

= Dusky shark =

The dusky shark (*Carcharhinus obscurus*) is a species of requiem shark , in the family Carcharhinidae , occurring in tropical and warm @-@ temperate continental seas worldwide . A generalist apex predator , the dusky shark can be found from the coast to the outer continental shelf and adjacent pelagic waters , and has been recorded from a depth of 400 m (1 @,@ 300 ft) . Populations migrate seasonally towards the poles in the summer and towards the equator in the winter , traveling hundreds to thousands of kilometers . One of the largest members of its genus , the dusky shark reaches 4 @.@ 2 m (14 ft) in length and 347 kg (765 lb) in weight . It has a slender , streamlined body and can be identified by its short round snout , long sickle @-@ shaped pectoral fins , ridge between the first and second dorsal fins , and faintly marked fins .

Adult dusky sharks have a broad and varied diet , consisting mostly of bony fishes , sharks and rays , and cephalopods , but also occasionally crustaceans , sea stars , bryozoans , sea turtles , marine mammals , carrion , and garbage . This species is viviparous with a three @-@ year reproductive cycle ; females bear litters of 3 ? 14 young after a gestation period of 22 ? 24 months , after which there is a year of rest before they become pregnant again . Females are capable of storing sperm for long periods , as their encounters with suitable mates may be few and far between due to their nomadic lifestyle and low overall abundance . Dusky sharks are one of the slowest @-@ growing and latest @-@ maturing sharks , not reaching adulthood until around 20 years of age .

Because of its slow reproductive rate , the dusky shark is very vulnerable to human @-@ caused population depletion . This species is highly valued by commercial fisheries for its fins , used in shark fin soup , and for its meat , skin , and liver oil . It is also esteemed by recreational fishers . The International Union for Conservation of Nature (IUCN) has assessed this species as Near Threatened worldwide and Vulnerable off the eastern United States , where populations have dropped to 15 ? 20 % of 1970s levels . The dusky shark is regarded as potentially dangerous to humans due to its large size , but there are few attacks attributable to it .

= = Taxonomy = =

French naturalist Charles Alexandre Lesueur published the first scientific description of the dusky shark in an 1818 issue of Journal of the Academy of Natural Sciences of Philadelphia . He placed it in the genus *Squalus* and gave it the specific epithet *obscurus* (Latin for " dark " or " dim ") , referring to its coloration . Subsequent authors have recognized this species as belonging to the genus *Carcharhinus* . Lesueur did not designate a type specimen , though he was presumably working from a shark caught in North American waters .

Many early sources gave the scientific name of the dusky shark as *Carcharias* (later *Carcharhinus*) *lamiella* , which originated from an 1882 account by David Starr Jordan and Charles Henry Gilbert . Although Jordan and Gilbert referred to a set of jaws that came from a dusky shark , the type specimen they designated was later discovered to be a copper shark (*C. brachyurus*) . Therefore , *C. lamiella* is not considered a synonym of *C. obscurus* but rather of *C. brachyurus* . Other common names for this species include bay shark , black whaler , brown common gray shark , brown dusky shark , brown shark , common whaler , dusky ground shark , dusky whaler , river whaler , shovelnose , and slender whaler shark .

= = Phylogeny and evolution = =

Teeth belonging to the dusky shark are fairly well represented in the fossil record , though assigning *Carcharhinus* teeth to species can be problematic . Dusky shark teeth dating to the Miocene (23 @-@ 5 @.@ 3 Ma) have been recovered from the Kendeace and Grand Bay formations in Carriacou , the Grenadines , the Moghra Formation in Egypt , Polk County , Florida , and possibly Cerro La Cruz in northern Venezuela . Teeth dating to the Late Miocene or Early Pliocene (11 @.@ 6 @-@ 3 @.@ 6 Ma) are abundant in the Yorktown Formation and the Pungo River , North Carolina , and from the Chesapeake Bay region ; these teeth differ slightly from the modern dusky

shark , and have often been misidentified as belonging to the oceanic whitetip shark (*C. longimanus*) . Dusky shark teeth have also been recovered from the vicinity of two baleen whales in North Carolina , one preserved in Goose Creek Limestone dating to the Late Pliocene (c . 3 @. @ 5 Ma) , and the other in mud dating to the Pleistocene @-@ Holocene (c . 12 @, @ 000 years ago) .

