

## = Silky shark =

The silky shark ( *Carcharhinus falciformis* ), also known by numerous names such as blackspot shark , grey whaler shark , olive shark , ridgeback shark , sickle shark , sickle @-@ shaped shark , and sickle silk shark , is a species of requiem shark , in the family Carcharhinidae , named for the smooth texture of its skin . It is one of the most abundant sharks in the pelagic zone , and can be found around the world in tropical waters . Highly mobile and migratory , this shark is most often found over the edge of the continental shelf down to 50 m ( 164 ft ) . The silky shark has a slender , streamlined body and typically grows to a length of 2 @. @ 5 m ( 8 ft 2 in ) . It can be distinguished from other large requiem sharks by its relatively small first dorsal fin with a curving rear margin , its tiny second dorsal fin with a long free rear tip , and its long , sickle @-@ shaped pectoral fins . It is a deep , metallic bronze @-@ gray above and white below .

With prey often scarce in its oceanic environment , the silky shark is a swift , inquisitive , and persistent hunter . It feeds mainly on bony fishes and cephalopods , and has been known to drive them into compacted schools before launching open @-@ mouthed , slashing attacks . This species often trails schools of tuna , a favored prey . Its sense of hearing is extremely acute , allowing it to localize the low @-@ frequency noises generated by other feeding animals , and , by extension , sources of food . The silky shark is viviparous , meaning that the developing embryos are sustained by a placental connection to their mother . Significant geographical variation is seen in its life history details . Reproduction occurs year @-@ round except in the Gulf of Mexico , where it follows a seasonal cycle . Females give birth to litters of up to 16 pups annually or biennially . The newborn sharks spend their first months in relatively sheltered reef nurseries on the outer continental shelf , growing substantially before moving into the open ocean .

The large size and cutting teeth of the silky shark make it potentially dangerous , and it has behaved aggressively towards divers . However , attacks are rare , as few humans enter its oceanic habitat . Silky sharks are valued for their fins , and to a lesser extent their meat , hide , liver oil , and jaws . Because of their abundance , they form a major component of commercial and artisanal shark fisheries in many countries . Furthermore , their association with tuna results in many sharks being taken as bycatch in tuna fisheries . Although slow @-@ reproducing like most other sharks , the wide distribution and large population size of the silky shark was once thought to buffer the species against these fishing pressures . However , data now suggest that silky shark numbers are declining around the world , which prompted the IUCN to reassess its conservation status from Least Concern to Near Threatened in 2007 .

## = Taxonomy =

A scientific description of the silky shark was first published by the German biologists Johannes Müller and Jakob Henle under the name *Carcharias* ( *Prionodon* ) *falciformis* , in their 1839 *Systematische Beschreibung der Plagiostomen* . Subsequent authors have assigned this species to the genus *Carcharhinus* . Because Müller and Henle 's type specimen was a 53 @-@ cm @-@ long female fetus from Cuba , adult silky sharks were historically not recognized as *C. falciformis* and were described as a separate species , *Carcharhinus floridanus* , by Henry Bigelow , William Schroeder , and Stewart Springer in 1943 . Jack Garrick , Richard Backus , and Robert Gibbs , Jr. synonymized *C. floridanus* with *C. falciformis* in 1964 .

The specific epithet *falciformis* is Latin for " sickle @-@ shaped " , which refers to the outline of the dorsal and pectoral fins . The silky shark 's common name comes from the fine texture of its skin compared to other sharks , a product of its tiny , densely packed dermal denticles . It may also be referred to as blackspot shark ( usually used for *C. sealei* ) , grey reef shark ( usually used for *C. amblyrhynchos* ) , grey whaler shark , olive shark , reef shark , ridgeback shark , sickle shark , sickle silk shark , sickle @-@ shaped shark , silk shark , and silky whaler .

## = Phylogeny and evolution =

Fossilized teeth belonging to the silky shark have been found in North Carolina : from the vicinity of two baleen whales , one in mud dating to the Pleistocene @-@ Holocene ( circa 12 @,@ 000 years ago ) and the other in Goose Creek Limestone dating to the Late Pliocene ( circa 3 @.@ 5 million years ago ? Mya ) , as well as from the Pungo River , dating to the Miocene ( 23 ? 5 @.@ 3 Mya ) . Fossil teeth have also been found in Pliocene strata at the Cava Serredi quarry in Tuscany , Italy . *Carcharhinus elongatus* , an earlier representative of its lineage with smooth @-@ edged teeth , is known from Oligocene ( 34 ? 23 Mya ) deposits in the Old Church formation of Virginia , and the Ashley formation of South Carolina . A set of poorly described , Eocene ( 56 ? 34 Mya ) teeth resembling those of this species are known from Egypt .

