

California's Living Marine Resources and Their Utilization

Eastern Pacific Yellowfin Tuna

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EASTERN PACIFIC YELLOWFIN TUNA

HISTORY OF THE FISHERY

Yellowfin tuna (*Thunnus albacares*) have been harvested, in the eastern Pacific, by commercial baitboat, purse seine, longline, gillnet, troll fisheries as well as recreational fisheries since the early 1900s. Eastern Pacific yellowfin tuna are highly migratory and have been fished by many different countries including Japan, Korea, Taiwan, U.S., Mexico, Ecuador, France and Spain. Landings from these countries are marketed throughout the Pacific Rim, Puerto Rico and the European Community. Fisheries landing yellowfin tuna in California operate between 150°W longitude and the coast of the Americas and between 40°N and 20°S latitude. California landings of yellowfin tuna are important to both commercial and recreational fisheries.

California landings of commercially caught yellowfin tuna date back to 1919. The landings mainly supplied California canneries, where yellowfin tuna were processed as light meat tuna. In recent years, some commercial yellowfin tuna landings have also been purchased by local markets and restaurants. Cannery prices paid for yellowfin tuna depend on fish size and market conditions. During the early 1990s, prices ranged between \$200 to \$1,100 a short ton (st). California commercial landings of yellowfin tuna, while fluctuating, generally increased from 350,000 pounds (lbs) in 1919 to 280 million lbs in 1976. Since 1976, yellowfin tuna landings declined steadily to 3 million lbs in 1999. Assuming a cannery price of \$1,000 a short ton, the estimated value of the 1999 California commercial yellowfin tuna landings is \$1.5 million. The decline in commercial landings in California can be attributed to the gradual relocation of cannery operations to American Samoa and Puerto Rico. Currently, only one cannery is operating in California. Purse seine and baitboat fisheries supply the bulk of the California commercial yellowfin tuna landings. Some landings are also by longline, troll, and gillnet fisheries.

Before the 1960s, baitboats supplied the majority of the commercial yellowfin tuna catch. The first baitboats operated in coastal waters between southern California and Mexico. The vessels used ice to preserve catches, relied on catching bait close to the coast and offshore islands and could only make short trips. In the 1930s, refrigeration improvements and construction of larger vessels enabled the fishery to expand farther south and offshore. From 1984 to 1999, California baitboat landings averaged 11% of the total landings of yellowfin tuna in California. Vessels ranged in size from 30 st carrying capacity to 200 st. The U.S. fleet size ranged from 75 vessels in 1976 to 1 in 1999. While baitboat fisheries dominated landings in the early days of the eastern Pacific yellowfin tuna fishery, catches and effort from this fishery quickly gave way to the more efficient purse seining method.

Purse seiners, based in San Diego, started to replace baitboats in the late 1950s and by 1961, supplied the majority of the California commercial yellowfin tuna landings. Vessels ranged in size from 150 to 2,000 st carrying capacity. Purse seiners, because of their size and ability to stay at sea for long periods of time, quickly expanded the fishery to areas between San Diego, California and Peru and out to 150°W longitude. Historically, three types of sets have been used to catch yellowfin tuna, sets associated with schools of dolphin, sets on free-swimming schools and sets associated with log or other

floating objects. U.S. purse seiners in the eastern Pacific primarily used sets associated with schools of dolphins. Purse seiners employed a standard purse seine with the exception of a porpoise panel that was used to release dolphins. The purse seines are deployed with a seine skiff and, when fishing dolphin schools, speed boats are used to herd the dolphins into the net. The schools of tuna are surrounded, the net is pursed and a backdown procedure is used to free the trapped dolphins. In the mid 1970s, marine mammal regulations were enacted to reduce dolphin mortality associated with purse seine fishing and in the 1990s, canneries stopped buying yellowfin tuna caught on dolphins. The cannery “dolphin safe” policy drove many U.S. vessels to the western Pacific and as a result, the U.S. fleet size decreased from 141 vessels in 1976 to 9 in 1999. From 1984 to 1999, California yellowfin tuna purse seine landings averaged 86% of the total California yellowfin tuna landings.