In 1982 , Jack Garrick published a phylogenetic analysis of *Carcharhinus* based on morphology , in which he placed the dusky shark and the Galapagos shark (*C. galapagensis*) at the center of the " obscurus group " . The group consisted of large , triangular @-@ toothed sharks with a ridge between the dorsal fins , and also included the bignose shark (*C. altimus*) , the Caribbean reef shark (*C. perezi*) , the sandbar shark (*C. plumbeus*) , and the oceanic whitetip shark . This interpretation was largely upheld by Leonard Compagno in his 1988 phenetic study , and by Gavin Naylor in his 1992 allozyme sequence study . Naylor was able to further resolve the interrelationships of the " ridge @-@ backed " branch of *Carcharhinus* , finding that the dusky shark , Galapagos shark , oceanic whitetip shark , and blue shark (*Prionace glauca*) comprise its most derived clade .

= = Distribution and habitat = =

The range of the dusky shark extends worldwide , albeit discontinuously , in tropical and warm @-@ temperate waters . In the western Atlantic Ocean , it is found from Massachusetts and the Georges Bank to southern Brazil , including the Bahamas and Cuba . In the eastern Atlantic Ocean , it has been reported from the western and central Mediterranean Sea , the Canary Islands , Cape Verde , Senegal , Sierra Leone , and possibly elsewhere including Portugal , Spain , Morocco , and Madeira . In the Indian Ocean , it is found off South Africa , Mozambique , and Madagascar , with sporadic records in the Arabian Sea , the Bay of Bengal , and perhaps the Red Sea . In the Pacific Ocean , it occurs off Japan , mainland China and Taiwan , Vietnam , Australia , and New Caledonia in the west , and from southern California to the Gulf of California , around Revillagigedo , and possibly off northern Chile in the east . Records of dusky sharks from the northeastern and eastern central Atlantic , and around tropical islands , may in fact be of Galapagos sharks . Mitochondrial DNA and microsatellite evidence suggest that Indonesian and Australian sharks represent distinct populations .

Residing off continental coastlines from the surf zone to the outer continental shelf and adjacent oceanic waters , the dusky shark occupies an intermediate habitat that overlaps with its more specialized relatives , such as the inshore sandbar shark , the pelagic silky shark (*C. falciformis*) and oceanic whitetip shark , the deepwater bignose shark , and the islandic Galapagos shark and silvertip shark (*C. albimarginatus*) . One tracking study in the northern Gulf of Mexico found that it spends most of its time at depths of 10 ? 80 m (33 ? 262 ft) , while making occasional forays below 200 m (660 ft) ; this species has been known to dive as deep as 400 m (1 @, @ 300 ft) . It prefers water temperatures of 19 ? 28 ° C (66 ? 82 ° F) , and avoids areas of low salinity such as estuaries .

The dusky shark is nomadic and strongly migratory , undertaking recorded movements of up to 3 @, @ 800 km (2 @, @ 400 mi) ; adults generally move longer distances than juveniles . Sharks along both coasts of North America shift northward with warmer summer temperatures , and retreat back towards the equator in winter . Off South Africa , young males and females over 0 @. @ 9 m (3 @. @ 0 ft) long disperse southward and northward respectively (with some overlap) from the nursery area off KwaZulu @-@ Natal ; they join the adults several years later by a yet @-@ unidentified route . In addition , juveniles spend spring and summer in the surf zone and fall and winter in offshore waters , and as they approach 2 @. @ 2 m (7 @. @ 2 ft) in length begin to conduct a north @-@ south migration between KwaZulu @-@ Natal in the winter and the Western Cape in summer . Still @-@ larger sharks , over 2 @. @ 8 m (9 @. @ 2 ft) long , migrate as far as southern Mozambique . Off Western Australia , adult and juvenile dusky sharks migrate towards the coast in summer and fall , though not to the inshore nurseries occupied by newborns .

