed fishermen to target swordfish with short-length drift gillnets and also limited entry to the fishery. About 200 permits were issued; most harpooners began fishing swordfish with gillnets.

California's swordfish landings soared to record-setting levels in 1983-85, following the warm-water El Nino years of 1982-83.



Fishermen switched to short-length, large-mesh drift gillnets because of the gear's size-selectivity and efficiency in operation -- its ability to provide a consistent catch in all water conditions. This provides consumers with a steady supply of high-quality, locally-caught swordfish.

## OPERATION

Today California driftnetters typically deploy nylon swordfish nets with a mesh size of 18 to 22 inches -- nearly as wide as an open car window. The size-selective mesh is suspended 36-75 feet underwater, which, unlike foreign high-seas drift nets, greatly reduces interactions with marine mammals and seabirds. The large mesh captures swordfish and shark, sometimes albacore, bluefin and yellowfin tuna, and when the water is right, tropical species such as opah and louvar, all prized at market. Nets are set at dusk to drift all night, attached to the boat. The catch is retrieved at dawn. Currently about 60 to 80 driftnet boats are active in California's swordfish fishery; many range up to 200 miles or more offshore, following ocean currents and temperature breaks in search of migrating broadbills.

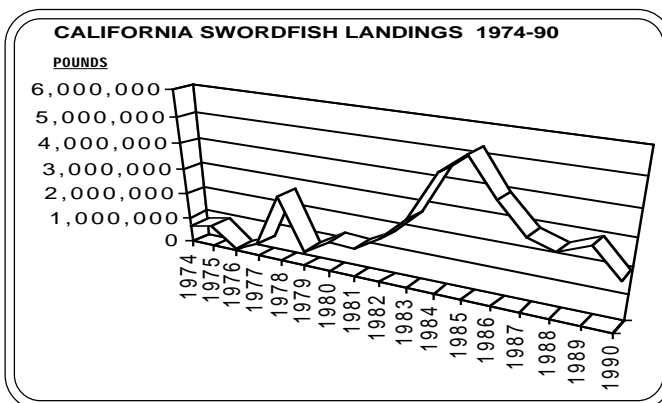
## REGULATIONS

California's swordfish driftnet fishery has been strictly regulated since its beginnings. Among restrictions:

- ☞ drift nets were limited to 6,000 feet (one nautical mile) in length;
- ☞ minimum mesh size was set at 14 inches.
- ☞ Areas were set aside for harpooners only; and
- ☞ extensive areas were closed to protect marine mammals.
- ☞ The fishery is closed within 25 miles of the mainland December through January to protect migrating gray whales.
- ☞ Legislation effective in 1990 prohibited driftnetting for swordfish or thresher shark within 75 miles of the mainland from February 1 through July 14 to conserve the thresher shark resource.
- ☞ The Marine Mammal Protection Act mandated observer coverage on driftnet vessels since 1989.

## THE DIFFERENCES: CALIFORNIA DRIFTNETS VS. FOREIGN HIGH-SEAS DRIFTNETS

- ☞ California driftnets are highly visible multi-strand braided nylon twine with mesh size of 18-22"; foreign high-seas squid nets are single-strand monofilament, with mesh sized 4", virtually invisible underwater.
- ☞ California net length is considered "small-scale," 1 mile or less. U.N. and Congressional resolutions pertain to "large-scale" foreign high-seas nets, over 1 1/2 miles in length.
- ☞ California nets are suspended 36-75 feet under-water, which greatly minimizes interactions with other marine life; Foreign nets drift on the surface, where most marine mammal and seabird entanglement occurs.
- ☞ All California driftnets use "pingers."
- ☞ Observer reports indicate that California's driftnet fishery has a minimal impact on sealife.



Sources: Planning the Future of Billfishes, Part 1: Fishery & Stock Synopses, Data Needs & Management

FAO Yearbook, Vol. 66, 1988 Fishery Statistics - Catches and Landings

Further reading: Pacific Fishing, May 1990, "Adrift in a Sea of Misplaced Sentiments," pp 44-51

# fish facts

## SEAFOOD SAFETY

### WHAT EXPERTS SAY ABOUT SEAFOOD SAFETY . . .

The report Seafood Safety, National Academy Press 1991, reviewed seafood-borne illness reported by the Centers for Disease Control in the 10-year period 1978-1987 with the following conclusions:

**"Fish and shellfish (combined) constitute only 3.6% of all cases when food-borne illnesses from all foods are considered."** (A case is a single ill person.)

**If shellfish (2.3% of illnesses) and fish (1.2%) are considered separately, the number of reported cases from each is lower -- two to four times lower -- than any animal meat category.**

- Among seafood consumers, those who eat raw molluscan shellfish are at greatest risk (of suffering seafood-borne illness).
- Consumers of recreational fishery products are the second largest constituency at risk.\*

\*According to Seafood Safety: "One-fifth of the fish and shellfish eaten in the United States is derived from recreational or subsistence fishing, and these products are not subject to health-based control; there is need to improve protection for consumers . . . by regulation of harvest and by education . . ."

At several Congressional hearings on seafood inspection, the nation's top officials spoke on the subject of seafood safety:

**"The Food and Drug Administration and the Centers for Disease Control agree, based on estimates of acute disease occurrences, not just those reported, that on a per weight consumed basis, fish is by far the safest source of muscle protein available."**

Frank E. Young, MD, PhD, Commissioner  
U.S. Food and Drug Administration  
June 5, 1989

The FDA Consumer, June 1991, reported the results of a risk assessment study undertaken by FDA's Center for Food Safety and Applied Nutrition in cooperation with the Centers for Disease Control, the federal agency responsible for collecting and analyzing health statistics.

