Other Mackerel Sharks

History of the Fishery

The mackerel sharks (*Order Lamniformes*) are a small, but diverse group containing seven families, six of which occur along the California coast. In addition to mako and thresher sharks, there are three additional mackerel shark species that are caught or have been fished along the coast, the basking shark (*Cetorhinus maximus*), white shark (*Carcharodon carcharias*), and salmon shark (*Lamna ditropis*).

The basking shark was the object of a localized harpoon fishery off the central California coast, but the fishery was sporadic due to periodic declines in the stocks. As with most shark species, the basking shark is slow growing, long-lived and probably produces relatively few young. The California basking shark fishery began in the 1930s, and peaked during the 1940s and 1950s. They were fished for their oil-rich livers, which were used for tanning leather and as a base for paints and cosmetics. In addition, they were utilized for food for human consumption, and their fins were used as soup stock. Presently, there is no fishery for these sharks in state coastal waters.

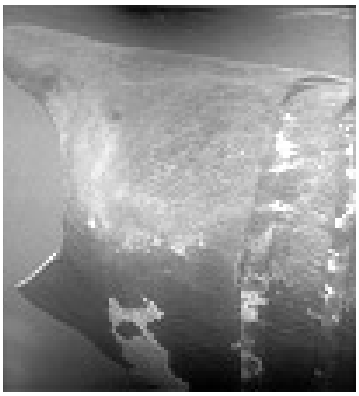
Since they are not abundant enough to be of commercial importance, there has never been a directed fishery for white sharks off California. They are often taken incidentally in commercial catches and by sport anglers. The meat is of good quality, the fins may be used as soup stock, and the teeth and jaws as decorations or jewelry. Although they have not been targeted in California, the state nevertheless imposed a ban on white shark fishing in 1993. This followed similar bans in Australia and South Africa where local artisan fisheries for this species had taken place.

Salmon sharks are not very abundant off California and are mainly taken as a bycatch to other species. The meat is of high quality and is readily sold along with the fins, which are used for soup stock. Fishermen often consider salmon sharks an annoyance because they destroy fishing gear used in more commercially important fisheries such as those for salmon.

Status of Biological Knowledge

The basking shark is a coastal pelagic species usually found in areas where the water temperature is between 46° and 57° F. They are found close inshore to well offshore at depths of over 330 feet, but usually over the continental shelf. A common species from the Gulf of Alaska to the Gulf of California, although they appear to be less abundant south of Point Conception.

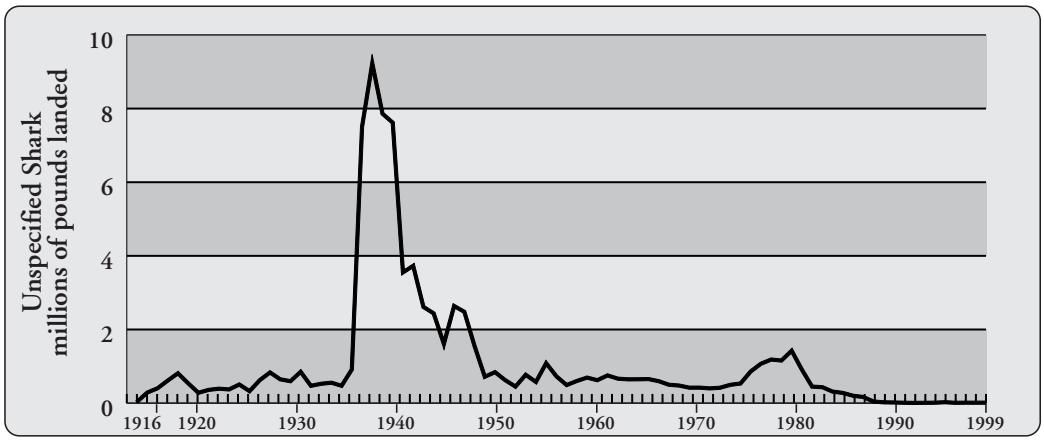
Basking sharks are presumed to be ovoviviparous, but whether they have intrauterine cannibalism like other lamnoids is uncertain. Gravid females have never been observed in this species. Males mature at about 13 to 16 feet, and females at about 27 to 29 feet. The maximum size for this species is 36 feet. The smallest recorded free-living basking shark measured 5.6 feet, but size at birth is unknown. Maturity has been estimated at six to seven years, although the aging technique has never been verified for this species and may underestimate the age by one-half. These sharks may live for 30 to 50 years or



Basking Shark, *Cetorhinus maximus*
Credit: DFG

White Sharks circling research boat, Carcharodon carcharias
Credit: DFG

Salmon Shark, *Lamna ditropis*
Credit: DFG



Commercial Landings 1916-1999, Unspecified Shark
Data Source: DFG Catch Bulletins and commercial landing receipts. All shark landings were aggregated until 1977.

more. Basking sharks grow at an estimated rate of about 16 inches per year, but with the onset of maturity this rate slows considerably.