= = Description = =

One of the largest members of its genus , the dusky shark commonly reaches a length of 3 @. @ 2 m (10 ft) and a weight of 160 ? 180 kg (350 ? 400 lb) ; the maximum recorded length and weight are 4 @. @ 2 m (14 ft) and 347 kg (765 lb) respectively . Females grow larger than males . This shark has a slender , streamlined body with a broadly rounded snout no longer than the width of the mouth . The nostrils are preceded by barely developed flaps of skin . The medium @- @ sized , circular eyes are equipped with nictitating membranes (protective third eyelids) . The mouth has very short , subtle furrows at the corners and contains 13 @- @ 15 (typically 14) tooth rows on either side of both jaws . The upper teeth are distinctively broad , triangular , and slightly oblique with strong , coarse serrations , while the lower teeth are narrower and upright , with finer serrations . The five pairs of gill slits are fairly long .

The large pectoral fins measure around one @- @ fifth as long as the body , and have a falcate (sickle @- @ like) shape tapering to a point . The first dorsal fin is of moderate size and somewhat falcate , with a pointed apex and a strongly concave rear margin ; its origin lies over the pectoral fin free rear tips . The second dorsal fin is much smaller and is positioned about opposite the anal fin . A low dorsal ridge is present between the dorsal fins . The caudal fin is large and high , with a well @- @ developed lower lobe and a ventral notch near the tip of the upper lobe . The dermal denticles are diamond @- @ shaped and closely set , each bearing five horizontal ridges leading to teeth on the posterior margin . This species is bronzy to bluish gray above and white below , which extends onto the flanks as a faint lighter stripe . The fins , particularly the underside of the pectoral fins and the lower caudal fin lobe) darken towards the tips ; this is more obvious in juveniles .

= = Biology and ecology = =

As an apex predator positioned at the highest level of the trophic web , the dusky shark is generally less abundant than other sharks that share its range . However , high concentrations of individuals , especially juveniles , can be found at particular locations . Adults are often found following ships far from land , such as in the Agulhas Current . A tracking study off the mouth of the Cape Fear River in North Carolina reported an average swimming speed of 0 @. @ 8 km / h (0 @. @ 50 mph) . The dusky shark is one of the hosts of the sharksucker (*Echeneis naucrates*) . Known parasites of this species include the tapeworms *Anthobothrium laciniatum* , *Dasyrhynchus pacificus* , *Platybothrium kirstenae* , *Floriceps saccatus* , *Tentacularia coryphaenae* , and *Triloculatum trilocolatum* , the monogeneans *Dermophthirius carcharhini* and *Loimos salpinggoides* , the leech *Stibarobdella macrothela* , the copepods *Alebion* sp . , *Pandarus cranchii* , *P. sinuatus* , and *P. smithii* , the pranzia larvae of gnathiid isopods , and the sea lamprey (*Petromyzon marinus*) .

Full @- @ grown dusky sharks have no significant natural predators . Major predators of young sharks include the ragged tooth shark (*Carcharias taurus*) , the great white shark (*Carcharodon carcharias*) , the bull shark (*C. leucas*) , and the tiger shark (*Galeocerdo cuvier*) . Off KwaZulu @- @ Natal , the use of shark nets to protect beaches has reduced the populations of these large predators , leading to a dramatic increase in the number of juvenile dusky sharks (a phenomenon called " predator release ") . In turn , the juvenile sharks have decimated populations of small bony fishes , with negative consequences for the biodiversity of the local ecosystem .