Longliners, based in California, started fishing in 1991. These vessels usually target bigeye tuna or swordfish outside the California 200-mile Exclusive Economic Zone (EEZ). Yellowfin tuna are an incidental catch in this fishery. Longliners usually fish between 30°N and 40°N latitude between Hawaii and the U.S. west coast EEZ. The U.S. fleet uses a typical longline gear with floats and branch lines. The gear is deployed at various depths, depending on the target species sought, and light sticks are used to attract fish. From 1991 to 1999, longline yellowfin tuna landings were less than 1% of the total yellowfin tuna landed in California.

From 1984 to 1999, commercial troll and gillnet fishing gears made up less than 3% of the annual California yellowfin tuna landings. These gears incidentally catch yellowfin tuna inside the EEZ south of San Francisco. Gillnet fisheries usually target swordfish and sharks, while troll fisheries typically target albacore.

California recreational fisheries for yellowfin tuna typically operate in waters off southern California and Mexico. The duration of trips is usually 1 to 7 days. The fleet consists mainly of commercial passenger-carrying fishing vessels (CPFV) and some private fishing vessels. Anglers use rod and reel fishing gear. Yellowfin tuna landings from the CPFV fishery, reached a record high of 120,000 fish in 1983, decreased to 4,000 fish in 1985, and averaged 81,000 fish from 1995 to 1998. Since the recreational catch cannot be sold, the value of the recreational fishery is difficult to determine, but must range into the millions of dollars and extend to many sectors of the business community. Vessel operators collect fares that are based on trip length but also collect fees for food and equipment rentals. Trips may catch yellowfin tuna but can also catch bluefin, skipjack or bigeye tuna, albacore, and other fish. Anglers buy equipment, fly in from various locations and stay in hotels.

U.S. commercial vessels that fish for yellowfin tuna in the eastern Pacific must abide by all federal (including those proposed by the Inter-American Tropical Tuna Commission, IATTC, and any other international regulatory agency to which the U.S. is a member) and state regulations. These include a mandatory logbook program under the High-seas Fishing Compliance Act of 1995, which requires a license and submission of the IATTC logbook (required by the IATTC before 1995). U.S. commercial vessels fishing in the eastern Pacific must also abide by regulations of the IATTC, such as the annual yellowfin tuna quota, and must pay California license fees and abide by Mexico’s EEZ regulations. U.S. purse seiners fishing for yellowfin tuna associated with dolphins in the eastern Pacific must also abide by dolphin quotas stipulated in the Marine Mammal Protection Act, and all large purse

seiners (>400 st) must carry observers.

Recreational fishermen must carry California fishing licenses, follow state regulations and buy Mexican fishing licenses while fishing in the EEZ of Mexico. Currently, California limits the take of yellowfin tuna to 10 fish a day.

STATUS OF BIOLOGICAL KNOWLEDGE

Eastern Pacific yellowfin tuna are distributed throughout areas between 40°N and 40°S latitude and 150°W longitude, and the coastlines of the U.S., Mexico, Central America and South America. The eastern Pacific stock is generally considered a separate population that is not believed to interact with stocks in the central and western Pacific. Yellowfin tuna are typically found in sea surface temperatures between 18°C and 31°C and are usually confined to the upper 100 m of the water column, or between the surface and the thermocline. Seasonal migrations are primarily along the coast. Surface schools of small eastern Pacific yellowfin tuna can be found aggregated around floating objects, while the larger fish are usually found in free-swimming unassociated schools or in schools associated with dolphins. Smaller yellowfin tuna (<100 cm) are frequently found in schools mixed with skipjack and bigeye tuna, whereas larger yellowfin tuna typically do not mix with other tunas.

Yellowfin tuna spawn throughout the year and across their entire range. However, 26°C is probably the lower temperature limit for yellowfin tuna spawning. Off Mexico and Central America, spawning occurs throughout the year, with peak spawning occurring at different times in different areas. Spawning is likely abbreviated and more sporadic in coastal areas than in northern equatorial areas more offshore. Some mature yellowfin tuna have been found between 50 and 60 cm fork length; however, most females mature at sizes above 91 cm and produce from 2 to 7 million eggs per spawn.

