

Rhincodon typus (Whale Shark)

Family: Rhincodontidae (Whale Shark)

Order: Orectolobiformes (Carpet Sharks)

Class: Chondrichthyes (Cartilaginous Fish)



Fig. 1. Whale shark, *Rhincodon typus*.

[<http://news.nationalgeographic.com/news/2014/01/140129-whale-shark-endangered-cites-ocean-animals-conservation/>, downloaded 1 March 2015]

TRAITS. *Rhincodon typus* is the largest species of shark, measuring about 12m in length, and can weigh up to 20 tonnes (Steel, 1985). Usually identified by their large size, and brownish or greyish colour. White spots are densely distributed about its large head, and ridges run along its dorsal side. It possesses two dorsal fins, with the larger fin being 1.2m tall, and pectoral fins spanning 2.4m in length. *Rhincodon* uses its large mouth as an efficient filtration mechanism, utilising numerous minuscule teeth (Steel, 1985). Five gill clefts on either side of its cylindrical body aids in filter feeding. Females are larger than the males, which is commonly observed in other shark species. The distinguishing feature of male whale sharks is the presence of claspers, which are a pair of external reproductive organs.

DISTRIBUTION. *Rhincodon* is found in the Atlantic, Pacific and Indian oceans, and is very rarely spotted in the Mediterranean (Fig. 2). This species is highly migratory, in that their movements depend on their food supply. Rare sightings of *Rhincodon* occur just off the south coast, and a few kilometres off the north coast of Tobago (Carwardine and Watterson, 2002). This particular species is not native to any one area, but is possibly attracted to the warm waters of the Caribbean Sea where zooplankton and other small organisms thrive.

HABITAT AND ACTIVITY. *Rhincodon* typically is a migratory species, therefore home ranges (the area where an organism spends most of its time) and territories (an area defended by an organism) are not found. Individuals have been observed to stay in one area for up to 33 days, while some may choose to remain there for up to six months (Hueter et al., 2013). When food supply has become significantly reduced in this area, they migrate to other waters with greater food supplies. Usually found in warm waters where zooplankton and other food sources are in high numbers. Whale sharks are diurnal organisms, feeding during the day in deeper waters, and remaining in more shallow waters during the night (Heyman et al., 2001). They are similar in appearance and habitat to basking sharks. *Rhincodon* can undergo stationary suction feeding by slowing down its movements upon reaching spawn clouds, and gulping repeatedly while staying motionless. Surface ram filter feeding also occurs whereby *Rhincodon* swims to the surface, lifts its jaw slightly above the water and gulps spawn clouds as it swims along (Heyman et al., 2001).

FOOD AND FEEDING. Feed on zooplankton, squid, and small fishes such as sardines or anchovies. It has been noticed in recent years that fish eggs have become part of their diet as well (Heyman et al., 2001). They utilise suction feeding or filter feeding by opening their large mouths to allow water and small organisms to enter (Fig. 3). The gill rakers on the inner side of the gills contain small structures that filter out anything larger than 1mm across (Carwardine and Watterson, 2002). Water then exits the gills, and the food is retained within the gut to be digested. Although *Rhincodon* has poor eyesight, highly sensitised nostrils and sharp hearing help in detecting large groups of zooplankton. Large schools of anchovies or sardines make a unique noise when swimming around, which can alert whale sharks to their presence. An association between schools of tuna and *Rhincodon* has been frequently observed, as the diet of both species is similar. Tuna splash around when feeding, and *Rhincodon* can pick up on those sounds to guide them to food sources. Feeding normally occurring individually, but studies have shown aggregations of whale sharks can meet to feed (Hueter et al., 2013). Due to its large size, hundreds of pounds of zooplankton and other small organisms are required, and therefore feeding occurs frequently.

POPULATION ECOLOGY. Whale sharks are usually solitary animals, but have been observed to segregate into groups according to sex, that is, adult males, adult females, and immature sharks. This is thought to occur because of differences in diet or swimming speeds (Graham and Roberts, 2007). These groups can contain either related or unrelated individuals, but the sizes of these groups are unknown. *Rhincodon* reaches sexual maturity at 21 years (Ward-Paige et al., 2010), but some may take between 35-50 years (Meekan et al., 2006). This species has a lifespan of around 70 years, but records have indicated that they can live to a maximum of 100 years (Ward-Paige et al., 2010). Whale sharks are rarely spotted, but have known aggregations yearly off the coast of the Yucatan Peninsula and the Ningaloo Reef near Western Australia.

REPRODUCTION. Much debate had surrounded the birth of whale sharks, but it is now known that this process is viviparous, that is, females give birth to live young. Embryos develop inside of egg cases and remain in them until they are ready to hatch. Hatching occurs within the uterus, and live juvenile pups are released. Females can give birth to a minimum of 16 pups, but the largest recorded pup litter was 300 juveniles for an 11m whale shark (Ward-Paige et al., 2010). Large litter size is a direct indicator of a low survival rate of pups, with only about 10% of the young whale sharks surviving until adulthood (Holmberg et al., 2009). Juveniles are usually 30-50cm in length, and have similar markings on their backs as adult whale sharks (Meekan et al., 2006). Mothers give birth to offspring and leave soon after, forcing them to fend for themselves. Little is known about the seasonality of reproduction, but studies conducted on yearly aggregations off the coast of Belize during the period May to September have shown that some males had frayed claspers, indicating that mating had taken place.

