

**SHARK BAY**

**Seaweeek 2005**  
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## **The whale shark**

By Brad Norman



The whale shark (*Rhincodon typus*) (© Brad Norman)

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### Introduction

The whale shark (*Rhincodon typus*) is the largest shark in the ocean, reaching lengths of 20 metres and a weight of 20 tonnes (figure 1). This icon species is often referred to as 'charismatic megafauna' and a 'gentle giant'. With very few defences, it has become susceptible to exploitation and has a global conservation status of 'vulnerable to extinction' as listed by the World Conservation Union in the *Red List of Threatened Species*.

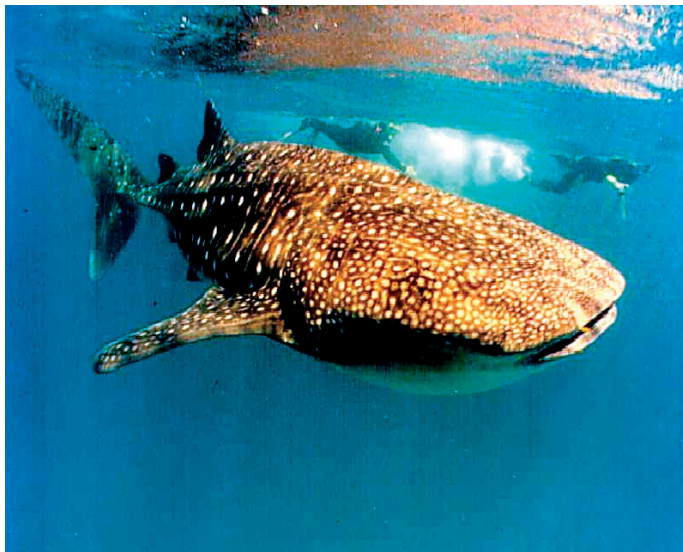


Figure 1. The whale shark (*Rhincodon typus*) (© Brad Norman).

### History

The whale shark is a relatively recent addition to the human record of the ocean and its inhabitants. However, the ancestry of this shark goes back to the Jurassic and Cretaceous periods 245–65 million years ago, when the present groups of sharks began to appear.

It was not until 1828 that the first whale shark specimen known to science was discovered off the South African coast. Dr Andrew Smith formally described the species later that year as the largest living shark in the ocean.

This species is rare. Prior to the mid-1980s, there had been less than 350 confirmed reports of whale sharks worldwide. Since

then, consistent sightings have been recorded in Australia. A lucrative ecotourism industry revolving around their annual appearance at Ningaloo Marine Park (NMP), on the Western Australian northwest coast, is now well established.

### Distribution

Whale sharks have a broad distribution in tropical and warm-temperate seas, usually between latitudes 30°N and 35°S (figure 2). They are thought to prefer surface sea-water temperatures of 21–25°C. Sightings at NMP, however, are most common in water temperatures around 27°C.

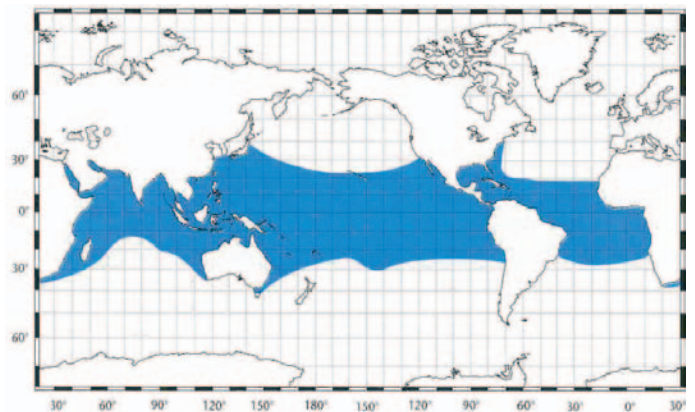


Figure 2. The whale shark is widely distributed through tropical seas (© CSIRO).

