

= Cookiecutter shark =

Cookiecutter shark (*Isistius brasiliensis*), also called the cigar shark , is a species of small dogfish shark in the family Dalatiidae . This shark occurs in warm , oceanic waters worldwide , particularly near islands , and has been recorded as deep as 3 @. @ 7 km (2 @. @ 3 mi) . It migrates vertically up to 3 km (1 @. @ 9 mi) every day , approaching the surface at dusk and descending with the dawn . Reaching only 42 ? 56 cm (16 @. @ 5 ? 22 in) in length , the cookiecutter shark has a long , cylindrical body with a short , blunt snout , large eyes , two tiny spineless dorsal fins , and a large caudal fin . It is dark brown , with light @-@ emitting photophores covering its underside except for a dark " collar " around its throat and gill slits .

The name " cookiecutter shark " refers to its feeding habit of gouging round plugs , as if cut out with a cookie cutter , out of larger animals . Marks made by cookiecutter sharks have been found on a wide variety of marine mammals and fishes , as well as on submarines , undersea cables , and even human bodies . It also consumes whole smaller prey such as squid . Cookiecutter sharks have adaptations for hovering in the water column and likely rely on stealth and subterfuge to capture more active prey . Its dark collar seems to mimic the silhouette of a small fish , while the rest of its body blends into the downwelling light via its ventral photophores . When a would @-@ be predator approaches the lure , the shark attaches itself using its suctorial lips and specialized pharynx and neatly excises a chunk of flesh using its bandsaw @-@ like set of lower teeth . This species has been known to travel in schools .

Though rarely encountered because of its oceanic habitat , a handful of documented attacks on humans were apparently caused by cookiecutter sharks . Nevertheless , this diminutive shark is not regarded as highly dangerous . The International Union for Conservation of Nature (IUCN) has listed the cookiecutter shark under Least Concern , as it is widely distributed , has no commercial value , and is not particularly susceptible to fisheries .

= = Taxonomy = =

French naturalists Jean René Constant Quoy and Joseph Paul Gaimard originally described the cookiecutter shark during the 1817 ? 1820 exploratory voyage of the corvette Uranie under Louis de Freycinet , giving it the name *Scymnus brasiliensis* because the type specimen was caught off Brazil . In 1824 , their account was published as part of Voyage autour du monde ... sur les corvettes de S.M. l 'Uranie et la Physicienne , Louis de Freycinet 's 13 volume report on the voyage . In 1865 , American ichthyologist Theodore Nicholas Gill coined the new genus *Isistius* for this species , after Isis , the Egyptian goddess of light .

One of the earliest accounts of the wounds left by the cookiecutter shark on various animals is in ancient Samoan legend , which held that atu (skipjack tuna) entering Palauli Bay would leave behind pieces of their flesh as a sacrifice to Tautunu , the community chief . In later centuries , various other explanations for the wounds were advanced , including lampreys , bacteria , and invertebrate parasites . In 1971 , Everet Jones of the U.S. Bureau of Commercial Fisheries (a predecessor of the National Marine Fisheries Service) discovered the cigar shark , as it was then generally known , was responsible . Shark expert Stewart Springer thus popularized the name " cookiecutter shark " for this species (though he originally called them " demon whale @-@ biters ") . Other common names used for this shark include luminous shark , smalltooth cookiecutter shark , and smooth cookiecutter shark .

= = Description = =

The cookiecutter shark has an elongated , cigar @-@ shaped body with a short , bulbously rounded snout . The nostrils have a very short flap of skin in front . The large , oval , green eyes are placed forward on the head , though not so that there is extensive binocular vision . Behind the eyes are large spiracles , positioned on the upper surface of the head . The mouth is short , forming a nearly transverse line , and is surrounded by enlarged , fleshy , suctorial lips . There are 30 ? 37 tooth rows

in the upper jaw and 25 ? 31 tooth rows in the lower jaw , increasing with body size . The upper and lower teeth are extremely different : the upper teeth are small , narrow , and upright , tapering to a single , smooth @-@ edged cusp . The lower teeth are also smooth @-@ edged , but much larger , broader , and knife @-@ like , with their bases interlocking to form a single saw @-@ like cutting edge . The five pairs of gill slits are small .

The pectoral fins are short and roughly trapezoidal in shape . Two spineless dorsal fins are placed far back on the body , the first originating just ahead of the pelvic fins and the second located just behind . The second dorsal fin is slightly larger than the first , and the pelvic fins are larger than either . The anal fin is absent . The caudal fin is broad , with the lower lobe almost as large as the upper , which has a prominent ventral notch . The dermal denticles are squarish and flattened , with a slight central concavity and raised corners . The cookiecutter shark is chocolate brown in color , becoming subtly lighter below , and there is a dark " collar " that wraps around the gill region . The fins have translucent margins , except for the caudal fin , which has a darker margin . Complex , light @-@ producing organs called photophores densely cover the entire underside , except for the collar , and produce a vivid green glow . The maximum recorded length for this species is 42 cm (17 in) for males and 56 cm (22 in) for females .

