

= Ocean sunfish =

The ocean sunfish or common mola (*Mola mola*) is the heaviest known bony fish in the world . It has an average adult weight between 247 and 1 @, @ 000 kg (545 ? 2 @, @ 205 lb) . The species is native to tropical and temperate waters around the globe . It resembles a fish head with a tail , and its main body is flattened laterally . Sunfish can be as tall as they are long when their dorsal and ventral fins are extended .

Sunfish live on a diet consisting mainly of jellyfish , but because this diet is nutritionally poor , they consume large amounts to develop and maintain their great bulk . Females of the species can produce more eggs than any other known vertebrate , up to 300 @, @ 000 @, @ 000 at a time . Sunfish fry resemble miniature pufferfish , with large pectoral fins , a tail fin , and body spines uncharacteristic of adult sunfish .

Adult sunfish are vulnerable to few natural predators , but sea lions , killer whales , and sharks will consume them . Among humans , sunfish are considered a delicacy in some parts of the world , including Japan , Korea , and Taiwan . In the EU , regulations ban the sale of fish and fishery products derived from the family Molidae . Sunfish are frequently caught in gillnets .

A member of the order Tetraodontiformes , which also includes pufferfish , porcupinefish , and filefish , the sunfish shares many traits common to members of this order . The ocean sunfish , *Mola mola* , is the type species of the genus .

= = Naming and taxonomy = =

Many of the sunfish 's various names allude to its flattened shape . Its specific name , *mola* , is Latin for " millstone " , which the fish resembles because of its gray color , rough texture , and rounded body . Its common English name , sunfish , refers to the animal 's habit of sunbathing at the surface of the water . The Dutch- , Portuguese- , French- , Catalan- , Spanish- , Italian- , Russian- , Greek- and German @-@ language names , respectively *maanvis* , *peixe lua* , *poisson lune* , *peix lluna* , *pez luna* , *pesce luna* , ???? @-@ ???? , ????????????? and *Mondfisch* , mean " moon fish " , in reference to its rounded shape . In German , the fish is also known as *Schwimmender Kopf* , or " swimming head " . In Polish , it is named *samog?ów* , meaning " head alone " , because it has no true tail . The Chinese translation of its academic name is *fan @-@ che yu* ??? , meaning " toppled wheel fish " . The ocean sunfish has various superseded binomial synonyms , and was originally classified in the pufferfish genus , as *Tetraodon mola* . It is now placed in its own genus , *Mola* , with two species : *Mola mola* and *Mola ramsayi* . The ocean sunfish , *Mola mola* , is the type species of the genus .

The genus *Mola* belongs to the family Molidae . This family comprises three genera : *Masturus* , *Mola* and *Ranzania* . The common name " sunfish " without qualifier is used to describe the marine family Molidae as well as the freshwater sunfishes in the family Centrarchidae which are unrelated to Molidae . On the other hand , the name " ocean sunfish " and " *mola* " refer only to the family Molidae .

The family Molidae belongs to the order Tetraodontiformes , which includes pufferfish , porcupinefish , and filefish . It shares many traits common to members of this order , including the four fused teeth that form the characteristic beak and give the order its name (*tetra* = four , *odous* = tooth , and *forma* = shape) . Indeed , sunfish fry resemble spiky pufferfish more than they resemble adult molas .

= = Description = =

The caudal fin of the ocean sunfish is replaced by a rounded clavus , creating the body 's distinct truncated shape . The body is flattened laterally , giving it a long oval shape when seen head @-@ on . The pectoral fins are small and fan @-@ shaped , while the dorsal fin and the anal fin are lengthened , often making the fish as tall as it is long . Specimens up to 3 @. @ 2 m (10 @. @ 5 ft) in height have been recorded .