The basking shark is one of three gigantic filter-feeding species of shark and feeds almost exclusively on small planktonic organisms that it traps in its gill rakers. The prey items include small copepods, barnacles, crustaceans, and fish eggs and larvae. Approximately one-half ton of food material may be present in the stomach of an individual shark. It has been estimated that an adult basking shark cruising at a constant speed of two knots passes approximately 2,000 tons of water over its gills per hour. Adult basking sharks probably have few predators due to their enormous size, young specimens though are preyed upon by white sharks, sperm whales, and killer whales.

Basking sharks are highly migratory, appearing and then disappearing seasonally at specific localities. These sharks are especially abundant between October and April off the California coast but move northward to Washington and British Columbia during late spring and summer. Basking sharks are very social animals and are often observed in small groups of three to 10, but at times number up to 500 or more individuals.

The white shark has a worldwide distribution from cold temperate to tropical waters, though it is most common in temperate waters between 53° and 68° F. In the eastern North Pacific the white shark occurs from the Gulf of Alaska to the Gulf of California. It is fairly common off central California and around the offshore islands of southern California.

The white shark occurs along the nearshore waters of the California coast, including bays and estuaries, but sometimes may be oceanic since individuals are common around the offshore islands. There seems to be some spatial segregation by size, as young white sharks under eight and older ones over 16 feet are common off southern California, while intermediate sized animals are more common in northern California waters.

White sharks are oviphagous, with litters of between three and 14 young. The low frequency with which pregnant females have been captured suggests that they may segregate away from the main population and that only a small proportion of the population may be gravid at any one time. The Channel Islands off southern California seem to be an area where large females and small white sharks are occasionally captured, leading to speculation that females may give birth there. Size at maturity is somewhat problematic for females since few pregnant individuals have been captured and accurately measured, but 15 to 16.5 feet appears to be a close approximation. Males mature at about 12 feet and grow to about 18 feet. The largest reliably measured white shark from California waters measured 18.8 feet; however, there is an unconfirmed record of one individual that measured 33 feet. The size at birth is four to five feet. The growth rate of white sharks has been estimated to be around 12 inches per year, and they may live to a maximum age of 30 years or more.

The white shark is perhaps the most formidable of large marine predators. It has a broad spectrum of prey species that includes bony fishes, other sharks, rays, and marine mammals. Sharks over 10 feet long tend to feed on marine mammals while those less than 6.5 feet feed more on bony and cartilaginous fishes. White sharks tend to congregate around seal rookeries, especially when these mammals are breeding. Sub-adult and young non-breeding adult seals appear to be most susceptible to predation.

The salmon shark range in the eastern Pacific Ocean is from the Bering Sea to central Baja California. It is a coastal and oceanic shark of subarctic and temperate waters, most often found in temperatures of less then 64° F and depths less than 1,200 feet. The salmon shark is

common on continental offshore waters to close inshore, but also ranges far from land, over deep oceanic waters.

Salmon sharks are oviphagous with litters of two to five young. Birth usually occurs in the spring between March and May after a 12-month gestation. Males mature between six and eight feet, and females at 6.25 to 8.25 feet. The maximum reported size is 10 feet. Size at birth is 25.5 to 31.5 inches. Estimated age at maturity is five years for males and nine or 10 years for females, with a maximum age of between 20 and 30 years.

The salmon shark feeds mostly on bony fishes. They may follow their main prey, salmon, as they migrate around the North Pacific Ocean basin. Salmon sharks are known to forage in groups of 30 to 40 individuals using social facilitation to hunt salmon and other schooling species. When attacking a school of salmon these sharks usually initiate the attack from below and catch their prey by running it down in a high-speed chase rather than ambushing it.

Status of the Populations

The basking shark has not been commercially fished for more than 30 years, and no recent stock assessment has been made.

Although no demographic studies exist to estimate the white shark's population in our area, circumstantial evidence suggests that their numbers may be increasing in response to the burgeoning marine mammal population. With California's increasing human population this may inevitably lead to more human-shark interactions. One researcher has estimated that between 10 and 20 white sharks are caught per year along the California coast. Unfortunately, more accurate data are unavailable.

There is virtually no information on the salmon shark's abundance and stock structure in the eastern North Pacific.

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