

Pacific Spiny Dogfish (*Squalus suckleyi*)

Searching for native plants and recording their locations, encountering unwelcome weeds, enjoying the sunshine, listening to the beat of the waves on the north side of the breakwater — it was just an average afternoon on the “Hook.” The survey complete, at least for that day, we walked to the calm bay side, separated from the restless Strait by sand and rock. The tide was low, permitting an uninterrupted



Pacific Spiny Dogfish (*Squalus suckleyi*), at Ediz Hook, Port Angeles

stroll, close to the water, shallow here at its upper reaches on the beach. We were searching for invertebrates — jellyfish, crabs, clams, stars — any would do.

A movement near the water’s edge, a flash of a fin, a twisting form unlike any sedentary beach creature drew my attention from a stranded jelly to the shoreline a few feet away. There it was again, this time revealing a slightly protruding nose, and swimming close to the exposed gravel. I didn’t know whether to aim the camera or keep my eyes focused on this ethereal creature. But I knew right away

what it was. That sideways sweeping tail, the triangular dorsal fin, the color, the length.

“Shark! Dogfish!” I exclaimed. “What?” questioned my companion.

What could it be doing near the beach? Chasing a delectable crab? Confused?

The encounter was brief, but as the shark arched a body tuned by the ages and swam quickly towards deeper waters, I felt relief. Surely, it must know where home was. Not here, in the shallows, but in the deep. And where were its companions? After all, this was a dogfish — the Pacific Spiny Dogfish — named for its habit of hunting in packs. Yes, like dogs. Perhaps this was a youngster, independent, out on its own. I would never know. For us, the encounter was frustratingly short but deeply satisfying. You just never know what you might see.

Originating over 400 million years ago, all fish labeled as sharks are members of the class Chondrichthyes, a group that numbers approximately 1,150 species including skates, rays, and ratfishes, as well as the sharks. The name is a latinized form of the Greek for “cartilage” and “fish,” acknowledging at least one distinctive feature shared by all Chondrichthyes species — structural support is provided by cartilage, not bone. Unfortunately for researchers trying to unravel the shark story, cartilage does not fossilize well, although it is very strong. Sharks can reach and exceed the size of whales, much more recently evolved marine mammals. Such is the case with the Whale Shark (*Rhincodon typus*) which has been recorded at nearly 62 feet in length, making it the largest nonmammalian vertebrate on the planet.

In addition to a cartilage skeleton, Chondrichthyes share three other features. With the exception of the ratfish, all have placoid scales. Also known as dermal denticles, these are rather like vertebrate

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teeth, complete with a blood supply and an enamel-like covering. It is possible that the teeth evolved after the body scales, but this is not known with certainty.

Class members also have fins without bony rays and bear their young live. These physiological features endowed Chondrichthyes with survivability, as these creatures swam the oceans long before dinosaurs walked the earth. And they are widespread, thriving in waters from the cool Arctic to the warm tropics, although absent from the Antarctic. Yet, today this ancient class is represented by a very small number of species; most fish (nearly 96 percent) are members of the more recently evolved teleost class.

Made infamous by predators such as the Great White Shark (*Carcharodon carcharias*), which can reach more than 15.5 feet (4.75 m) in length, most sharks are much smaller and prey on invertebrates and fish, posing little threat to humans. These silent saltwater-dwelling fish include species that range from less than 7 inches to the Whale Shark, which, like the even larger Blue Whale is a filter-feeding species, making a living on plankton-sized organisms.

The largest order of sharks are the Squaliformes, which number approximately 126 species distributed across six families. One, the Squalidae, meaning “dirty,” apparently in reference to what was once considered inedible flesh, is represented in the Strait of Juan de Fuca by the Pacific Spiny Dogfish

(*Squalus suckleyi*), a medium-sized, long-lived shark. This dogfish averages about three feet in length, with the females larger than the males. As with other sharks, the Pacific Spiny Dogfish is covered with rough sandpaper-like scales and has oblique teeth top and bottom useful for grinding, rather than tearing flesh.

The Pacific Spiny Dogfish ranges widely from the northern Asian Pacific coast, across to Alaska and south as far as California.