Yellowfin tuna can grow to approximately 210 cm. The larger fish have very large anal and second dorsal fins that may extend to over 20% of the fork length. Approximately 20 broken nearly vertical lines cross the sides of the fish and a yellow coloration is present on the sides, dorsal and anal fins and finlets. Yellowfin tuna enter surface fisheries at approximately 25 cm and commonly reach lengths up to 150 cm. In longline fisheries, fish range from 50 to 180 cm. Growth is rapid and approximate sizes at age are: 1 year - 48 cm; 2 years - 86 cm; 3 years - 126 cm; 4 years - 149 cm; 5 years - 172 cm; 6 years - 175 cm, 7 years - 185 cm. Maximum age is probably around 10 years. Instantaneous rate of natural mortality is generally believed to be 0.8 for all males. Females have a natural mortality of 0.8 during the first 30 months and then increase linearly to 4.8 at 80 months.

Yellowfin tuna are opportunistic feeders and therefore have a very diverse diet; however, only a few organisms in the piscivorous, cephalopods and crustaceans categories are dominant in stomach samples from fish in the eastern Pacific. The most dominant is *Auxis* sp such as bullet tuna and *Portunidae* or pelagic crabs. Other organisms include fish commonly found around flotsam such as skipjack tuna, black skipjack, flying fish, light fish and squids. Predators of yellowfin tuna include sharks, billfishes and other large tuna, including yellowfin tuna.

STATUS OF POPULATION

In general, the population of eastern Pacific yellowfin tuna is being fully utilized by fisheries operating in the area and is at levels that will produce the maximum sustainable yield. The IATTC has recommended an annual eastern Pacific yellowfin tuna catch quota since 1966 to maintain the stock. Catches peaked at 252,100 metric tons (mt) in 1976, decreased to 104,400 mt in 1983, peaked again in 1989 at 306,400 mt and then decreased to 274,000 mt in 1997. Because of management-imposed measures, it is difficult to use strictly catch as an indicator of overall population abundance. However, four abundance indices, one based on estimates of standardized catch-per-days fishing, two based on age models and one based on a searching time method, have been developed and indicate that abundance dropped steeply from the late 1960s to historically low levels in the early 1980s. Abundance estimates rebounded substantially in 1986 and have remained fairly constant at slightly lower levels in 1987 to 1997.

Eastern Pacific yellowfin tuna stock assessments are conducted annually by the IATTC. The latest assessment combined the conclusions of three methods: age structured analyses, yield-per-recruit (YPR) analyses and effort/catch based production model analyses. These methods and their results assumed that there was little or no interaction between the eastern Pacific yellowfin tuna stock and those in the central-western Pacific. The most current age structured analysis indicated that if eastern Pacific yellowfin tuna recruitment during 1998 equals the average recruitment in 1989-1997, and if fishing effort and age-specific fishing mortality in 1998 equals that in 1997, the 1998 catch should decrease by about 30,000 mt to approximately 230,000 mt. The decrease can be attributed to a shift in the fishery to smaller fish. The YPR analysis indicated that at current effort levels, yields from the fisheries could be increased if the fleet concentrated on large fish and fishing effort was decreased. Both the YPR and production models indicated that the amount of effort exerted from 1984 to 1997 was near or greater than that needed to produce the maximum sustainable yield and the eastern Pacific yellowfin fishery could continue to harvest approximately 270,000 mt annually without further lowering the stock size. In accordance with these findings, the IATTC set the annual 1998 yellowfin quota at 210,000 mt, with 15,000 mt increments added at the discretion of the IATTC. Closure of the fishery based on this quota was in November of 1998.

MANAGEMENT RECOMENDATIONS

The current IATTC management objective for eastern Pacific yellowfin tuna is to maintain the stock at levels capable of producing the average maximum sustainable yield. To attain this objective, the IATTC continues to recommend an annual catch quota. Future management issues for eastern Pacific yellowfin tuna will also include capacity reductions to maintain or reduce effort levels and reduced fishing on drifting objects to minimize the catches of small fish and by-catch.