Whale sharks are known to inhabit both deep and shallow coastal waters and the lagoons of coral atolls and reefs. Australia is one of the most reliable locations to find them. Regular sightings have also been recorded from many other regions including India, the Maldives, South Africa, Belize, Mexico, the Galapagos Islands, Southeast Asia and Indonesia.

This species is widely distributed in Australian waters. Although most common at NMP (and to a lesser extent at Christmas Island and in the Coral Sea), sightings have been confirmed further south than Kalbarri (on the mid-west coast of Western Australia) and near Eden (New South Wales). Whale sharks have also been recorded from Australian waters between Australia and Indonesia.

### Biology

This species is closely related to the bottom-dwelling sharks (Orectolobiformes), which include the wobbegong. There is a pattern of lines and spots on the skin of each shark that enables them to 'blend' into their surroundings. This 'camouflage' makes the sharks less conspicuous in their oceanic environment. The unique patterning does not appear to change over time and can be used to identify individuals (see [photoid.whaleshark.org](http://photoid.whaleshark.org)).

One of only three filter-feeding sharks (the other two being the basking and megamouth sharks), the whale shark feeds on minute organisms (figure 3) including krill, crab larvae, jellyfish, etc, and has been known to feed on larger prey (e.g. sardines, anchovies, mackerels, small tunas and squid). Although they have approximately 3000 tiny teeth (each less than 6 mm in length), these teeth are not used while feeding. Instead, the whale shark can sieve prey items as small as 1 mm through the fine mesh of the gill-rakers. They are able to open their mouth to a great width (greater than 1 metres) to optimise feeding and are occasionally sighted hanging vertically in the water allowing baitfish and other concentrated food items to be ‘sucked’ in.



Figure 3. Copepods and juvenile crabs are eaten by whale sharks (© Brad Norman).

## Reproduction

Whale sharks have internal fertilisation and produce live young (the eggs hatch in the uterus prior to birth [ovoviviparity]). They have more young than any shark, producing litters of around 300 pups—although these are very small at an average length of around 55 cm. The length of gestation, how often they breed, and where they breed remains unknown. The only pregnant female whale shark ever recorded was found off the coast of Taiwan. There have been very few juvenile whale sharks seen at any location throughout their range.

Studies of the whale sharks at NMP have established that male whale sharks do not usually mature before they reach a length of around 8–9 metres. Males can be distinguished by the presence of two claspers (absent in females) near the pelvic fin. The size at maturity of female whale sharks cannot be determined through external observation.

## Habitat and ecology

Although whale sharks are most often observed swimming at the surface during ‘seasonal’ aggregations, evidence from tracking studies indicate that whale sharks can dive to great depths (~700 metres). They can also remain beneath the surface for long periods.

They regularly appear at locations where seasonal food ‘pulses’ are known to occur. The predictable annual whale shark aggregation at NMP is closely linked with an increase in productivity of the region associated with a mass coral spawning that occurs around March–April each year. It is likely that this represents a critical habitat in the life cycle of this species.

Acoustic-tracking studies at NMP reveal that individual whale sharks sometimes stay close to Ningaloo Reef over day–night periods. In addition, using the *ECOCEAN Whale Shark Photo-identification Library*, it has been possible to record many sharks returning to Ningaloo in different years and remaining there over long periods during the whale shark ‘season’. As an example, one individual (A-012) was resighted at NMP on 14 separate days over a 28-day period within a very restricted area. In addition, some sharks appear to show a level of ‘site-attachment’ when returning to the Australian northwest coastline.

## Migration

Whale sharks are regarded as highly migratory—although their ‘migration patterns’ are poorly understood. Research at NMP suggests the sharks may undertake a northerly migration when leaving the area. Their seasonal appearance at Christmas Island and sightings near Ashmore Reef provide support for this theory (figure 4). It is when the sharks leave Australian waters that they are potentially at risk of ‘unsustainable hunting pressure’.