= = = Feeding = = =

The dusky shark is a generalist that takes a wide variety of prey from all levels of the water column , though it favors hunting near the bottom . A large individual can consume over a tenth of its body weight at a single sitting . The bite force exerted by a 2 m (6 @. @ 6 ft) long dusky shark has been measured at 60 kg (130 lb) over the 2 mm² (0 @. @ 0031 in²) area at the tip of a tooth . This is the highest figure thus far measured from any shark , though it also reflects the concentration of force at the tooth tip . Dense aggregations of young sharks , forming in response to feeding opportunities , have been documented in the Indian Ocean .

The known diet of the dusky shark encompasses pelagic fishes , including herring and anchovies ,

tuna and mackerel , billfish , jacks , needlefish and flyingfish , threadfins , hairtails , lancetfish , and lanternfish ; demersal fishes , including mullets , porgies , grunts , and flatheads , eels , lizardfish , cusk eels , gurnards , and flatfish ; reef fishes , including barracudas , goatfish , spadefish , groupers , scorpionfish , and porcupinefish ; cartilaginous fishes , including dogfish , sawsharks , angel sharks , catsharks , thresher sharks , smoothhounds , smaller requiem sharks , sawfish , guitarfish , skates , stingrays , and butterfly rays ; and invertebrates , including cephalopods , decapod crustaceans , barnacles , and sea stars . Very rarely , the largest dusky sharks may also consume sea turtles , marine mammals (mainly as carrion) , and human refuse .

In the northwestern Atlantic , around 60 % of the dusky shark 's diet consists of bony fishes , from over ten families with bluefish (*Pomatomus saltatrix*) and summer flounder (*Paralichthys dentatus*) being especially important . Cartilaginous fishes , mainly skates and their egg cases , are the second @-@ most important dietary component , while the lady crab (*Ovalipes ocellatus*) is also a relatively significant food source . In South African and Australian waters , bony fishes are again the most important prey type . Newborn and juvenile sharks subsist mainly on small pelagic prey such as sardines and squid ; older sharks over 2 m (6 @. 6 ft) long broaden their diets to include larger bony and cartilaginous fishes . The run of the southern African pilchard (*Sardinops sagax*) , occurring off the eastern coast of South Africa every winter , is attended by medium and large @-@ sized dusky sharks . Pregnant and post @-@ partum females do not join , possibly because the energy cost of gestation leaves them unable to pursue such swift prey . One South African study reported that 0 @. 2 % of the sharks examined had preyed upon bottlenose dolphins (*Tursiops truncatus*) .

== = Life history == =

Like other requiem sharks , the dusky shark is viviparous : the developing embryos are initially nourished by a yolk sac , which is converted into a placental connection to the mother once the yolk supply is exhausted . Mating occurs during spring in the northwestern Atlantic , while there appears to be no reproductive seasonality in other regions such as off South Africa . Females are capable of storing masses of sperm , possibly from multiple males , for months to years within their nidamental glands (an organ that secretes egg cases) . This would be advantageous given the sharks ' itinerant natures and low natural abundance , which would make encounters with suitable mates infrequent and unpredictable .

With a gestation period estimated at up to 22 ? 24 months and a one @-@ year resting period between pregnancies , female dusky sharks bear at most one litter of young every three years . The litter size ranges from 3 to 16 , with 6 to 12 being typical , and does not correlate with female size . Sharks in the western Atlantic tend to produce slightly smaller litters than those from the southeastern Atlantic (averaging 8 versus 10 pups per litter) . Depending on region , birthing may occur throughout the year or over a span of several months : newborn sharks have been reported from late winter to summer in the northwestern Atlantic , in summer and fall off Western Australia , and throughout the year with a peak in fall off southern Africa . Females move into shallow inshore habitats such as lagoons to give birth , as such areas offer their pups rich food supplies and shelter from predation (including from their own species) , and leave immediately afterward . These nursery areas are known along the coasts of KwaZulu @-@ Natal , southwestern Australia , western Baja California , and the eastern United States from New Jersey to North Carolina .