The mature ocean sunfish has an average length of 1 @. @ 8 m (5 @. @ 9 ft) and a fin @-@ to @-@ fin length of 2 @. @ 5 m (8 @. @ 2 ft) . The average weight of mature specimens can range from 247 to 1 @, @ 000 kg (545 to 2 @, @ 205 lb) , but even larger individuals are not unheard of . The maximum size is up to 3 @. @ 3 m (10 @. @ 8 ft) in length 4 @. @ 2 m (14 ft) across the fins and up to 2 @, @ 300 kg (5 @, @ 100 lb) in mass .

The spinal column of *M. mola* contains fewer vertebrae and is shorter in relation to the body than that of any other fish . Although the sunfish descended from bony ancestors , its skeleton contains largely cartilaginous tissues , which are lighter than bone , allowing it to grow to sizes impractical for other bony fishes . Its teeth are fused into a beak @-@ like structure , and pharyngeal teeth located in the throat .

The sunfish lacks a swim bladder . Some sources indicate the internal organs contain a concentrated neurotoxin , tetrodotoxin , like the organs of other poisonous tetraodontiformes , while others dispute this claim .

== Fins ==

In the course of its evolution , the caudal fin (tail) of the sunfish disappeared , to be replaced by a lumpy pseudotail , the clavus . This structure is formed by the convergence of the dorsal and anal fins , and is used by the fish as a rudder . The smooth @-@ denticled clavus retains 12 fin rays , and terminates in a number of rounded ossicles .

Ocean sunfish often swim near the surface , and their protruding dorsal fins are sometimes mistaken for those of sharks . However , the two can be distinguished by the motion of the fin . Sharks , like most fish , swim by moving the tail sideways while keeping the dorsal fin stationary . The sunfish , though , swings its dorsal fin and anal fin in a characteristic sculling motion .

== Skin ==

Adult sunfish range from brown to silvery @-@ grey or white , with a variety of mottled skin patterns ; some of these patterns may be region @-@ specific . Coloration is often darker on the dorsal surface , fading to a lighter shade ventrally as a form of countershading camouflage . *M. mola* also exhibits the ability to vary skin coloration from light to dark , especially when under attack . The skin , which contains large amounts of reticulated collagen , can be up to 7 @. @ 3 cm (2 @. @ 9 in) thick on the ventral surface , and is covered by denticles and a layer of mucus instead of scales . The skin on the clavus is smoother than that on the body , where it can be as rough as sandpaper .

More than 40 species of parasites may reside on the skin and internally , motivating the fish to seek relief in a number of ways . One of the most frequent ocean sunfish parasites is the flatworm , *Accacoelium contortum* .

In temperate regions , drifting kelp fields harbor cleaner wrasses and other fish which remove parasites from the skin of visiting sunfish . In the tropics , *M. mola* solicits cleaning help from reef fishes . By basking on its side at the surface , the sunfish also allows seabirds to feed on parasites from its skin . Sunfish have been reported to breach , clearing the surface by approximately 3 m (9 @. @ 8 ft) , in an effort to dislodge embedded parasites .

== Range and behavior ==

Ocean sunfish are native to the temperate and tropical waters of every ocean in the world . *Mola* genotypes appear to vary widely between the Atlantic and Pacific , but genetic differences between individuals in the Northern and Southern hemispheres are minimal .

Although early research suggested sunfish moved around mainly by drifting with ocean currents , individuals have been recorded swimming 26 km in a day , at a top speed of 3 @. @ 2 km / h . Sunfish are pelagic and swim at depths to 600 m (2 @, @ 000 ft) . Contrary to the perception that sunfish spend much of their time basking at the surface , *M. mola* adults actually spend a large portion of their lives submerged at depths greater than 200 m (660 ft) , occupying both the

epipelagic and mesopelagic zones .