= = Distribution and habitat = =

Inhabiting all of the world 's major tropical and warm @-@ temperate oceanic basins , the cookiecutter shark is most common between the latitudes of 20 ° N and 20 ° S , where the surface water temperature is 18 ? 26 ° C (64 ? 79 ° F) . In the Atlantic , it has been reported off the Bahamas and southern Brazil in the west , Cape Verde , Guinea to Sierra Leone , southern Angola , and South Africa in the east , and Ascension Island in the south . In the Indo @-@ Pacific region , it has been caught from Mauritius to New Guinea , Australia , and New Zealand , including Tasmania and Lord Howe Island , as well as off Japan . In the central and eastern Pacific , it occurs from Fiji north to the Hawaiian Islands , and east to the Galápagos , Easter , and Guadalupe Islands . Fresh wounds observed on marine mammals suggest this shark may range as far as California in warm years .

Based on catch records , the cookiecutter shark appears to conduct a diel vertical migration of up to 3 km (1 @.@ 9 mi) each way . It spends the day at a depth of 1 ? 3 @.@ 7 km (0 @.@ 62 ? 2 @.@ 30 mi) , and at night it rises into the upper water column , usually remaining below 85 m (279 ft) , but on rare occasions venturing to the surface . This species may be more tolerant of low dissolved oxygen levels than sharks in the related genera *Euprotomicrus* and *Squaliolus* . It is frequently found near islands , perhaps for reproductive purposes or because they hold congregations of large prey animals . In the northeastern Atlantic , most adults are found between 11 ° N and 16 ° N , with the smallest and largest individuals being found in lower and higher latitudes , respectively . There is no evidence of gender segregation .

= = Biology and ecology = =

Best known for biting neat round chunks of tissue from marine mammals and large fish , the cookiecutter shark is considered a facultative ectoparasite , as it also wholly ingests smaller prey . It has a wide gape and a very strong bite , by virtue of heavily calcified cranial and labial cartilages . With small fins and weak muscles , this ambush predator spends much of its time hovering in the water column . To maintain neutral buoyancy , its liver , which can comprise some 35 % of its weight , is rich in low @-@ density lipids . As this species has higher skeletal density than *Euprotomicrus* or *Squaliolus* , its body cavity and liver are proportionately much larger , and the oil content is much higher . Its large caudal fin allows for a quick burst of speed to catch larger , faster prey that come in range .

The cookiecutter shark regularly replaces its teeth like other sharks , but sheds its lower teeth in entire rows rather than one at a time . A cookiecutter shark 14 cm (5 @.@ 5 in) long has been calculated to have shed 15 sets of lower teeth by the time it is 50 cm (20 in) long , totaling 435 ?

465 teeth . This represents a significant investment of resources and is probably why the shark swallows its old sets of teeth , so that it can recycle the calcium content . Unlike other sharks , the retina of the cookiecutter shark has ganglion cells concentrated in a concentric area rather than in a horizontal streak across the visual field ; this may help to focus on prey in front of the shark . This fat shark has been known to travel in schools , which may increase the effectiveness of its lure (see below) , as well as discourage counterattacks by much larger predators .

= = = Bioluminescence = = =

The intrinsic green luminescence of the cookiecutter shark is the strongest known of any shark , and has been reported to persist for three hours after it has been taken out of water . The ventrally positioned photophores serve to disrupt its silhouette from below by matching the downwelling light , a strategy known as counter @-@ illumination , that is common among bioluminescent organisms of the mesopelagic zone . The individual photophores are set around the denticles and are small enough that they cannot be discerned by the naked eye , suggesting they have evolved to fool animals with high visual acuity and / or at close distances .

Set apart from the glowing underside , the darker , nonluminescent collar tapers at both sides of the throat , and has been hypothesized to serve as a lure by mimicking the silhouette of a small fish from below . The appeal of the lure would be multiplied in a school of sharks . If the collar does function in this way , the cookiecutter shark would be the only known case of bioluminescence in which the absence of light attracts prey , while its photophores serve to prevent premature detection by incoming would @-@ be predators . As the shark can only match a limited range of light intensities , its vertical movements likely serve to preserve the effectiveness of its disguise across various times of day and weather conditions .

