



Driven by a love of the sea and its largest fish, the elusive whale shark, Australian naturalist Brad Norman has created a worldwide photo-identification system which enables ordinary people to assist in its conservation. In recognition of his contribution to the understanding of the threatened shark, Norman has become the first Australian Laureate of the Rolex Awards for Enterprise in 25 years. **Julian Cribb** reports.

Up to 18 metres long and weighing up to 20 tonnes, the whale shark is the world's biggest living fish. Its non-predatory behaviour earned it the title of 'gentle giant'.

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Before the swimmer's eyes, glowing flecks shine like stars eerily transposed into the depths of the sea. Through a blue-dark veil of water, a huge shape gradually resolves itself, rising slowly and majestically to the surface.

After hundreds of sightings, Brad Norman's blood still thrills as the great, spotted whale shark comes into view, gliding effortlessly forward, its pale, metre-wide mouth agape to scoop up thousands of litres of protein-rich sea water.

'When they are down deep, they look like a star field under water,' he says. 'As you swim above, the shark's body seems to disappear and its white spots light up like stars in the night sky. It's an awe-inspiring sight.'

The imagery illumines the abiding passion of this 38-year-old Australian naturalist who has dedicated most of his adult life to the pursuit, identification, understanding and protection of the world's largest fish, *Rhincodon typus*, the aptly named whale shark. Reaching 18 metres in length, the huge beast resembles

nothing so much as 'a bus under water', Norman says – an animate, placid, occasionally inquisitive bus, pursuing its mysterious life across tens of thousands of kilometres of open ocean.

First recorded in 1828, only 350 whale-shark sightings were documented in the ensuing 150 years. Recent growth in underwater tourism has brought a surge in sightings. Yet the whale shark remains elusive, and the World Conservation Union (IUCN), which engaged Norman to assess the species, regards it as 'vulnerable' to extinction. It is protected in only a handful of countries.

While it has few natural enemies – though orcas and predatory sharks may attack the young – the whale shark now has joined the long list of species to suffer the insatiable human appetite for seafood. Its flesh, fins and body parts are appearing in growing quantities in Asian markets where they fetch US\$18 per kilo or more.

The whale shark is one of only three sharks that are filter-feeders, using gill rakers to scoop up krill (shrimp), small fish and other tiny ocean life as its sole source of sustenance. These small fish reflect the condition of the oceans and their bio-productivity. Since whale sharks travel immense distances to collect food, the demographics of these fish can serve as an indicator of ocean health – and of the human impact on it.

Whale sharks have an uncanny instinct for locating food concentrations. Tagged individuals have been tracked for 13 000 kilometres across the Pacific, and 3000 kilometres in the Indian Ocean. It is sighted at more than 100 places around the globe – including the Philippines, South China Sea and Indonesia; off India, Australia and Africa; off Mexico, the United States and



Whale sharks (*Rhincodon typus*) are known to travel extensively across the oceans, but their demographics, migratory patterns and reproductive behaviour are still a mystery.

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Far left: Brad Norman developed a photo-identification system which uses whale shark sightings and photography around the world as a tool to contribute to the conservation of this charismatic species.

Left: A keen diver, Brad Norman helped draft simple guidelines for photographing whale sharks.

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the Galapagos Islands (Ecuador). Yet it remains so scarce almost nothing is known of its abundance, breeding habits or habitat preferences.

Brad Norman is determined to find out much more about these fish. His visionary plan to involve thousands of ordinary people worldwide in the photo-monitoring and conservation of whale sharks, significantly enhancing knowledge of this elusive species, has earned him a 2006 Rolex Award for Enterprise.

Since his first awe-filled encounter in 1994, in Western Australia's Ningaloo Marine Park, Norman has striven to uncover all he can about this lordly animal, whose ancestry extends back 400 million years.

'My first encounter seemed quite surreal. There was this huge, living thing coming directly towards me. My eyes were popping out of my head. I almost "swallowed my snorkel". I was screaming silently to myself in excitement,' he recalls. 'Yet, oddly, I wasn't afraid. I just floated there, too amazed to swim after him.'