Initial efforts to resolve the evolutionary relationships of the silky shark were inconclusive ; based on morphology , Jack Garrick in 1982 suggested the blackspot shark ( *C. sealei* ) as its closest relative . In 1988 , Leonard Compagno assigned it phenetically to an informal " transitional group " also containing the blacknose shark ( *C. acronotus* ) , the blacktip reef shark ( *C. melanopterus* ) , the nervous shark ( *C. cautus* ) , the copper shark ( *C. brachyurus* ) , and the night shark ( *C. signatus* ) .

More recently , Gavin Naylor 's 1992 phylogenetic analysis , based on allozyme sequence data , found that the silky shark is part of a group containing large sharks with a ridge between the dorsal fins . One branch within this group contains the sandbar shark ( *C. plumbeus* ) and the bignose shark ( *C. altimus* ) , while the silky shark is the basal member of the other branch and the sister taxon to a clade containing the Caribbean reef shark ( *C. perezi* ) , Galapagos shark ( *C. galapagensis* ) , oceanic whitetip shark ( *C. longimanus* ) , dusky shark ( *C. obscurus* ) , and blue shark ( *Prionace glauca* ) . Mine Dosay @-@ Abkulut 's 2008 ribosomal DNA analysis , which included the silky , blue , and bignose sharks , confirmed the closeness of those three species .

= = Distribution and habitat = =

The silky shark has a cosmopolitan distribution in marine waters warmer than 23 ° C ( 73 ° F ) . In the Atlantic Ocean , it is found from the U.S. state of Massachusetts to Spain in the north , and from southern Brazil to northern Angola in the south , including the Mediterranean Sea , Gulf of Mexico , and Caribbean Sea . It occurs throughout the Indian Ocean , as far south as Mozambique in the west and Western Australia in the east , including the Red Sea and the Persian Gulf . In the Pacific Ocean , the northern extent of its range runs from southern China and Japan to southern Baja California and the Gulf of California , while the southern extent runs from Sydney , Australia , to northern New Zealand to northern Chile . Based on life history differences , four distinct populations of silky sharks have been identified in ocean basins worldwide : in the northwestern Atlantic , in the western and central Pacific , in the eastern Pacific , and in the Indian Ocean .

Primarily an inhabitant of the open ocean , the silky shark is most common from the surface to a depth of 200 m ( 660 ft ) , but may dive to 500 m ( 1 @,@ 600 ft ) or more . Tracking studies in the tropical eastern Pacific and northern Gulf of Mexico have found that cruising silky sharks spend 99 % of their time within 50 m ( 160 ft ) of the surface , and 80 ? 85 % of their time in water with a temperature of 26 ? 30 ° C ( 79 ? 86 ° F ) ; the pattern was constant regardless of day or night . This species favors the edges of continental and insular shelves , often over deepwater reefs and around islands . Its range extends farther north and south along continental margins than in oceanic waters . On occasion , it may venture into coastal waters as shallow as 18 m ( 59 ft ) . Silky sharks are highly mobile and migratory , though the details of their movements are little @-@ known . Tagging data have recorded individual sharks moving up to 60 km ( 37 mi ) per day , and covering distances up to 1 @,@ 339 km ( 832 mi ) . Larger sharks generally move longer distances than smaller ones . In the Pacific Ocean and possibly elsewhere , it spends the summer at slightly higher latitudes , particularly during warmer El Niño years . In the northern Atlantic , most sharks follow the Gulf Stream northward along the U.S. East Coast . In the Gulf of Aden , it is most common in late spring and summer .

= = Description = =

Slim and streamlined , the silky shark has a fairly long , rounded snout with barely developed flaps of skin in front of the nostrils . The circular , medium @-@ sized eyes are equipped with nictitating membranes ( protective third eyelids ) . Short , shallow furrows are present at the corners of the mouth . Fourteen to 16 and 13 ? 17 tooth rows are found on either side of the upper and lower jaws , respectively ( typically 15 for both ) . The upper teeth are triangular and strongly serrated , with a notch in the posterior edge ; they are erect at the center and become more oblique towards the sides . The lower teeth are narrow , erect , and smooth @-@ edged . The five pairs of gill slits are moderate in length .

