

## Big Fish

*Dinosaurs shook the ground with their massive feet and in the river immense fish swam and spawned. Could the Earth and Sea support animals any larger than these distant cousins? Was it a contest of size? Or was it just the luck of habitat, gills rather than lungs, each absorbing oxygen, one from water and the other from air. And as a giant rock burned brightly in the oxygen-rich atmosphere and tumbled downward to shatter the earth, the fish were sheltered beneath the protective cover of water, while the giants above choked on ash and shivered beneath diminished sunshine.*

*On land, the beasts declined, leaving air-borne birds as their legacy. Furry survivors scurried across a terrain seemingly infinite with possibilities. But in the sea, a fish without bones or scales swam on, changing little, for eons safe in the comforting sea. Only in the distant future would its kind face the threat of extinction, not from the fiery heavens but rather from an upright land creature that would transform the world, sometimes unwittingly, for its own purposes.*

The most complete sturgeon fossil discovered by paleontologists is about 70 million years old, but the record of related fish extends back much earlier, prior to the time when the largest of the dinosaurs walked the land, with the sturgeon order, Acipenseriformes, dating to the Jurassic Period, 200 million years ago and possibly older. These ancestors of the more recently evolved sturgeons swam the ancient seas with exotic creatures such as the reptilian mosasaurs. Sturgeons are “ray-fin” fish, meaning their fins are composed of a skin-like webbing supported by bony spines, a structure found in many fish, most of which are bony species. But like their progenitors, the sturgeons that populate rivers and oceans today are cartilaginous, meaning they are given rigidity by a kind of flexible, connective tissue, rather like the ancient sharks, although the two are not directly related. Sturgeons do have bony skulls, placing them in the same class as bony fish, the Osteichthyes. Strictly cartilaginous fish like sharks belong to the Chondrichthyes class. Lacking scales, sturgeons are stiffened by five parallel rows of platelike structures, called scutes. Toothless, these fish are nevertheless capable of sucking large prey into their mouths with their fleshy, protruding lips.

With only 25 or so species extant today, sturgeons are often labeled as “living fossils,” their current form differing little from their appearance at the time of the dinosaurs. Some are very large, but others are a “short” two feet in length. This wide variation in size among a small number of species is considered by scientists to be an interesting evolutionary relationship.

The paucity of species and wide range in size in part may owe its origins to the dynamic nature of the sturgeons’ environment, particularly when the Ice Ages enforced a new geographical reality on Pacific Northwest fish. Tectonic forces, local river and sea changes, variability in temperature, and many other factors associated with earth and atmospheric processes could have influenced the speciation of this anadromous group of ancient fish.

The smallest North American sturgeon is a member of a different genus than the Green Sturgeon found in the Strait but belongs to the same family – Acipenseridae. This is the Shovelnose Sturgeon (*Scaphirhynchus platyrhynchus*), a southeastern species that matures to less than two feet. Meanwhile the great Beluga Sturgeon (*Huso huso*), a fish of the Caspian and Black Seas, is the longest freshwater fish on the planet, with the record nearing 24 feet and a stunning weight of over 3,400 pounds. This sturgeon is not completely cartilaginous. As with several other species, its continued existence is imperiled by overfishing and habitat loss.

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**Green Sturgeon (*Acipenser medirostris*)**

Small by comparison to the Beluga Sturgeon, the Green Sturgeon (*Acipenser medirostris*), a species of the Pacific Ocean, including the Strait of Juan de Fuca, at seven feet and a maximum of 350 pounds is nevertheless a very large fish. This species spawns in the Sacramento River of California, as well as the Klamath River and Rogue River of southern Oregon. Except for spawning in freshwater, the Green Sturgeon is a marine species and an apparently mobile one; when at sea, it ranges north to the Aleutian Islands and the Gulf of Alaska.

As with other sturgeon species, the Green Sturgeon is anadromous (meaning “running upward”), although it does not die after spawning, a lifestyle referred to as “iteroparity” as opposed to “semelparity,” meaning spawning only once, as with the salmon. All sturgeon spawn in fresh water, but the Green Sturgeon and other species as well do not necessarily return to their natal rivers on an annual basis. Adult Green Sturgeon mature at approximately 15 years of age and may live to an old age of 60 years or more. Adults often travel far upriver to spawn, preferring deep, relatively fast-flowing clean water, with a substrate composed of sand and gravel. The heavy adhesive eggs sink to this pebbly surface where the young larvae, which are poor swimmers, can find protection.

Green Sturgeon are olive green to dark green above, whitish below, with a stripe along the side and another beneath. They have a long narrow snout, with a few barbels located close to the mouth; these sensory appendages are an aid to detecting the bottom and to finding prey. Females are larger than the males, on the average topping the scales at around 100 pounds. Although lacking scales, as with other

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sturgeon, this species is adorned with five rows of pointed scutes along the body; these are a bony structure with a hard outer surface. The pectoral fins are low and rounded, and pelvic fins are located towards the rear of the body.