Satellite tracking of whale sharks in waters off the United States of America and also in the South China Sea reveals that these animals can travel great distances (thousands of kilometres). These migrations may take years to complete. A far greater understanding of whale shark movements will be possible with the continuation of tagging and tracking studies throughout the world and through expansion of the *ECOCEAN Whale Shark Photo-identification Library*. Using ‘natural tagging’ via photo-identification, it is possible for snorkellers and SCUBA divers from around the world to help with research on this species, by sending basic sighting information (e.g. date and location) with a photograph of the unique natural patterning on the skin of each shark to the online Library.

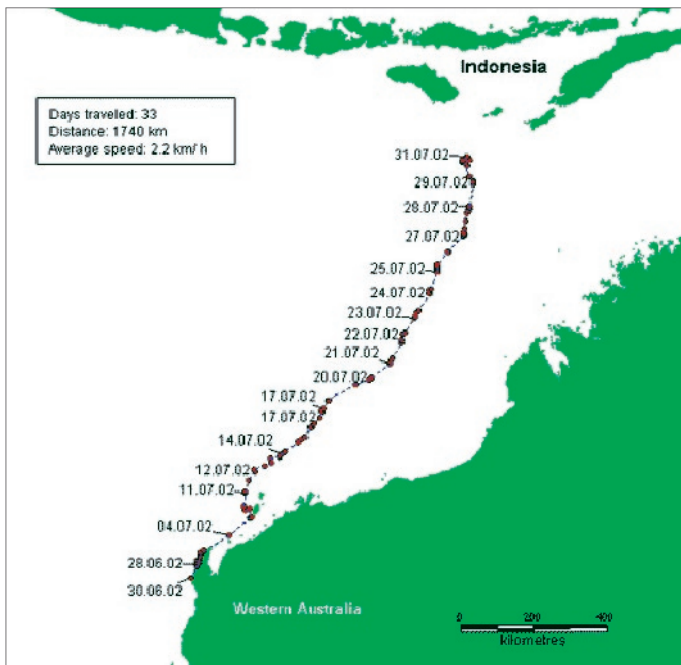
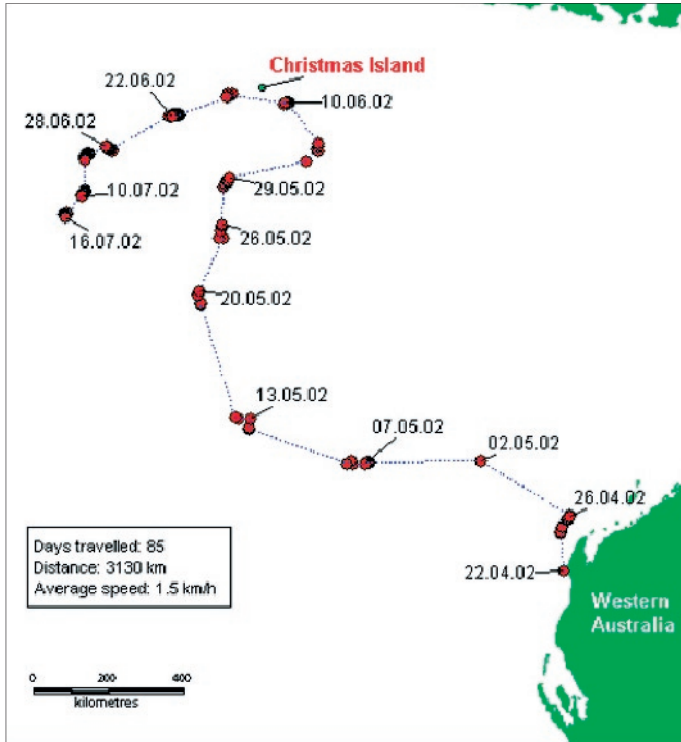


Figure 4. Satellite-tagged whale sharks in 2002  
(© <http://www.marine.csiro.au/research/pelagic/tagging/hopetraveller/index.htm>).