Sunfish are most often found in water warmer than 10 ° C (50 ° F) ; prolonged periods spent in water at temperatures of 12 ° C (54 ° F) or lower can lead to disorientation and eventual death . Surface basking behavior , in which a sunfish swims on its side , presenting its largest profile to the sun , may be a method of " thermally recharging " following dives into deeper , colder water . Sightings of the fish in colder waters outside of its usual habitat , such as those southwest of England , may be evidence of increasing marine temperatures .

Sunfish are usually found alone , but occasionally in pairs or in large groups while being cleaned . They swim primarily in open waters , but are sometimes seen near kelp beds , taking advantage of resident populations of smaller fish which remove ectoparasites from their skin . Because sunfish must consume a large volume of prey , their presence in a given area may be used as an indicator of nutrient @-@ rich waters where endangered species may be found .

= = = Feeding = = =

The diet of the ocean sunfish consists primarily of various jellyfish . It also consumes salps , squid , crustaceans , small fish , fish larvae , and eel grass . This range of food items indicates that the sunfish feeds at many levels , from the surface to deep water , and occasionally down to the seafloor in some areas . The diet is nutritionally poor , forcing the sunfish to consume a large amount of food to maintain its size .

= = = Lifecycle = = =

Ocean sunfish may live up to ten years in captivity , but their lifespan in a natural habitat has not yet been determined . Their growth rate is also undetermined . However , a young specimen at the Monterey Bay Aquarium increased in weight from 26 to 399 kg (57 to 880 lb) and reached a height of nearly 1 @. @ 8 m (5 @. @ 9 ft) in 15 months .

The sheer size and thick skin of an adult of the species deters many smaller predators , but younger fish are vulnerable to predation by bluefin tuna and mahi mahi . Adults are consumed by sea lions , Orca , and sharks . Sea lions appear to hunt sunfish for sport , tearing the fins off , tossing the body around , and then simply abandoning the still @-@ living but helpless fish to die on the seafloor .

The mating practices of the ocean sunfish are poorly understood , but spawning areas have been suggested in the North Atlantic , South Atlantic , North Pacific , South Pacific , and Indian oceans . Females can produce as many as 300 million eggs at a time , more than any other known vertebrate . Sunfish eggs are released into the water and externally fertilized by sperm .

Newly hatched sunfish larvae are only 2 @. @ 5 mm (0 @. @ 0.098 in) long and weigh a fraction of a gram . They grow to become fry , and those which survive grow many millions of times their original size before reaching adult proportions . Sunfish fry , with large pectoral fins , a tail fin , and body spines uncharacteristic of adult sunfish , resemble miniature pufferfish , their close relatives . Young sunfish school for protection , but this behavior is abandoned as they grow . By adulthood , they have the potential to grow more than 60 million times their birth size , arguably the most extreme size growth of any vertebrate animal .

= = Human interaction = =

Despite their size , ocean sunfish are docile , and pose no threat to human divers . Injuries from sunfish are rare , although a slight danger exists from large sunfish leaping out of the water onto boats ; in one instance , a sunfish landed on a 4 @-@ year @-@ old boy when the fish leaped onto the boy 's family 's boat . Areas where they are commonly found are popular destinations for sport dives , and sunfish at some locations have reportedly become familiar with divers . The fish is more of a problem to boaters than to swimmers , as its immense size and weight can cause significant damage to a boat striking one of these fish . Collisions with sunfish are very common in some parts

of the world and have caused damage to the hull of a boat , and their bodies can become lodged in the propellers of larger ships .

The flesh of the ocean sunfish is considered a delicacy in some regions , the largest markets being Taiwan and Japan . All parts of the sunfish are used in cuisine , from the fins to the internal organs . Some parts of the fish are used in some areas of traditional medicine . If the body does contain toxins , then the marketing and sale of ocean sunfish is forbidden in the European Union according to Regulation (EC) No 853 / 2004 of the European Parliament and of the Council .

Sunfish are accidentally but frequently caught in drift gillnet fisheries , making up nearly 30 % of the total catch of the swordfish fishery employing drift gillnets in California . The bycatch rate is even higher for the Mediterranean swordfish industry , with 71 % to 90 % of the total catch being sunfish .

