= Bigeye sand tiger =

The bigeye sand tiger ( Odontaspis noronhai ) is an extremely rare species of mackerel shark in the family Odontaspididae , with a possible worldwide distribution . A large , bulky species reaching at least 3 @.@ 6 m ( 12 ft ) in length , the bigeye sand tiger has a long bulbous snout , large orange eyes without nictitating membranes , and a capacious mouth with the narrow teeth prominently exposed . It can be distinguished from the similar smalltooth sand tiger ( O. ferox ) by its teeth , which have only one lateral cusplet on each side , and by its uniformly dark brown color .

Inhabiting continental margins and oceanic waters at depths of 60 ? 1 @,@ 000 m ( 200 ? 3 @,@ 280 ft ) , the bigeye sand tiger may make vertical and horizontal migratory movements . It feeds on bony fishes and squid , and its sizable eyes and dark coloration suggest that it may spend most of its time in the mesopelagic zone . Reproduction is probably viviparous with oophagous embryos like in other mackerel shark species . This shark is caught incidentally by commercial fisheries , though so infrequently that the International Union for Conservation of Nature ( IUCN ) cannot yet determine its conservation status .

= = Taxonomy and phylogeny = =

The first known bigeye sand tiger was a female 1 @.@ 7 m ( 5 @.@ 6 ft ) long caught off Madeira in April 1941 , on a longline set for black scabbardfish ( Aphanopus carbo ) . The specimen was mounted and later formed the basis for a scientific description authored by German ichthyologist Günther Maul in a 1955 article for Notulae Naturae . He named the species noronhai in honor of Adolfo César de Noronha , the late Director of the Funchal Museum . Maul assigned his new species to the genus Carcharias , which at the time was used for all members of the sand tiger shark family . When the Odontaspis came to be recognized as a valid genus separate from Carcharias , the bigeye sand tiger was reassigned as well given its resemblance to the smalltooth sand tiger ( O. ferox ) . Until more specimens were examined in the 1980s , some authors speculated that this species represented an extreme variant of the smalltooth sand tiger . Other names for this shark include black sand tiger , oceanic sand tiger , and bigeye ragged @-@ tooth shark .

Whether the bigeye and smalltooth sand tigers belong in the same family as the superficially similar sand tiger shark ( C. taurus ) has been debated among systematists , with morphological and dentitional studies giving inconsistent results . A 2012 molecular phylogenetic analysis , based on mitochondrial DNA , supported a sister species relationship between O. noronhai and O. ferox but not a clade consisting of Odontaspis and Carcharias . Instead , Odontaspis was found to be closer to the crocodile shark ( Pseudocarcharias kamoharai ) , suggesting that it and Carcharias should be placed in separate families .

= = Description = =

With its heavyset body , conical bulbous snout , and large mouth filled with protruding teeth , the bigeye sand tiger looks much like the better @-@ known sand tiger shark . The large eyes lack nictitating membranes , and behind them are small spiracles . The corner of the mouth extends to behind the level of the eyes , and the jaws are highly protrusible . There are 34 ? 43 upper and 37 ? 46 lower tooth rows ; these include zero to two rows of small teeth at the upper symphysis ( jaw midpoint ) and two to four more rows at the lower symphysis . In each half of the upper jaw , the teeth in the first and second rows are large , those in the third and sometimes fourth rows are small , and those in the rows after are large again . Each tooth has a narrow , awl @-@ like central cusp flanked by one smaller cusplet on each side ; this contrasts with the smalltooth sand tiger , which has two or three lateral cusplets on each side . There are five pairs of gill slits .

The pectoral fins are medium @-@ sized and broad with rounded tips . The large first dorsal fin has a rounded apex and is positioned closer to the pectoral than the pelvic fins . The second dorsal fin is about half the size of the first and originates over the rear tips of the pelvic fins . The pelvic fins are

almost as large as the first dorsal fin . The anal fin is smaller than the second dorsal fin and positioned behind it . The caudal peduncle has a crescent @-@ shaped notch at the dorsal origin of the caudal fin . The lower lobe of the caudal fin is short but distinct , while the upper lobe is long and has a deep notch in the trailing margin near the tip . The skin is covered by overlapping dermal denticles , each with three horizontal ridges leading to marginal teeth . This species is plain dark reddish brown to chocolate brown , sometimes with black trailing margins on the fins or a white @-@ tipped first dorsal fin . The eyes are dark orange with vertically oval , green @-@ tinted pupils . There are several black patches inside the mouth , such as around the jaws , on the floor of the mouth , and on the gill arches . The largest male and female specimens measured 3 @.@ 6 and 3 @.@ 3 m ( 12 and 11 ft ) long respectively .

= = Distribution and habitat = =

Though extremely rare , the bigeye sand tiger has been reported from scattered locations around the world , suggesting a wide and possibly disjunct global distribution in tropical and warm @-@ temperate oceanic waters . Most known specimens have come from the Atlantic , where it has been found off Madeira , southern Brazil , Texas , eastern Florida , and the Mid @-@ Atlantic Ridge . The only evidence for its presence in the Indian Ocean is a set of jaws that may have originated from the Seychelles , though the South China Sea is another possibility . The existence of this species in the Pacific Ocean was first suspected in 1970 from teeth recovered from bottom sediments , which was confirmed over a decade later by captures from the Marshall Islands and Hawaii .

The bigeye sand tiger has been caught between the depths of 60 and 1 @,@ 000 m ( 200 and 3 @,@ 280 ft ) . Some were recorded over continental and insular shelves , both from near the sea floor and in mid @-@ water . Others were fished from parts of the open ocean that were 4 @.@ 5 ? 5 @.@ 3 km ( 2 @.@ 8 ? 3 @.@ 3 mi ) deep , where they were swimming in the upper levels of the water column . Nighttime captures from relatively shallow depths suggest that this species may make a diel vertical migration , rising from the mesopelagic zone to the epipelagic zone at night to feed . In Brazilian waters , bigeye sand tigers are only captured in spring , hinting at some type of seasonal migratory movement .

= = Biology and ecology = =

One account of a bigeye sand tiger that had been caught alive noted that it behaved very aggressively , thrashing and snapping violently in and out of the water . Its large eyes and uniformly dark coloration are characteristic traits of a mesopelagic fish . The bigeye sand tiger feeds on bony fishes and squid . Its reproduction is little @-@ known but probably similar to that of other mackerel sharks , which are viviparous with embryos that feed on unfertilized eggs during gestation ( oophagy ) . Adult females have a single functional ovary , on the right , and two functional uteruses . Males mature sexually at somewhere between 2 @.@ 2 and 3 @.@ 2 m ( 7 @.@ 2 and 10 @.@ 5 ft ) long , while females mature at around 3 @.@ 2 m ( 10 ft ) long . No information is available on growth or aging .

= = Human interactions = =

Because the bigeye sand tiger is encountered so infrequently , it has no commercial importance . It is caught incidentally on longlines and in gillnets and purse seines , though the paucity of captures suggest that it mostly lives in waters too deep for commercial fisheries . The International Union for Conservation of Nature ( IUCN ) has listed this species as Data Deficient , citing a lack of biological and population data . Since 1997 , the National Marine Fisheries Service ( NMFS ) has prohibited the taking of this species in United States waters .