## Threats

### Targeted or bycatch fisheries

- The most significant threat to the species appears to be humans. In one fishery alone (India), as many as 1000 whale sharks were believed killed in 1999 and 2000. Their habit of swimming at the surface makes them particularly susceptible to fishing. In previous times, the fins of whale sharks were sold for high prices on the Asian market, although demand has declined. There is still a market for whale shark meat in several countries including Taiwan and China.

- In Taiwan, there is a quota of 120 whale sharks for capture per year, although this is feared to be unsustainable. Of great concern is the reduction on the size of individuals caught in the Taiwanese fishery today compared with those of the early 1980s.

### Natural predators

- There are very few known predators of the whale shark. In nature, the most dangerous period in their life cycle appears to be before reaching a substantial size (i.e., when the sharks are still very young). Pups are a fraction of their adult size—only approximately 55 cm in length at birth. The skin of an adult whale shark provides their main protection. On average, the thickness of the skin on the dorsal surface is 12–15 cm, greater than that of any other living animal. In young whale sharks, however, this ‘protection’ is not fully developed.

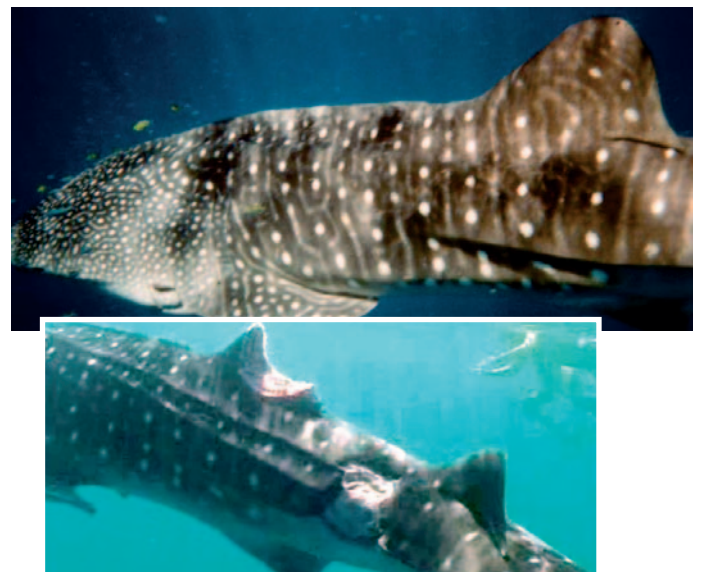


Figure 5. a) A-076 photographed in 1999 with dorsal fin intact; (© <http://www.shepherdproject.org/sharks.jsp?shark=A-076>); b) A-076 photographed in 2003 with dorsal fin damaged from attack (© <http://www.shepherdproject.org/sharks.jsp?shark=A-076>).

- Very few juvenile whale sharks (i.e., less than 1–2 metres) have ever been reported, although it is known that small individuals are sometimes preyed upon by blue marlin and blue sharks. There is also a record of an adult whale shark taken by a killer whale in Mexican waters, and evidence of a whale shark (A-076) being attacked by a larger shark off Australia. This individual was sighted in 2002 with fin intact and resighted in 2003 at Ningaloo with fresh wounds (figure 5 a, b).

### Vessel contact

- Because of their habit of swimming slowly at or near the surface, whale sharks are particularly susceptible to boat strike. Earlier in the 19<sup>th</sup> century there were occasional reports of whale sharks being impaled on the bow of steamships. Today there are very few reports of this happening, although many sharks that are sighted near ecotourism activities in some parts of the world show propeller wounds (i.e., evidence of vessel contact).

### Ecotourism

- Ecotourism is well-managed in Australia via a collaborative approach between industry and the management agency, which is the Western Australian Department of Conservation and Land Management (CALM). Ecotourism is developing at other locations throughout the world, and it is important that such activity is well-regulated to minimise any impacts on this threatened species.
- Whale sharks have shown a reaction to SCUBA bubbles, touching and flash photography. These activities are not permitted during whale shark ecotours in Australia (figure 6).