The fishery bycatch and destruction of ocean sunfish are unregulated worldwide . In some areas , the fish are " finned " by fishermen who regard them as worthless bait thieves ; this process , in which the fins are cut off , results in the eventual death of the fish , because it can no longer propel itself without its dorsal and anal fins . The species is also threatened by floating litter such as plastic bags which resemble jellyfish , its main food . Bags can choke and suffocate a fish or fill its stomach to the extent that it starves .

Many areas of sunfish biology remain poorly understood , and various research efforts are underway , including aerial surveys of populations , satellite surveillance using pop @-@ off satellite tags , genetic analysis of tissue samples , and collection of amateur sighting data . A decrease in sunfish populations may be caused by more frequent bycatch and the increasing popularity of sunfish in human diet .

In 2015 , a video went viral of a Boston man profanely expressing his amazement when encountering a sunfish for the first time .

= = = In captivity = = =

Sunfish are not widely held in aquarium exhibits , due to the unique and demanding requirements of their care . Some Asian aquaria display them , particularly in Japan . The Kaiyukan Aquarium in Osaka is one of few aquariums with *M. mola* on display , where it is reportedly as popular an attraction as the larger whale sharks . The Lisbon Oceanarium in Portugal has sunfish showcased in the main tank , and in Spain , the Valencia Oceanogràfic has specimens of sunfish . The Nordsøen Oceanarium in the northern town of Hirtshals in Denmark is also famous for its sunfish .

While the first ocean sunfish to be held in an aquarium in the United States is claimed to have arrived at the Monterey Bay Aquarium in August 1986 , other specimens have previously been held at other locations . Marineland of the Pacific , closed since 1998 and located on the Palos Verdes Peninsula in Los Angeles County , California , held an ocean sunfish in its warm @-@ water tank as early as 1957 , and in 1964 held a 650 @-@ pound (290 kg) specimen , claimed as the largest ever captured at that time . However , another 1 @, @ 000 @-@ pound (450 kg) specimen was brought alive to Marineland Studios Aquarium , near St. Augustine , Florida , in 1941 .

Because sunfish had not been kept in captivity on a large scale before , the staff at Monterey Bay was forced to innovate and create their own methods for capture , feeding , and parasite control . By 1998 , these issues were overcome , and the aquarium was able to hold a specimen for more than a year , later releasing it after its weight increased by more than 14 times . *Mola mola* has since become a permanent feature of the Open Sea exhibit . Monterey Bay Aquarium 's largest sunfish specimen was euthanized on February 14 , 2008 , after an extended period of poor health .

A major concern to curators is preventive measures taken to keep specimens in captivity from injuring themselves by rubbing against the walls of a tank , since ocean sunfish cannot easily maneuver their bodies . In a smaller tank , hanging a vinyl curtain has been used as a stopgap measure to convert a cuboid tank to a rounded shape and prevent the fish from scraping against the sides . A more effective solution is simply to provide enough room for the sunfish to swim in wide circles . The tank must also be sufficiently deep to accommodate the vertical height of the sunfish , which may reach 3 @. @ 2 m (10 ft) .

Feeding captive sunfish in a tank with other faster @-@ moving , more aggressive fish can also

present a challenge . Eventually , the fish can be taught to respond to a floating target to be fed , and to take food from the end of a pole or from human hands .

= = = Research and info = = =

FishBase reference
Australian Museum
OceanSunfish.org

= = = Images and videos = = =

Mike Johnson Natural History Photography
Phillip Colla Photography / Oceanlight.com
Video lecture (16 : 53) : Swim with giant sunfish in the open ocean - Tierney Thys
Skaphandrus.com Mola mola photos
Giant sunfish filmed off Malta
Sunfish filmed off the coast of Massachusetts in 2015