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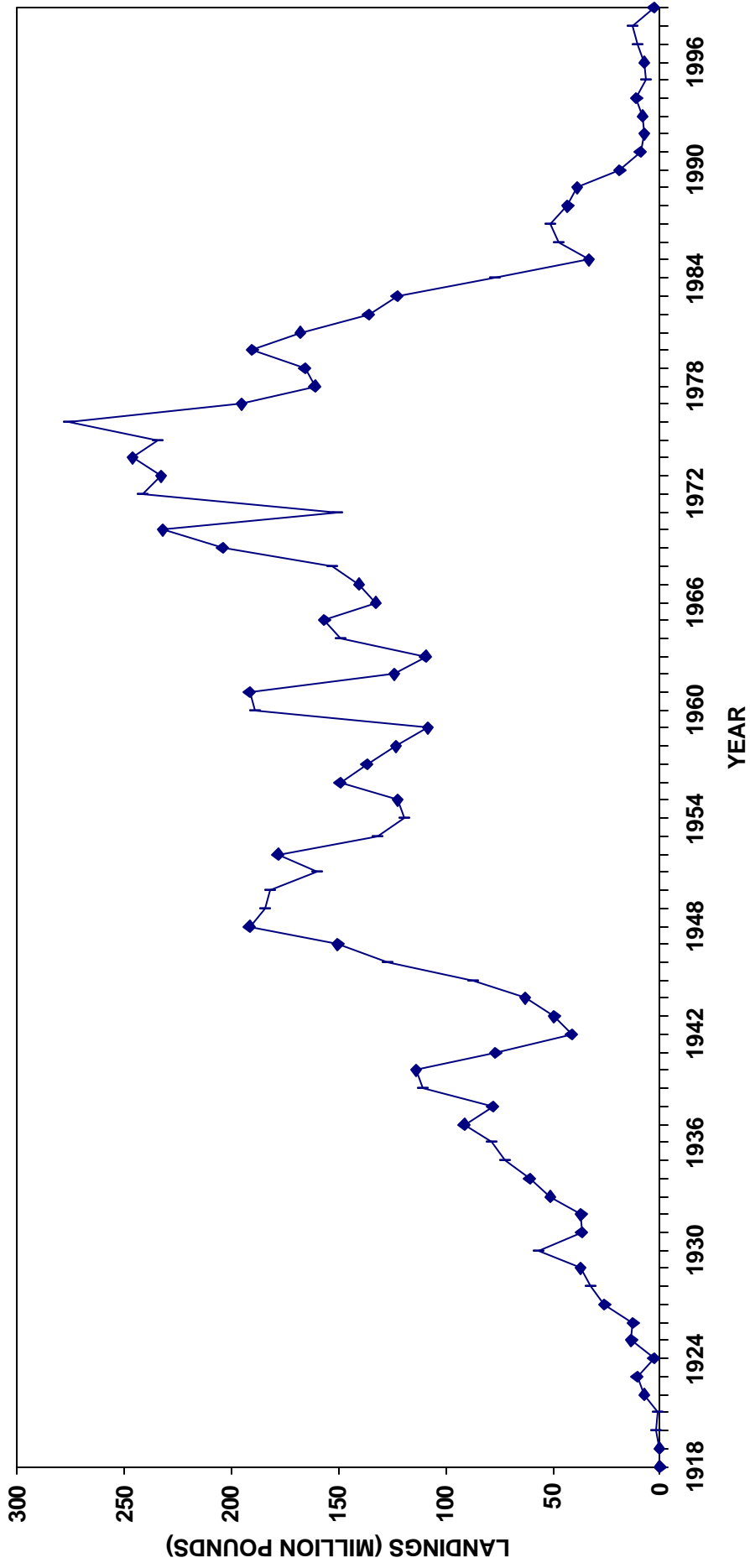
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CALIFORNIA COMMERCIAL YELLOWFIN TUNA LANDINGS



CALIFORNIA RECREATIONAL YELLOWFIN TUNA CATCH