Female Green Sturgeon produce 59,000 - 242,000 eggs; these do not tolerate temperatures above 73 degrees and are most viable in water of 60 degrees, although juveniles can survive warmer conditions. The larvae are large, measuring at 65 milligrams when five days old, twice the size of young White Sturgeon, a larger species. The young may reach a length of 12 inches in a year; survival rate is high, in part due to the substantial yolk, an energy drain for the female, but the source of nourishment that promotes rapid growth. Juveniles spend 1-4 years in fresh and estuarine waters, migrating to a saltwater environment when they are 12-30 inches in length.

Green Sturgeon spend more time in salt water than many other North American sturgeon species. The presence of Green Sturgeon in northern waters such as the Strait of Juan de Fuca and the waters of Alaska is indicative of the capability of this species to travel far from rivers and estuaries.

At sea, Green Sturgeon are primarily bottom feeders, preying on a variety of invertebrates and fish in relatively shallow water.

In the Strait, catch-and-release fishing is permitted, but until recent years little was known about the ecology of this species. In 2002 a program to tag Green Sturgeon was begun in their natal rivers; by 2019, 350 had been fitted with transmitters. Data collected over a span of 15 years revealed over 200 fish in the Strait. Of these, 71 percent were members of the southern Distinct Population Segment (DPS), sturgeon that spawn in the Sacramento River and are considered "threatened," in part because only a single spawning population is known in the cooler waters of the upper part of the river. Many of these detected fish in the Strait are believed to have migrated north to the Strait of Georgia, rather than south to the Puget Sound region. Thus, the Strait has been designated an "area of high conservation value." However, the importance of the Strait to the survival of the Green Sturgeon is unknown. Although fishing is permitted the northern DPS (those that spawn in the Rogue River and Klamath and Umpqua) are considered "species of concern." What this implies is that not enough is known about this more northerly group to list it under the U.S. Endangered Species Act. But as with many sturgeon species, Green Sturgeon numbers have consistently declined.

One of the reasons for the loss of Green Sturgeon is the cumulative adverse effect of activities such as dredging, blasting, and sand and gravel mining. Other pressures on population include the presence of invasive plants and even oyster growing. Green Sturgeon are often caught as bycatch in commercial fishing operations. And like so many populations of sturgeon species worldwide, extinction is a constant concern for conservationists.

### **White Sturgeon (*Acipenser transmontanus*)**

The largest freshwater fish in North America and a species of the Pacific Northwest and California, the White Sturgeon (*Acipenser transmontanus*) does occasionally stray into the Strait, possibly as a seasonal foray to or from the lower Fraser River, which is considered to harbor a distinct population of this species. Not often encountered, White Sturgeon have been tracked moving north from the Klamath River to the lower Fraser; one individual was recorded in the Fraser over a year after tagging in the Klamath River; undoubtedly this fish traversed the Strait on its long voyage. White Sturgeon may possess this sea-going/freshwater flexibility in part because they do not undergo physiological changes when entering saltwater.

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White Sturgeon belong to the same ancient Acipenseriformes order as Green Sturgeon, but evidence suggests the species itself dates to only about 4.5 million years ago, in geological terms not too distant from the onset of the Pleistocene Ice Age. As with other fish species, White Sturgeon adapted to changing environments implied by the relatively short glacial onslaught which would have at the very least influenced its migratory patterns and the location of its natal river, with so much of its former habitat being covered with ice.

Primarily freshwater fish, White Sturgeon reach very large size, with the “official” record at 468 pounds, although larger fish have been recorded in the Fraser River. One huge specimen was over 11 feet in length and weighed nearly 900 pounds. More typical size is around 3.5 feet with a modest 20 pounds weight.

Their large size implies that White Sturgeon have few natural enemies, other than humans, and generally this is true. In the lower reaches of the Columbia River, seals and sea lions do pursue adult sturgeon, and many fish will eat sturgeon eggs. Although not much is known about predatory behavior patterns in the Strait, in 2009 an encounter between a White Sturgeon and a Steller’s Sealion (also known as the Northern Sealion) was photographed near Race Rocks on Vancouver Island. The sealion was tossing the sturgeon, clearly dominating the battle between them. This rare sighting provided evidence of the presence of White Sturgeon in the Strait as well as the possibility of predation by large mammals.

Observations indicate that White Sturgeon movement into saltwater is undertaken by young fish, with few over the age of 40 recorded outside the main body of the Fraser River, including the estuary. Thus, although these forays into the sea are confirmed, relatively little is known about their ocean movements. Typically, White Sturgeon adults migrate downstream in spring and upstream in summer, with spawning in the northern rivers most common in June and July, and congregations often occurring in cold, low velocity water during the winter.

