

= Portuguese dogfish =

The Portuguese dogfish or Portuguese shark (*Centroscyrnus coelolepis*) is a species of sleeper shark of the family Somniosidae . This globally distributed species has been reported down to a depth of 3 @, @ 675 m (12 @, @ 057 ft) , making it the deepest @-@ living shark known . It inhabits lower continental slopes and abyssal plains , usually staying near the bottom . Stocky and dark brown in color , the Portuguese dogfish can be distinguished from similar @-@ looking species (such as the kitefin shark , *Dalatias licha*) by the small spines in front of its dorsal fins . Its dermal denticles are also unusual , resembling the scales of a bony fish . This species typically reaches 0 @. @ 9 ? 1 m (3 @. @ 0 ? 3 @. @ 3 ft) in length ; sharks in the Mediterranean Sea are much smaller and have distinct depth and food preferences .

Relatively common , the Portuguese dogfish is an active hunter capable of tackling fast , large prey . It feeds mainly on cephalopods and fishes , though it also consumes invertebrates and cetacean carrion . This shark has acute vision optimized for detecting the bioluminescence of its prey , as sunlight does not reach the depths at which it lives . The Portuguese dogfish is aplacental viviparous , with the young provisioned by yolk and perhaps uterine fluid . The females give birth to up to 29 young after a gestation period of over one year . Valued for its liver oil and to a lesser extent meat , Portuguese dogfish are important to deepwater commercial fisheries operating off Portugal , the British Isles , Japan , and Australia . These fishing pressures and the low reproductive rate of this species have led the International Union for Conservation of Nature (IUCN) to assess it as Near Threatened .

= = Taxonomy = =

The first scientific description of the Portuguese dogfish was published by Portuguese zoologists José Vicente Barbosa du Bocage and Félix António de Brito Capello , in an 1864 issue of Proceedings of the General Meetings for Scientific Business of the Zoological Society of London . They created the new genus *Centroscyrnus* for this shark , and gave it the specific epithet *coelolepis* , derived from the Greek *koilos* (" hollow ") and *lepidos* (" fish scale ") and referring to the structure of the dermal denticles . The type specimen , caught off Portugal , has since been destroyed in a fire .

= = Distribution and habitat = =

One of the widest @-@ ranging deepwater sharks , the Portuguese dogfish is patchily distributed around the world . In the western Atlantic , it occurs from the Grand Banks of Newfoundland to the U.S. state of Delaware . In the eastern Atlantic , it is found from Iceland to Sierra Leone , including the western Mediterranean Sea , the Azores and Madeira , as well as from southern Namibia to western South Africa . In the Indian Ocean , this species has been caught off the Seychelles . In the Pacific , this shark occurs off Japan , New Zealand , and Australia from Cape Hawke , New South Wales , to Beachport , South Australia , including Tasmania .

The deepest @-@ living shark known , the Portuguese dogfish has been reported at depths of 150 m (490 ft) to 3 @, @ 675 m (12 @, @ 057 ft) from the lower continental slope to the abyssal plain , and is most common between 400 m (1 @, @ 300 ft) and 2 @, @ 000 m (6 @, @ 600 ft) . This species is found deeper in the Mediterranean , seldom occurring above a depth of 1 @, @ 500 m (4 @, @ 900 ft) and being most common at 2 @, @ 500 ? 3 @, @ 000 m (8 @, @ 200 ? 9 @, @ 800 ft) . The deep Mediterranean has a relatively constant temperature of 13 ° C (55 ° F) and a salinity of 38 @. @ 4 ppt , whereas in the deep ocean the temperature is generally only 5 ° C (41 ° F) and the salinity 34 ? 35 ppt . The Portuguese dogfish is essentially benthic in nature , though young sharks can be found a considerable distance off the bottom . There is depth segregation by size and sex ; pregnant females are found in shallower water , above 1 @, @ 200 ? 1 @, @ 500 m (3 @, @ 900 ? 4 @, @ 900 ft) , while juveniles are found deeper . There may be several separate populations in the Atlantic , and sharks in the Mediterranean and off Japan appear to be distinct as well .