The dorsal and pectoral fins are distinctive and help to distinguish the silky shark from similar species . The first dorsal fin is relatively small , measuring less than a tenth as high as the shark is long , and originates behind the free rear tips of the pectoral fins . It has a rounded apex , an " S " -shaped rear margin , and a free rear tip about half as long as the fin is tall . The second dorsal fin is tiny , smaller than the anal fin , with a drawn @-@ out free rear tip up to three times as long as the fin is tall . A narrow dorsal ridge runs between the dorsal fins . The pectoral fins are narrow and sickle @-@ shaped , and particularly long in adults . The anal fin originates slightly ahead of the second dorsal fin and has a deep notch in the posterior margin . The caudal fin is fairly high with a well @-@ developed lower lobe .

The skin is densely covered by minute , overlapping dermal denticles . Each dermal denticle is diamond @-@ shaped and bears horizontal ridges leading to posterior marginal teeth , which increase in number as the shark grows . The back is metallic golden @-@ brown to dark gray and the belly is snowy white , which extends onto the flank as a faint lighter stripe . The fins ( except for the first dorsal ) darken at the tips ; this is more obvious in young sharks . The coloration quickly fades to a dull gray after death . One of the larger members of its genus , the silky shark commonly reaches a length of 2 @. @ 5 m ( 8 @. @ 2 ft ) , with a maximum recorded length and weight of 3 @. @ 5 m ( 11 ft ) and 346 kg ( 763 lb ) , respectively . Females grow larger than males .

= = Biology and ecology = =

The silky shark is one of the three most common pelagic sharks along with the blue and oceanic whitetip sharks , and counts among the most numerous large oceanic animals in the world with a population of at least tens of millions . Compared to the other two species , it is less strictly pelagic with the greatest numbers found in offshore waters associated with land , where food is more readily obtained than farther out in the truly open ocean . The silky shark is an active , inquisitive , and aggressive predator , though it will defer to the slower but more powerful oceanic whitetip shark in competitive situations . When approaching something of interest , it may seem inattentive , sedately circling and sometimes swinging its head from side to side . However , it can respond with startling swiftness to any shift in its immediate surroundings . This shark is often found around floating objects such as logs or tethered naval buoys .

Younger silky sharks are known to form large , loosely organized aggregations , possibly for mutual defense . During migrations , over a thousand individuals may gather . These groups are generally segregated by size , and in the Pacific perhaps also by sex . Silky sharks within a group have been observed to " tilt " , presenting their full lateral profile towards each other , as well as gape their jaws or puff out their gills . On occasion , sharks have also been seen suddenly charging straight up , veering away just before reaching the surface and gliding back down to deeper water . The significance of these behaviors is unknown . When confronted , the silky shark may perform a threat display , in which it arches its back , drops its tail and pectoral fins , and elevates its head . The shark then proceeds to swim in tight loops with a stiff , jerky motion , often turning broadside towards the perceived threat .

Potential predators of the silky shark include larger sharks and killer whales ( *Orcinus orca* ) . Known parasites of this shark include the isopod *Gnathia trimaculata* , the copepod *Kroeyerina cortezensis* , and the tapeworms *Dasyrhynchus variouncinatus* and *Phyllobothrium* sp . Silky sharks frequently intermingle with schools of scalloped hammerheads ( *Sphyrna lewini* ) , and have been

known to follow marine mammals . One account from the Red Sea describes 25 silky sharks following a large pod of bottlenose dolphins ( *Tursiops* sp . ) , along with 25 grey reef sharks ( *C. amblyrhynchos* ) and a lone silvertip shark ( *C. albigladius* ) . Silky sharks are themselves accompanied by juvenile pilot fish ( *Naucrates ductor* ) , which " ride " the pressure wave ahead of the shark , as well as by jacks , which snatch scraps of food and rub against the shark 's skin to scrape off parasites .