The spiny dogfish body is slender, cylindrical in cross section, with a short, narrow head, and a long, blunt snout. It resembles other sharks in many

respects, including lidless eyes, the lack of an airbladder, with floating made possible by its large, oil-rich liver. It is gray above and whitish below, with white dots along the back and sides. The five gills are uncovered, the dorsal fins small, but the tail is long and strong, an aid to rapid movement.

“Spiny” refers to two venomous spines, one in front of each dorsal fin, which provide some protection against marine predators. When the shark senses danger it can arch its back or roll into a ball, causing the spines to protrude. For the unwary human who lacks attention when handling a thrashing dogfish, a nasty sting and serious complications may result.



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Cosmopolitan in its preferences, but with a small mouth, the spiny dogfish consumes invertebrates, such as crabs, squid, shrimp, and small fish as well. And, as the common name implies, like wild dogs they often hunt in large packs, sweeping up food as they go.

Late to mature, females are typically nearly three feet in length before breeding. They are “aplacental ovoviparous,” meaning the young develop within the mother’s body where they are nourished by a yolk sack rather than a placenta. When born the pups are 8.5 to 12 inches in length, surely a heavy load for a 4-foot female. She carries as many as 20 pups for up to two years, one of the longest gestation periods for any animal.

Pacific Spiny Dogfish sometimes live 80 years. They are marine fish, typically ranging at depths of less than 330 feet (100 m) but sometimes encountered as deep as 4,100 feet (1,250 m). This fish is known to move vertically and horizontally in response to many factors, including temperature and availability of prey. Most do not migrate great distances, although it has been determined that dogfish of the Salish Sea do move to offshore waters during winter and spring. And some spiny dogfish have been tagged and retrieved thousands of miles from their original location. At least one individual traveled from Washington state waters to Japan, a distance of 5,000 miles (8,047 km). Much remains to be learned about such migrations.

Commercial Fishing, Vitamin A, and the Pacific Spiny Dogfish

Pacific Spiny Dogfish commercial fishing has been subject to the ups-and-downs of demand and, in the case of one product, substitution. The start was in British Columbia, where indigenous people sought the spiny dogfish for its oil, used for lighting and heating and as a lubricant. In 1876, commercial fisheries began in the Strait of Georgia in British Columbia. Initially a large fishery, meeting demand in both the United States and Canada, the market fluctuated for several years. In 1927, the discovery that dogfish liver oil was an excellent source of Vitamin A drove the market once again; the oil was also used in animal foods. By 1936, the United States was also processing dogfish for their oil.

Fishing peaked in World War II, when the decrease of European sources of Vitamin A drove demand. The introduction of trawling greatly increased the catch, with the highest tonnage processed in the United States in 1944. Approximately 18,800 tons were caught that year; by comparison, in 2021 the number was 795 tons. The sharp increase in dogfish take was reflected not only in the market for oil but in the estimates of spiny dogfish biomass. This number went from an approximated high in 1940 of 32,555 pups to 13,615 in 2021, a number fairly constant over the last 10 years. Following World War II, Vitamin A was produced synthetically, reducing the demand for spiny dogfish livers. As commercial production declined, dogfish populations stabilized.

Official Harassment

Although spiny dogfish fishing produced economic benefits for Canada and the United States, the species was nevertheless at times subject to a more serious assault, including methods officially endorsed. With its tiny mouth, the dogfish preys on invertebrates and small fish. Yet it was blamed for tearing nets laid down for other catch such as herring. In 1958, the Canadian government began an eradication program for this “nuisance fish,” offering cash rewards or fishing rights for herring in return for the kill, which resulted in the take of about 2,200 tons per year. The program was discontinued in

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1962 when it was deemed ineffective. It is conjectured that the attempt to eliminate the spiny dogfish place took place during good years for dogfish recruitment.

Not so fortunate was the Basking Shark (*Cetorhinus maximus*), second only to the Whale Shark in size and, like that enormous fish, a filter feeder on tiny plankton. Up to 33 feet (10 m) in length, with its 5-foot gaping maw this shark was also considered a nuisance to boaters and fishers in British Columbia waters. Up to 90 percent of the population was eliminated, leading to the 2010 listing of this benign shark species as endangered. Today it is estimated that just a few hundred ply the waters from Mexico to British Columbia; they are rarely seen.