Newborn dusky sharks measure 0 @. 7 ? 1 @. 0 m (2 @. 3 ? 3 @. 3 ft) long ; pup size increases with female size , and decreases with litter size . There is evidence that females can determine the size at which their pups are born , so as to improve their chances of survival across better or worse environmental conditions . Females also provision their young with energy reserves , stored in a liver that comprises one @-@ fifth of the pup 's weight , which sustains the newborn until it learns to hunt for itself . The dusky shark is one of the slowest @-@ growing shark species , reaching sexual maturity only at a substantial size and age (see table) . Various studies have found growth rates to be largely similar across geographical regions and between sexes . The annual growth rate is 8 ? 11 cm (3 @. 1 ? 4 @. 3 in) over the first five years of life . The maximum

lifespan is believed to be 40 ? 50 years or more .

= = Human interactions = =

The dusky shark is considered to be potentially dangerous to humans because of its large size , though little is known of how it behaves towards people underwater . As of 2009 , the International Shark Attack File lists it as responsible for six attacks on people and boats , three of them unprovoked and one fatal . However , attacks attributed to this species off Bermuda and other islands were probably in reality caused by Galapagos sharks . Shark nets used to protect beaches in South Africa and Australia entangle adult and larger juvenile dusky sharks in some numbers . From 1978 to 1999 , an average of 256 individuals were caught annually in nets off KwaZulu @-@ Natal ; species @-@ specific data is not available for nets off Australia . Young dusky sharks adapt well to display in public aquariums .

The dusky shark is one of the most sought @-@ after species for shark fin trade , as its fins are large and contain a high number of internal rays (ceratotrichia) . In addition , the meat is sold fresh , frozen , dried and salted , or smoked , the skin is made into leather , and the liver oil is processed for vitamins . Dusky sharks are taken by targeted commercial fisheries operating off eastern North America , southwestern Australia , and eastern South Africa using multi @-@ species longlines and gillnets . The southwestern Australian fishery began in the 1940s and expanded in the 1970s to yield 500 ? 600 tons per year . The fishery utilizes selective demersal gillnets that take almost exclusively young sharks under three years old , with 18 ? 28 % of all newborns captured in their first year . Demographic models suggest that the fishery is sustainable , provided that the mortality rate of sharks over 2 m (6 @.@ 6 ft) long is under 4 % .

In addition to commercial shark fisheries , dusky sharks are also caught as bycatch on longlines meant for tuna and swordfish (and usually kept for its valuable fins) , and by recreational fishers . Large numbers of dusky sharks , mostly juveniles , are caught by sport fishers off South Africa and eastern Australia . This shark was once one of the most important species in the Florida trophy shark tournaments , before the population collapsed .

= = = Conservation = = =

The International Union for Conservation of Nature (IUCN) has assessed this species as Near Threatened worldwide and Vulnerable in the northwestern Atlantic and the Gulf of Mexico . The American Fisheries Society has also assessed North American dusky shark populations as Vulnerable . Its very low reproductive rate renders the dusky shark extremely susceptible to overfishing .

Stocks off the eastern United States are severely overfished ; a 2006 stock assessment survey by the U.S. National Marine Fisheries Service (NMFS) showed that its population had dropped to 15 ? 20 % of 1970s levels . In 1997 , the dusky shark was identified as a Species of Concern by the NMFS , meaning that it warranted conservation concern but there was insufficient information for listing on the U.S. Endangered Species Act (ESA) . Commercial and recreational retention of dusky sharks was prohibited in 1998 , but this has been of limited effectiveness due to high bycatch mortality on multi @-@ species gear . In addition , some 2 @,@ 000 dusky sharks were caught by recreational fishers in 2003 despite the ban . In 2005 , North Carolina implemented a time / area closure to reduce the impact of recreational fishing . To aid conservation efforts , molecular techniques using polymerase chain reaction (PCR) have been developed that can identify whether marketed shark parts (e.g. fins) are from prohibited species like the dusky shark , versus similar allowed species such as the sandbar shark .