== Description ==

The Portuguese dogfish typically reaches a length of 0.9 m (3 @.0 ft) for males and 1.0 m (3 @.0 ft) for females , though specimens up to 1.2 m (3 @.9 ft) long have been recorded . Sharks in the Mediterranean are smaller , growing no more than 65 cm (26 in) long . This species has a flattened , broadly rounded snout that is shorter than the mouth is wide . The nostrils are preceded by short flaps of skin . The eyes are large and oval in shape , positioned laterally on the head and equipped with a reflective tapetum lucidum that produces a yellow @-@ green " eye shine " . The mouth is wide and slightly arched , with moderately thick , smooth lips and short furrows at the corners extending onto both jaws . The upper teeth are slender and upright with a single cusp , numbering 43 ? 68 rows . The lower teeth have a short , strongly angled cusp and number 29 ? 41 rows ; their bases interlock to form a continuous cutting surface . The five pairs of gill slits are short and nearly vertical .

The body of the Portuguese dogfish is thick and cylindrical except for the flattened belly . The two dorsal fins are small and of similar size and shape , each bearing a tiny grooved spine in front . The first dorsal fin originates well behind the pectoral fins , while the second dorsal originates over the middle of the pelvic fin bases . The pectoral fins are medium @-@ sized with a rounded margin . There is no anal fin . The caudal fin has a short but well @-@ developed lower lobe and a prominent ventral notch near the tip of the upper lobe . The very large dermal denticles change in shape with age : in juveniles , they are widely spaced and heart @-@ shaped with an incomplete midline ridge and three posterior points , while in adults they are overlapping , roughly circular , smooth , and flattened with a round central concavity , superficially resembling the scales of bony fishes . Young sharks are a uniform blue @-@ black in color , while adults are brown @-@ black ; there are no prominent fin markings . In 1997 , a partially albino individual , with a pale body but normal eyes , was caught in the northeastern Atlantic . This represented the first documented case of albinism in a deep @-@ sea shark .

== Biology and ecology ==

Living almost exclusively in the aphotic zone where little to no sunlight penetrates , the Portuguese dogfish is relatively common and the dominant shark species in deeper waters . The large , squalene @-@ rich liver of this shark allows it to maintain neutral buoyancy and hover with minimal effort ; males contain more squalene in their livers than females . A tracking study in the Porcupine Seabight has found that the Portuguese dogfish has an average swimming speed of 0.072 m / s (0 @.24 ft / s) , and does not remain in any particular area for long . This species may be preyed upon by larger fishes and sharks . Known parasites of this species include monogeneans in the genus *Erpocotyle* , and the tapeworms *Sphyricephalus viridis* , *S. richardi* , and *Anthobothrium* sp .

An active predator of mobile , relatively large organisms , the Portuguese dogfish feeds mainly on cephalopods (including *Mastigoteuthis* spp .) and bony fishes (including slickheads , orange roughy , lantern fishes , and rattails) . It has also been known to take other sharks and invertebrates (such as the medusa *Atolla wyvillei*) , as well as scavenging from whale carcasses . The Portuguese dogfish has more acute vision than many other deepsea sharks : in addition to having a large pupil and lens , and a tapetum lucidum , its eyes also contain a high concentration of ganglion cells mostly concentrated in a horizontal streak that is densest at the center ; these cells impart highly sensitive motion detection along the horizontal plane . The visual system of this species appears adapted for detecting bioluminescence : the maximum absorption of its visual pigments correspond to the wavelengths of light emitted by favored prey , such as the squids *Heteroteuthis dispar* , *Histioteuthis* spp . , *Lycoteuthis lorigera* , and *Taningia danae* .

In the Mediterranean sea , the Portuguese dogfish is one of the most common deepwater sharks along with the blackmouth catshark (*Galeus melastomus*) and the velvet belly lantern shark (*Etmopterus spinax*) , and the only shark abundant below a depth of 1 @, 500 m (4 @, 900 ft)

. By inhabiting deeper water , Portuguese dogfish in the Mediterranean may reduce competition with the other two species . The smaller size of Mediterranean sharks relative to those from the rest of the world may be due to limited food availability and / or the warmer , saltier environment . Some 87 % of the diet of Portuguese dogfish in the Mediterranean consists of cephalopods . Bony fishes are a secondary food source , while immature sharks favor the shrimp *Acantheephyra eximia* , the most common decapod crustacean in their environment . Unlike in other regions , Mediterranean sharks seldom scavenge .