Commercial Fishing, Market Resumption

Bonanza years for fishing the Pacific Spiny Dogfish, particularly lucrative in the Strait of Georgia, peaked in 1979. The expanded fishery was in part driven by the establishment of a foodfish industry in the Strait. Taking 4,780 tons in 1979, and continuing relatively high throughout the 1980s and 1990s, an inevitable decline began in Canadian stock. Meanwhile, in the United States, the much smaller commercial fishery meant less tonnage in the catch. Yet estimating Pacific Spiny Dogfish population was always complicated by two major factors. The first involved fisheries practice and the second the biological cycle of this long-lived, slowly reproducing shark.

Attempts to estimate dogfish numbers were made difficult, at least in the earlier surveying efforts, by the fact that the spiny dogfish was typically not a targeted fishery. Instead, they were in the category of “bycatch,” a fate for many noncommercial species, but in the case of this shark, a nearly complete loss of those fish caught in nets intended for other species. It is estimated that nearly 100 percent of caught dogfish were discarded, a reality noted by the few observers present on fishing vessels

The second concern over estimating dogfish numbers concerns the life cycle of the fish. Recruitment is slow and hard to estimate for a species that lives long and reproduces slowly. A two-year gestation period for dogfish pups with typically no greater than 20 born in a season means less replenishment. The taking of large fish with trawls also has a significant impact on reproduction.

These realities of Pacific Spiny Dogfish biology have been quantitatively addressed in recent studies which model the relationships between survival, recruitment trends, and female fecundity. The results of these studies indicate that Pacific Spiny Dogfish off the coast is at 34% of its unexploited number. Since 40% is the chosen number for management, this number is below the desired level, although officially the dogfish is not considered overfished.

Yet in the second decade of the 21st century, dogfish fishing exceeded a rate considered desirable for replenishment of the species.

Endangered Relative

Meanwhile, a few thousand miles to the east, a close relative, the Atlantic Dogfish (*Squalus acanthias*) has been exploited to the extent that stocks are overfished, particularly in European waters. This fish is one of the primary species used in British “fish and chips.” With a reduction in European stocks, exports from the United States increased, and in 2017 landings in the Atlantic exceeded 21.5 million pounds. Atlantic Dogfish is closely related to Pacific Spiny Dogfish (they were considered one species until 2010).

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The increase in Atlantic Dogfish fishing was at least in part due to the decline of cod and haddock, heavily fished in the region. Aggressive marketing met with some success, as sales to institutions increased. Today In Europe, the consumption of Atlantic Dogfish continues, although it has been listed as “vulnerable” by the IUCN (International Union for Conservation of Nature). This species was once considered the most abundant shark on the planet.

Lessons from the overfishing of Atlantic Dogfish seem obvious for Pacific Spiny Dogfish management. Considered an edible fish with a mild, sweet flavor, dogfish must be quickly processed after capture to avoid the effects of concentrated urea in the flesh following death. Additionally, high mercury content in older fish has resulted in recommendations of eating fish smaller than 24 inches (60 cm). Broiled, baked, or fried, the dogfish will undoubtedly be promoted as a consumable in the years to come.

However, the estimated catch of Pacific Spiny Dogfish over the next ten years is predicted to decline while it seems pressure for its acquisition will increase. In part, it will be sought as a replacement for decimated stocks of other species; this has certainly been the case with the Atlantic Dogfish. It can be hoped that careful management of the Pacific Spiny Dogfish will ensure a good reproductive stock and a bright future.

As with so many fish species, knowledge of the Pacific Spiny Dogfish life cycle and specific requirements is incomplete. Migration patterns, slow reproduction rate, effects of global warming on a fish that has a narrow temperature preference range — all of these and more complicate the acquisition of knowledge about this once abundant shark. Even its role in the ocean’s ecosystem is poorly understand, and data analysis, not to mention survey results, is subject to vagaries in funding, the interests of the public, and even those responsible for its management. A member of one of the most ancient extant shark families, a fish that has plied the ocean through eons of change will hopefully exhibit a flexibility never before required of its ancestors.