As his encounters multiplied, Norman grew to appreciate many aspects of the whale shark. Its economical cruising speed of 1 to 1.5 metres per second was perfect for observation. Though able to dive as deep as 1500 metres, it often swam conveniently near the surface. Its placid temperament made it safe compared with other big sharks (it has never been known to attack humans). Yet it could also be dynamic: 'I once observed seven in an area where there was a huge swarm of krill, a real soup of food in the water. They were charging through it, mouths open, thrashing around. That was a big adrenalin rush. I never felt frightened, but I did keep my arms down and made myself small.'

'Even with something as big as a whale shark, you're not afraid – and nor is it. It is a calming experience. You feel at one.' Swimming alongside its head, Norman has seen its little eye turn, observing him – a glimmer of acknowledgement. 'Maybe it just thinks I'm a big remora [sucker fish],' he laughs. Nonetheless, he

Whale sharks' docile nature and slow swimming speeds are making them tourism stars.

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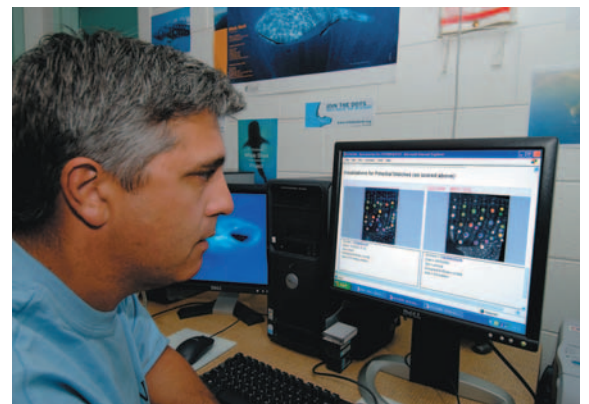


Right: Ningaloo Reef in Western Australia is a model for whale shark ecotourism that can be applied in other locations around the world where the sharks appear regularly.



Far right: Brad Norman uses the ECOCEAN system which identifies individual whale sharks by running an algorithm adapted from astronomy.

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respects the shark's brute power, and has assisted in the drafting of guidelines for divers and tour operators worldwide on how to behave around whale sharks.

Norman's love of the ocean was born on the golden beaches of Perth, on Australia's Indian Ocean coastline, where he body-surfed as a youngster. This led to diving and, via a science degree, to a deep interest in marine conservation, which he has pursued as a researcher and fisheries management consultant.

His encounter with the whale sharks of Ningaloo was a life-altering experience. The shark was an unknown, and there was little money for its study or conservation. Norman survived hand-to-mouth on sporadic grants, and funded much research himself. He mounted national and international campaigns for the whale shark's conservation, emerging as a global expert on the animal and its needs. He also helped authorities develop plans for its protection, wrote scientific reports and provided information for divers and children.

Many mysteries of the whale shark remain unsolved. While young males gather at Ningaloo, no one knows where the females collect or where the sharks breed. The key to studying their thin, dispersed and cryptic demographics lay in identifying individuals. Following a clue provided by an experienced fisherman, Norman's painstaking research managed to prove that every whale

shark has a pattern of white spots on its body as individually distinctive as a human fingerprint. This gave him the idea of using underwater camera images as a practical, non-invasive way to identify individuals.

In 1999, he set up the ECOCEAN Whale Shark Photo-identification Library on the Internet, a global project to record sightings and images.

Despite the growing body of information, Norman lacked an efficient way to compare shots of whale sharks taken from different angles, under varying conditions and fish postures. In 2002, US computer engineer and fellow diver Jason Holmberg contacted him, offering to help organise and automate the ECOCEAN database. He explained the photo-ID problem to a friend, NASA-affiliated astronomer Zaven Arzoumanian, whose colleague Gijs Nelemans pointed out that a technique used by Hubble Space Telescope scientists for mapping star patterns, known as the Groth algorithm, might also be useful for recognising whale sharks by mapping the unique patterns of white spots on the shark's hide.