= = = Life history = = =

The Portuguese dogfish is aplacental viviparous , with the female retaining eggs internally until they hatch . The embryos are sustained by yolk , and possibly also by uterine fluid secreted by the mother . Figueiredo et al . (2008) reported that there are two breeding seasons per year off Portugal , from January to May and from August to December , with only a fraction of the population reproductively active at a time . However , previous accounts have described continuous reproduction with females in various stages of pregnancy present year @-@ round . The ovarian follicles take some time to mature ; they are ovulated into the uterus at a diameter of 5 ? 6 cm (2 @.@ 0 ? 2 @.@ 4 in) . Studies of females have found no traces of sperm inside their reproductive tracts , which suggests that fertilization occurs immediately following copulation , which may also trigger ovulation . The reproductive cycles of Portuguese dogfish in the Atlantic and Pacific are generally similar ; sharks off Japan tend to produce larger numbers of smaller oocytes than elsewhere , while sharks off the British Isles exhibit a larger litter size and birth size (but smaller oocytes) than those off Portugal . There is a record of a hermaphroditic specimen with an ovary on its right side and a testis on its left .

Early in development , the embryos are sexually undifferentiated , unpigmented , and possess filamentous external gills ; the external yolk sac in this stage weighs 120 ? 130 g (4 @.@ 2 ? 4 @.@ 6 oz) . Recognizable sex organs develop by an embryonic length of 92 mm (3 @.@ 6 in) , and tissue differentiation is complete by a length of 150 mm (5 @.@ 9 in) . Body pigmentation appears when the embryo is 100 ? 150 mm (3 @.@ 9 ? 5 @.@ 9 in) long ; the external gills regress at around the same time . An internal yolk sac develops when the embryo is 140 mm (5 @.@ 5 in) long , which begins to take in yolk as the external yolk sac shrinks ; by the time the embryo is 233 ? 300 mm (9 @.@ 2 ? 11 @.@ 8 in) long the external yolk sac has been completely resorbed . Off Portugal , the young seem to be born in May and December following a gestation period of over a year . As they near giving birth , the females undergo ovarian atresia (regression of the follicles) , suggesting that they enter a resting period afterwards . The litter size ranges from 1 to 29 (typically 12) , and is not correlated with female size . Parturition may occur in a yet @-@ unknown nursery area , as newborns are rarely ever caught . The length at birth has been reported as 23 ? 30 cm (9 @.@ 1 ? 11 @.@ 8 in) in the Atlantic , and 30 ? 35 cm (12 ? 14 in) in the Pacific .

Aside from the distinctive Mediterranean population , Portuguese dogfish attain sexual maturity at similar sizes around the world : males and females mature at 90 ? 101 cm (35 ? 40 in) and 85 ? 115 cm (33 ? 45 in) respectively off the Iberian Peninsula , 86 cm (34 in) and 102 cm (40 in) respectively west of the British Isles , 70 cm (28 in) and 95 ? 100 cm (37 ? 39 in) respectively in Suruga Bay , Japan , and 82 ? 90 cm (32 ? 35 in) and 99 ? 110 cm (39 ? 43 in) respectively off southeastern Australia . In the Mediterranean , males mature at around 53 cm (21 in) long .

= = Human interactions = =

The Portuguese dogfish is too small and occurs too deep to pose a danger to humans . This species has long been commercially fished , using hook @-@ and @-@ line , gillnets , and trawls . It is mainly valued for its liver , which contains 22 ? 49 % squalene by weight and is processed for vitamins . The meat may also be sold fresh or dried and salted for human consumption , or converted into fishmeal . An important fishery for the Portuguese dogfish exists in Suruga Bay for

liver oil ; catches peaked during World War II , but declined soon after from over @-@ exploitation . In the past few years , catches by the South East Trawl Fishery off Australia have been increasing , as fishers have been seeking out species not covered by commercial quotas following the relaxation of seafood mercury regulations . Shark landings in this fishery are affected by a prohibition on landing livers without the rest of the carcass .

Until recently , Portugal was the only European country to utilize the Portuguese dogfish . An important bycatch of the black scabbardfish (*Aphanops carbo*) longline fishery , between 300 and 900 tons of this shark were landed annually from 1986 to 1999 . Its per @-@ weight value has been increasing since 1986 , and thus exploitation is likely to continue . Around 1990 , French bottom trawlers began to fish for Portuguese dogfish and leafscale gulper sharks (*Centrophorus squamosus*) west of the British Isles for meat and livers ; these two species are together referred to as siki . The siki catch peaked at 3 @,@ 284 tons in 1996 before declining to 1 @,@ 939 tons in 1999 . The French have since been joined by Norwegian , Irish , and Scottish longliners and trawlers , making the Portuguese dogfish a significant component of deepwater fisheries in the northwest Atlantic . While stocks off Portugal seem to be stable for now , stocks off the British Isles have diminished substantially in recent years ; this may reflect the disparity between the less massified Portuguese fishery and the commercial French fishery . The International Union for Conservation of Nature (IUCN) has assessed this species as Near Threatened , because of its commercial value and low reproductive productivity .