### Protection

The whale shark is protected in the waters of very few of the approximately 100 countries where it is known to visit. It is protected in Honduras and some waters off the United States of America. The Maldives brought in legislation to protect whale sharks in 1995, and the Philippine government banned the hunting of whale sharks in 1998. India followed in mid-2001. However, at several other locations, unregulated fishing for whale sharks is still apparent.

- The whale shark is identified as a migratory species and a threatened species on the Australian Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and fully protected in Commonwealth waters.
- The whale shark is listed on Appendix II of the *Convention on International Trade in Endangered Species*. This listing will enable all member countries (~160) to monitor international trade in whale shark products.



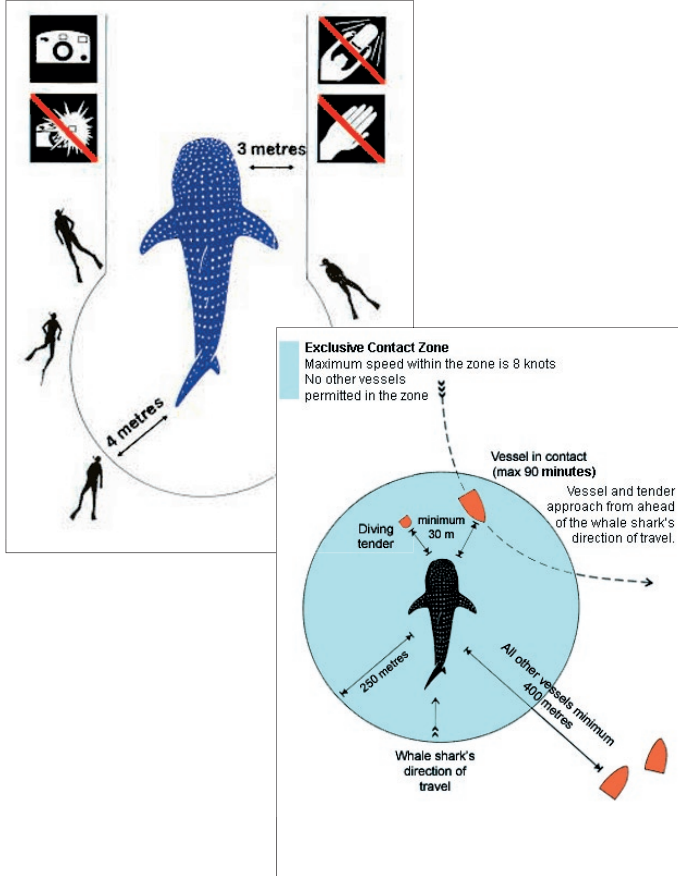
Figure 6. Whale sharks move slowly enabling ecotourists to swim alongside (© www.ecocean.org).

- In Western Australian waters, the whale shark is fully protected under the *Wildlife Conservation Act 1950* (and under this Act the *Wildlife Conservation (Closed Season for Whale Sharks) Notice 1996*) and the *Fish Resources Management Act 1994*.
- The whale shark is also listed on the *Bonn Convention for the Conservation of Migratory Species*. This identifies the whale shark as a species whose conservation status would benefit from the implementation of international cooperative agreements.

### What can you do?

When swimming with whale sharks, follow the Regulations to minimise impacts on this species (figure 7).

Also, assist monitoring by noting simple sighting details of the whale shark and if an identification photo(s) is available, please submit this to the public online *ECOCEAN Library* (<http://photoid.whaleshark.org>).



## For further information

ECOCEAN Whale Shark Conservation:  
<http://www.ecocean.org/whalesharks01.html>

National Plan of Action for the Conservation and Management of Sharks (Shark-plan):  
<http://www.daff.gov.au/sharkplan>

## Acknowledgements

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Figure 7. CALM / Industry management guidelines to minimise impacts on sharks from ecotourism activities  
 (© [http://www.calm.wa.gov.au/tourism/whalesharks\\_swimming.html](http://www.calm.wa.gov.au/tourism/whalesharks_swimming.html)).