Male White Sturgeon mature at about 11 years of age, but females are more commonly at least 25 or older. Spawning of adult fish seems to be triggered by a rising river water temperature as well as flow. Ovulation and egg development is sensitive to temperature, with failure above 15°C (59 °F) and a minimum temperature of 8 °C (46° F) required for larval survival. In addition to sensitivity to temperature, egg production is greatly influenced by silt; recruitment failure is believed to be directly related to an increase in stream sedimentation.

Fertilization is external and eggs are released into the water column where they subsequently sink to the bottom, adhering to the substrate. A large White Sturgeon female can produce over 4.5 million eggs. These hatch quickly (6.5 days), and within 60 days the young resemble the adults. Interestingly, spawning sites are typically in water of low productivity. As disadvantageous as such nutrient-poor rivers may seem, energy from marine animals is often present; salmon and other fish move upriver, sometimes pursued by hungry sturgeon.

In British Columbia, four of the White Sturgeon populations are considered Endangered, while the others are designated as Threatened. Researchers believe the upper Columbia population is destined for extinction; only the lower Fraser River supports numbers measured in the thousands. One of the biggest problems for this species is the lack of “recruitment,” the replacement of aging stock with younger fish. This difficulty is exacerbated by the long life of the sturgeon, not so much because it can live to the old age of 100 years, but because it is slow to mature, and spawning does not necessarily take place on an annual basis. Also, White Sturgeon are observed to be very faithful to spawning sites which can

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sometimes prove to be a disadvantage. Adult fish may return to a location that is no longer suitable for egg and larva viability.

Indigenous peoples along the coast and rivers fished for White Sturgeon, and today the fish are particularly popular amongst anglers in the Columbia River, where their population is augmented by hatchery fish. White Sturgeon from the Moses Lake hatchery in central Washington were first released in 2004 in collaboration with the Colville Tribe. In 2008, the Yakama Nation opened a sturgeon hatchery, and by 2011 approximately 13,000 juvenile White Sturgeon were released into the middle Columbia.

What do sturgeon taste like? It is reported that they have firm flesh, with variable flavor; the Green Sturgeon is considered to have a strong taste. Historically, the most well-known use of sturgeon has been for the roe (the eggs) which makes a desirable caviar, although some reports have indicated that Green Sturgeon caviar is not as tasty as other sturgeon eggs.

At one time the Columbia River was nearly swarming with sturgeon, and demand was sufficient or promoted to the extent that in the 1880s commercial harvesting began. Within two decades the White Sturgeon had nearly disappeared. Since the 1990s, commercial fishing of White Sturgeon has been illegal in British Columbia, but in the United States limited commercial fishing is offered on the Columbia. All this for the taste of fish eggs.

### **Caviar and Conservation:**

Globally, 35 countries farm sturgeon and in the United States the largest harvest is of White Sturgeon, accounting for over 95% of the production by weight over the other five species raised in artificial environments. The meat is sold to restaurants, but farming is primarily motivated by the worldwide demand for caviar, those delicate-tasting eggs which reportedly have a multitude of positive health benefits. Farming of sturgeon will undoubtedly increase in the future, a reality most easily justified by the worry of extinction of wild fish.

Eating fish eggs is probably as old as *Homo sapiens*, or at least dates to the time when the relationship with fish began for this upright, foraging, very hungry species. In general, fish roe is nutritious, and caviar, the Persian name for sturgeon eggs, is packed with beneficial vitamins and minerals. What does it taste like? The answer to that question depends on the information source. Read a website devoted to the promotion of caviar, and you will wonder how you could have enjoyed life at all without it (although the visual image of broad pink human lips tasting black caviar definitely adds to the sexual content so common in advertising). A bit buttery, a bit like "ocean water" (if tasted recently), "salty," somewhat "fishy," best if fresh, but usually found canned. Like diamonds, a rather bland gemstone cleverly promoted for many years, a limited supply of sturgeon would increase the price, making caviar a most desirable food.

*Meanwhile fishing for wild sturgeon in the Pacific Northwest is catch-and-release only. Size is restricted, and hope may reside in habitat protection, particularly of spawning sites, as much as constraints upon fishing. And although the farming industry is not without controversy, it is fortunate for wild sturgeon that most caviar is derived from these fish. As with other species it is difficult to undo the damage caused by the overfishing of sturgeon. How ironic that a confined hatchery provides the only way to reproduce a huge fish that is the source of a delicacy for the human palate. Fish without teeth, feeding on the small, survivors of a 250-million-year-old lineage, possibly lost in the briefest speck of time.*