= = = Feeding = = =

Virtually every type of medium to large @-@ sized oceanic animal sharing the habitat of the cookiecutter shark is open to attack : bite scars have been found on cetaceans (including porpoises , dolphins , beaked whales , sperm whales , and baleen whales) , pinnipeds (including fur seals , leopard seals , and elephant seals) , dugongs , sharks (including blue sharks , goblin sharks , basking sharks , great white sharks , megamouth sharks and smalltooth sand tiger sharks) , stingrays (including deepwater stingrays , pelagic stingrays and sixgill stingrays) , and bony fishes (including billfishes , tunas , dolphinfishes , jacks , escolars , opahs , and pomfrets) . The cookiecutter shark also regularly hunts and eats entire squid with a mantle length of 15 ? 30 cm (5 @. @ 9 ? 11 @. @ 8 in) , comparable in size to the shark itself , as well as bristlemouths , copepods , and other prey of more modest dimensions .

Parasitic attacks by the cookiecutter shark leave a round " crater wound " , averaging 5 cm (2 @. @ 0 in) across and 7 cm (2 @. @ 8 in) deep . The prevalence of these attacks can be high ; off Hawaii , nearly every adult spinner dolphin bears scars from this species . Diseased or otherwise weakened animals appear to be more susceptible ; in the western Atlantic , there are records of emaciated beached melon @-@ headed whales with dozens to hundreds of recent and healing cookiecutter shark wounds , while such wounds are rare on nonemaciated beached whales . The impact of parasitism on prey species , in terms of resources diverted from growth or reproduction , is uncertain .

The cookiecutter shark exhibits a number of specializations to its mouth and pharynx for its parasitic lifestyle . The shark first secures itself to the body surface of its prey by closing its spiracles and retracting its basihyal (tongue) to create pressure lower than that of the surroundings ; its suctorial lips ensure a tight seal . It then bites , using its narrow upper teeth as anchors while its razor sharp lower teeth slices into the prey . Finally , the shark twists and rotates its body to complete a circular cut , quite possibly aided by the initial forward momentum and subsequent struggles of its prey . The action of the lower teeth may also be assisted by back @-@ and @-@ forth vibrations of the jaw , a mechanism akin to that of an electric carving knife . This shark 's ability to create strong suction into

its mouth is likely also of utility in capturing smaller prey such as squid .

== Life history ==

Like other dogfish sharks , the cookiecutter shark is aplacental viviparous , with the developing embryos being sustained by yolk until birth . Females have two functional uteruses and give birth to litters of 6 to 12 pups . There is a record of a female carrying 9 embryos 12 @. @ 4 ? 13 @. @ 7 cm (4 @. @ 9 ? 5 @. @ 4 in) long ; though they were close to the birth size , they still had well @-@ developed yolk sacs , suggesting a slow rate of yolk absorption and a long gestation period . The embryos had developed brown pigmentation , but not the dark collar or differentiated dentition . Newborn cookiecutter sharks measure 14 ? 15 cm (5 @. @ 5 ? 5 @. @ 9 in) long . Males attain sexual maturity at a length of 36 cm (14 in) , and females at a length of 39 cm (15 in) .

== Human interactions ==

Favoring offshore waters and thus seldom encountered by humans , the cookiecutter shark is not considered very dangerous because of its small size . However , it has been implicated in a few attacks ; in one notable case , a school of fierce , 30 cm (12 in) long fish with blunt snouts attacked an underwater photographer on an open ocean dive . Similar reports have come from shipwreck survivors , of suffering small , clean , deep bites during night time . In March 2009 , Maui resident Mike Spalding was bitten by a cookiecutter shark while swimming across Alenuihaha Channel . There are at least two records of bodies recovered from the water with post @-@ mortem cookiecutter shark bites .

During the 1970s , several U.S. Navy submarines were forced back to base to repair damage caused by cookiecutter shark bites to the neoprene boots of their AN / BQR @-@ 19 sonar domes , which caused the sound @-@ transmitting oil inside to leak and impaired navigation . An unknown enemy weapon was initially feared , before this shark was identified as the culprit , and the problem was solved by installing fiberglass covers around the domes . In the 1980s , some thirty U.S. Navy submarines were damaged by cookiecutter shark bites , mostly to the rubber @-@ sheathed electric cable leading to the sounding probe used to ensure safety when surfacing in shipping zones . Again , the solution was to apply a fiberglass coating . Oceanographic equipment and telecommunications cables have also been damaged by this species .

The harm inflicted by cookiecutter sharks on fishing nets and economically important species may have a minor negative effect on commercial fisheries . The shark itself is too small to be of value , and is only infrequently taken , as bycatch , on pelagic longlines and in midwater trawls and plankton nets . The lack of significant population threats , coupled with a worldwide distribution , has led the IUCN to assess the cookiecutter shark as of Least Concern .