BEHAVIOUR. Juveniles are left soon after birth, and therefore have little interaction with their parents. Survival rates of young whale sharks are quite low, causing difficulty in observing their behavioural patterns. No significant mechanism has been evolved to ward off predators, but their skin is very tough which allows for greater chance of survival if damaged. Feeding is mostly done in deeper, open waters where zooplankton and schools of teleosts (bony fish) reside, thus making juveniles susceptible to predation by blue marlins and blue sharks (de la Parra Venegas et al., 2011). As juveniles mature to adults, their size may make it difficult for predators to attack them. Few predators such as killer whales (*Orca*) and great white sharks have been known to attack fully mature *Rhincodon*. Since whale sharks are mainly solitary animals, there is little information available about the communication between individuals. Highly sensitized hearing can pick up the faintest sound that may be given off by prey or fellow whale sharks, while ampullae of Lorenzini, located in the head region, aid in the detection of weak electrical signals and magnetic fields to assist in navigation (Steel, 1985).

APPLIED ECOLOGY. *Rhincodon* is listed by the IUCN as ‘Vulnerable’. While the juveniles are susceptible to predation by other sharks, adult whale sharks have few predators (Hueter et al., 2013). Their main threat is overexploitation and damage by humans, which can have both direct and indirect effects on the population size. Propellers from boats often graze the backs of whale sharks, and some may end up entangled in fishing nets and are pulled up onto fishing boats (Graham, 2007). Countries such as Taiwan and Indonesia have a great demand for whale shark meat, and have established fisheries solely for catching and processing this meat (National Geographic, 2015). The only fishery dedicated to whale sharks in the Caribbean was located in Cuba, and processed about 9 sharks a year. In 1991, the Cuban Government recognised the need for conservation of this species, and subsequently shut down the fishery (Graham, 2007). Many countries such as Australia, the Maldives, the Philippines, India, Honduras, and Belize have seen the need to safeguard this species, and thus have listed *Rhincodon* as a protected species (Carwardine and Watterson, 2002).

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Posted online: 2015

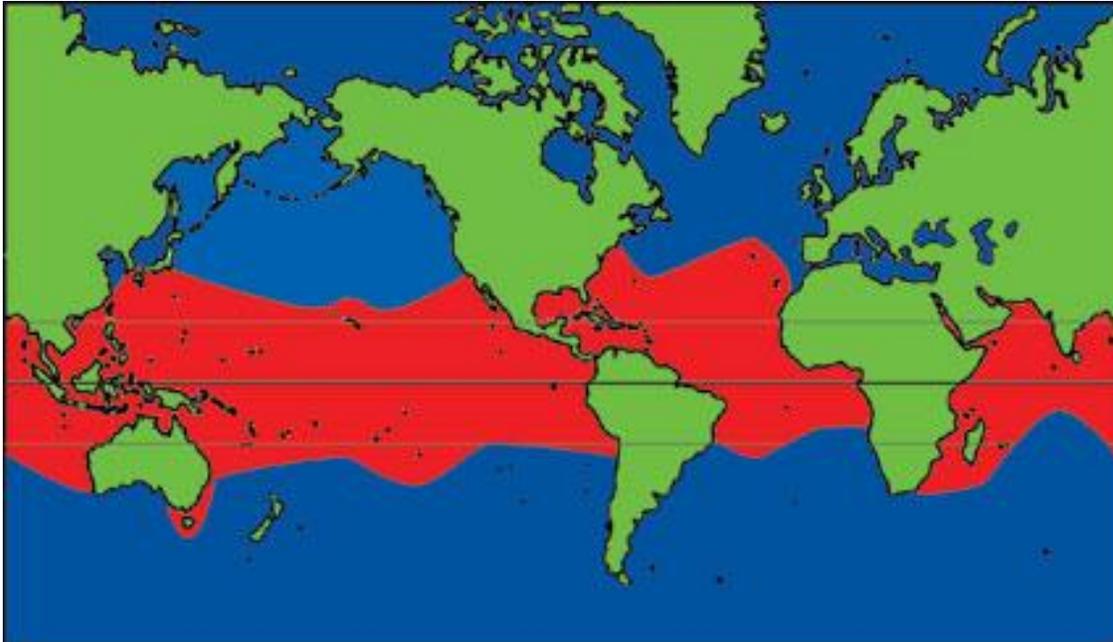


Fig. 2. Whale shark worldwide distribution (red).

[http://www.sharktrust.org/en/whale_shark_distribution, downloaded 4 March 2015]



Fig. 3. Whale sharks undergoing suction feeding.

[<http://ngm.nationalgeographic.com/2011/10/whale-sharks/aw-photography#/04-whale-sharks-scramble-snack-670.jpg>, downloaded 22 March 2015]

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