#### == Feeding ==

The silky shark is an opportunistic predator , feeding mainly on bony fishes from all levels of the water column , including tuna , mackerel , sardines , mullets , groupers , snappers , mackerel scads , sea chubs , sea catfish , eels , lanternfishes , filefishes , triggerfishes , and porcupinefishes . It may also take squid , paper nautilus , and swimming crabs , and fossil evidence indicates it scavenged on whale carcasses . Good feeding opportunities can draw silky sharks in large numbers ; one such feeding aggregation in the Pacific has been documented " herding " a school of small fishes into a compact mass ( a bait ball ) and trapping it against the surface , whereupon the sharks consumed the entire school . When attacking tightly packed fish , silky sharks charge through the ball and slash open @-@ mouthed , catching the prey fish at the corners of their jaws . Although multiple individuals may feed at once , each launches its attack independently .

Studies conducted off the Florida coast and the Bahamas have shown that silky sharks are highly sensitive to sound , in particular low @-@ frequency ( 10 ? 20 Hz ) , irregular pulses . Experiments in which these sounds were played underwater attracted sharks from hundreds of meters away . Silky sharks likely orient to these sounds because they are similar to the noise generated by feeding animals such as birds or dolphins , thus indicating promising sources of food . These studies have also demonstrated that a silky shark attracted by one sound will quickly withdraw if that sound abruptly changes in amplitude or character ; this change need not be a sound produced by a predator to evoke the reaction . Over repeated exposures , silky sharks habituate to the sound change and stop withdrawing , though it takes them much longer to do so compared to the bolder oceanic whitetip shark .

The bite force of a 2 @-@ m @-@ long silky shark has been measured at 890 newtons ( 200 lbf ) . A well @-@ established association exists between this species and tuna : off Ghana , almost every tuna school has silky sharks trailing behind , and in the eastern Pacific , these sharks inflict such damage to tuna fishing gear and catches that fishery workers have given them the moniker " net @-@ eating sharks " . Silky sharks and bottlenose dolphins compete when both species target the same school of fish ; the amount eaten by the dolphins decreases relative to the number of sharks present . If a large number of sharks is present , they tend to remain inside the prey school , while the dolphins consign themselves to the periphery , possibly to avoid incidental injury from the sharks ' slashing attacks . Conversely , if a large enough group of dolphins gathers , they become able to chase the sharks away from the prey school . Regardless of which one dominates , the two predators do not engage in any overtly aggressive behavior against each other .

#### == Life history ==

Like other members of its family , the silky shark is viviparous : once the developing embryo exhausts its supply of yolk , the depleted yolk sac is converted into a placental connection through which the mother delivers nourishment . Relative to other viviparous sharks , the placenta of the silky shark is less similar to the analogous mammalian structure in that no interdigitation exists between the tissues of the fetus and mother . Furthermore , the fetal red blood cells are much smaller than maternal blood cells , which is opposite the pattern seen in mammals . Adult females have a single functional ovary ( on the right side ) and two functional uteri , which are divided lengthwise into separate compartments for each embryo .

Silky sharks in most parts of the world are thought to reproduce year @-@ round , whereas mating and birthing in the Gulf of Mexico take place in late spring or early summer ( May to August ) .

However , in some cases , the presence of reproductive seasonality may have been obscured by biases in data collection . Females give birth after a gestation period of 12 months , either every year or every other year . The litter size ranges from one to 16 and increases with female size , with six to 12 being typical . The pups are born in reef nursery areas on the outer continental shelf , where ample food supplies and protection from large pelagic sharks occur . The risk of predation has selected for fast growth in young sharks , which add 25 ? 30 cm ( 9 @. @ 8 ? 11 @. @ 8 in ) to their length within their first year of life . After a few months ( or by the first winter in the Gulf of Mexico ) , the now @-@ subadult sharks migrate out from the nursery into the open ocean .

The life history characteristics of the silky shark differ across its range ( see table ) . Northwestern Atlantic sharks tend to be larger than those in the western @-@ central Pacific at all ages , while eastern Pacific sharks tend to be smaller than sharks in other regions . Eastern Atlantic and Indian Ocean sharks seem to match or exceed the size of northwestern Atlantic sharks , but the figures are based on relatively few individuals and more data are needed .

The overall growth rate of the silky shark is moderate compared to other shark species and similar for both sexes , though it varies significantly between individuals . One central Pacific study has found females growing much slower than males , but the results may have been skewed by missing data from large females . The highest reported growth rates are from sharks in the northern Gulf of Mexico , and the lowest from sharks off northeastern Taiwan . Males and females reach sexual maturity at ages of 6 ? 10 years and 7 ? 12 + years , respectively . Sharks from more temperate waters may grow slower and mature later than those in warmer regions . The maximum lifespan is at least 22 years .