It took many months of intense mathematical calculations and computer programming to refine the algorithm for use on a living creature – but in the end these colleagues gained a breakthrough for biology: a reliable way to identify individuals in virtually any spotted animal population, without tagging or harassing them.

Brad Norman's passion

Why is the whale shark important?

These fish are rare, and a few decades ago few people knew about them. They were only really important to those who hunted them. Their conservation status was listed in 1996 as 'data deficient' and we just didn't know. Then reports began coming in that they were declining, and we realised how vulnerable they were.

In the late 1990s, the Asian [fish] market went 'bang', especially in Taiwan and China. Whale shark meat and fins were showing up regularly. To feed the demand, people were taking whale sharks from the Philippines, India, the Pacific, as well as locally.

A lot of mystery still surrounds the whale sharks. They go on these huge journeys and seek out food pulses in different parts of the oceans, which are an indicator of the biological condition of the seas.

How did your personal interest in the whale shark begin?

It was pretty amazing to see my first whale shark. It was at Ningaloo (Marine Park, Western Australia) in 1994 where I was helping with some research into reef fish. I'd heard about whale sharks being sighted but hadn't seen one the first time I was there. Then, when I came back, the first day I was in the water, I saw my first whale shark.

What do you hope will be the long-term result of your project?

In the beginning I had a vision and I knew if I worked hard enough at it, it would come off. It is doing so. It is really workable.

There's now a public awareness campaign



Since 2000, Brad Norman has been educating children, the public, local authorities and tourism operators worldwide about whale shark conservation. Copyright Rolex Awards/Kurt Amsler

for the whale shark – that's what the ECOCEAN library is doing. It takes science out of the lab and puts it in the hands of the public. Everyone can take part.

The Rolex Award means we can now expand this program around the world, giving people in many places a sense of active involvement in conserving their ocean better.

We're turning around the attitude towards the oceans, and people are starting to pay attention. We really are making progress in overcoming hunting and getting people to appreciate that ecotourism pays much better in the long run than killing whale sharks.

Can your recognition technology apply to other species?

It's going to open up a new world in animal recognition. Manta rays have dark markings on their undersides, blue whales have mottled sides also. Grey nurse sharks have patterns as do wrasse and many reef fishes.

On land, African wild dogs and leopards can be identified from their spots and skin markings, and zebras or giraffes from their patterns. Even the pattern of whiskers on big cats can be used in identification. This will be very helpful in studying their population dynamics.

In 2005, the researchers reported their findings in the *Journal of Applied Ecology*. More than 500 whale sharks have since been identified and added to the database using the technique.

This is high, planet-scale science. But at another scale, individual divers worldwide can now follow Norman's simple guidelines for photographing whale sharks and log their images, activities and locations on the ECOCEAN site. Ordinary people can take part in real science. On ECOCEAN, their photos are automatically catalogued, compared and, if possible, identified as belonging to a known individual. Each new image helps Norman compile a global map of where whale sharks live and their migratory patterns. Contributors receive notice by email of all past and further sightings of 'their' shark. Together, the images are helping to build a global picture of the abundance, health, range and fluctuations of the whale shark population.

'Just about anyone with a disposable underwater camera can now play a part in helping to conserve whale sharks, and so help to monitor the health of the oceans,' Norman explains. 'It gives people a direct stake in whale shark stewardship.'

With the Rolex Award of US\$100 000, Brad Norman is devoting two years full time to his project, training local authorities, tourism operators and 20 research assistants around the Pacific, Atlantic and Indian oceans to observe, record and protect whale sharks. In this way he will further develop whale shark photography as a significant tool for conservation.

He plans also to explain to those who hunt the shark that there is more to be gained by leaving it alive. Ningaloo's whale sharks draw more than 5000 visitors a year, mainly from April to June, generating ecotourism worth an estimated US\$10 million, proving a live whale shark earns far more than a dead one.

'The whale shark is worth saving – and we can do something about it,' Brad says. 'It is a big, beautiful and charismatic animal, and not dangerous. It is a perfect flagship for the health of the oceans.'

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