### ILLNESSES PER SERVING

Raw mollusks	1/1,000 - 1/2,000
Seafood, including raw mollusks	1/250,000
Seafood, excluding raw mollusks	1/1,000,000
Cooked finfish	1/5,000,000 USA Today 9/26/89

**Excluding raw mollusks, seafood -- and especially cooked finfish -- has the best safety record of any muscle meat.**

### FDA'S OFFICE OF SEAFOOD

Reflecting consumers' growing preference for fish, the U.S. FDA established its Office of Seafood in 1991 to strengthen the agency's domestic and imported seafood programs. Responsibilities of the new Office include:

- overseeing seafood inspection programs;
- researching and testing methods to detect and evaluate the effects of contaminants in fish;
- administering the National Shellfish Sanitation Program, which works to maintain safety of shellfish;
- participating in programs to increase industry awareness of FDA seafood regulations and enforcement;
- overseeing development of seafood safety inspection programs for inspectors . . .

In March 1991, the FDA announced it had begun a special inspection of the nation's seafood processing plants and other seafood establishments and had launched a new inspection program, in cooperation with the National Marine Fisheries Service, applying Hazard Analysis Critical Control Point (HACCP) methods, identifying and controlling critical processing points. California processors participated in the voluntary inspection program established by the FDA and NMFS. The FDA also sponsored legislation requiring all seafood processors and wholesalers to implement HACCP plans by December 18, 1997. California processors have assisted in setting HACCP guidelines. For more information on seafood safety in California, please turn the page.



# SEAFOOD SAFETY IN CALIFORNIA

**California's fishing industry is routinely monitored, inspected, and regulated by numerous state and federal agencies to insure that seafood is wholesome and safe to eat. Agencies responsible for monitoring the environment, regulating industry, or both, include the California Department of Health Services, Water Quality Control Board, Department of Fish and Game, and California Environmental Protection Agency, as well as the federal Food and Drug Administration (FDA) and the National Marine Fisheries Service (NMFS), a branch of the Department of Commerce .**

## ENVIRONMENTAL MONITORING

California's current Mussel Watch Program has been operating since 1977 under the authority of the California Water Quality Control Board; tests are performed under contract with the Department of Fish and Game.

Designed to measure inorganic contaminants in coastal waters, the basic Mussel Watch procedure samples mussels at 150 stations statewide in January of every year, testing for inorganic toxins. Routine tests are conducted for over 50 different chemicals, including toxic heavy metals, chlorinated pesticides, and hydrocarbons. Testing is done annually because long-term research indicates that most chemicals do not show strong seasonal trends in levels present. In addition to routine testing, special studies are conducted at specific sites, such as the Diablo nuclear power plant.

The California Department of Health Services (CDHS), Environmental Management Branch, also monitors nearshore waters in its Shellfish Sanitation Program for bivalve shellfish, including oysters, clams, and mussels. The Environmental Management Branch certifies and regulates shellfish growing areas according to standards mandated by the National Shellfish Sanitation Program manual of operations. All harvesters and growers of bivalve shellfish must obtain a certificate from the CDHS prior to harvest.

The Environmental Management Branch monitors state waters, testing for the presence of biotoxins occasionally found in natural "blooms" of marine algae. Biotoxins assimilated in bivalve shellfish can cause illness such as paralytic shellfish poisoning (PSP). Domoic acid, a toxin recently identified on the west coast for the first time, can cause amnesic shellfish poisoning (ASP).

- California's six commercial shellfish growing areas are tested weekly for marine biotoxins.
- A total of 24 other sampling stations statewide are tested for biotoxins up to 18 times per year.
- State officials, the U.S. Food and Drug Administration, and the U.S. Department of Commerce are developing an expanded, coordinated plan to address natural toxins in seafood.

## MONITORING SEAFOOD

The California Department of Health Services, Food and Drug Branch, regulates seafood processors and has primary responsibility for seafood safety in the Golden State. Where the Environmental Management Branch regulates shellfish growing areas, the Food and Drug Branch assumes responsibility after shellfish are harvested.

**In fact, the Food and Drug Branch requires mandatory registration of all California seafood processors and conducts a mandatory annual inspection for sanitation, packaging, proper temperature control procedures and other public health concerns. The CDHS also validates Hazard Analysis Critical Control Point (HACCP) programs and works closely with the voluntary federal inspection program established by the FDA and NMFS, in which California seafood processors, wholesalers, and retailers participate. Additionally, all seafood processors and wholesalers now operate under HACCP plans as required by the federal FDA.**

In the FDA/NMFS program, seafood handlers contract for sanitation and actual product inspection at their own expense. Services include vessel and plant sanitation and product and processing methods inspection from raw material to final product. Product may also be graded and certified by a USDC inspector. Specific seafood lots destined for import or export also are routinely inspected and certified. In addition, the USDC provides technical advice on sanitation standards, processing techniques and government regulations. And the NMFS National Seafood Inspection Laboratory performs chemical analyses on fishery products.

The state Department of Health Services maintains strict requirements for California food-processing canneries, including mandatory licensing and inspection of all cooking processes. Each lot must be inspected and tested for size, water content, time and temperature, and can condition, insuring against leakage, before the lot receives approval for sale. Because of rigid testing and inspection standards, no case of botulism has been reported from California's commercial cannery pack since the mid-1950's.