#### = = Human interactions = =

Given its formidable size and dentition , the silky shark is regarded as potentially dangerous to humans . However , it only rarely comes into contact with people due to its oceanic habits . Its natural curiosity and boldness may lead it to repeatedly and closely approach divers , and it can become dangerously excited in the presence of food . The silky shark tends to be more aggressive if encountered on a reef than in open water . Cases of individual sharks persistently harassing divers and even forcing them out of the water have been reported . As of May 2009 , the International Shark Attack File lists six attacks attributable to the silky shark , three of them unprovoked and none fatal .

Large numbers of silky sharks are caught by commercial and artisanal multispecies shark fisheries operating off Mexico , Guatemala , El Salvador , Costa Rica , the United States , Ecuador , Spain , Portugal , Sri Lanka , the Maldives , Yemen , and Côte d 'Ivoire . Even greater numbers are caught incidentally by tuna longline and purse seine fisheries throughout its range , particularly those using fish aggregating devices . It is the most common shark caught as bycatch in the eastern Pacific and Gulf of Mexico tuna fisheries , and the second @-@ most common shark caught as bycatch ( next to the blue shark ) overall . The fins are valued as an ingredient in shark fin soup , with captured sharks often finned at sea and the rest of the body discarded . Fins from an estimated one @-@ half to one and a half million silky sharks are traded globally per year ; it is the second- or third @-@ most common species auctioned on the Hong Kong fin market , which represents over half the global trade . The meat ( sold fresh or dried and salted ) , skin , and liver oil may also be used , as well as the jaws : this species is the predominant source of dried shark jaw curios sold to tourists in the tropics . Some sport fishers catch silky sharks .

#### = = Conservation = =

As one of the most abundant and widely distributed sharks on Earth , the silky shark was once thought to be mostly immune to depletion despite heavy fishing mortality . In 1989 alone , some 900 @, @ 000 individuals were taken as bycatch in the southern and central Pacific tuna longline fishery , seemingly without effect on the total population . Fishery data on this shark are often confounded by under @-@ reporting , lack of species @-@ level separation , and problematic identification .

Nevertheless , mounting evidence indicates the silky shark has , in fact , declined substantially worldwide , a consequence of its modest reproductive rate which is unable to sustain such high levels of exploitation . The total annual catch reported to the Food and Agricultural Organization fell steadily from 11 @, @ 680 tons in 2000 to 4 @, @ 358 tons in 2004 . Regional assessments have found similar trends , estimating declines of some 90 % in the central Pacific from the 1950s to the 1990s , 60 % off Costa Rica from 1991 to 2000 , 91 % in the Gulf of Mexico from the 1950s to the 1990s , and 85 % ( for all large requiem sharks ) in the northwestern Atlantic from 1986 to 2005 . The silky shark fishery off Sri Lanka reported a drop from a peak catch of 25 @, @ 400 tons in 1994 to only 1 @, @ 960 tons in 2006 , indicative of a local stock collapse . However , Japanese fisheries in the Pacific and Indian Oceans have recorded no change in catch rate between the 1970s and the 1990s , and the validity of the methodologies used to assess declines in the Gulf of Mexico and the northwestern Atlantic have come under much debate .

In light of recent findings , in 2007 , the IUCN reassessed the silky shark from Least Concern to Near Threatened worldwide . Regionally , it is listed as Near Threatened in the southwestern Atlantic , Indian Ocean , and western central Pacific , and as Vulnerable in the eastern central and southeastern Pacific and the northwestern and western central Atlantic . The silky shark is listed on Annex I , Highly Migratory Species , of the United Nations Convention on the Law of the Sea , though this has yet to result in any management schemes . The species should benefit from bans on shark finning , which are being increasingly implemented by nations and supranational entities , including the United States , Australia , and the European Union . Organizations such as the International Commission for the Conservation of Atlantic Tunas and the Inter @-@ American Tropical Tuna Commission have also taken steps to improve fishery monitoring , with the ultimate goal of reducing shark bycatch . However , given the highly migratory nature of the silky shark and its association with tuna , no simple way is known to reduce bycatch without also affecting the economics of the fishery .