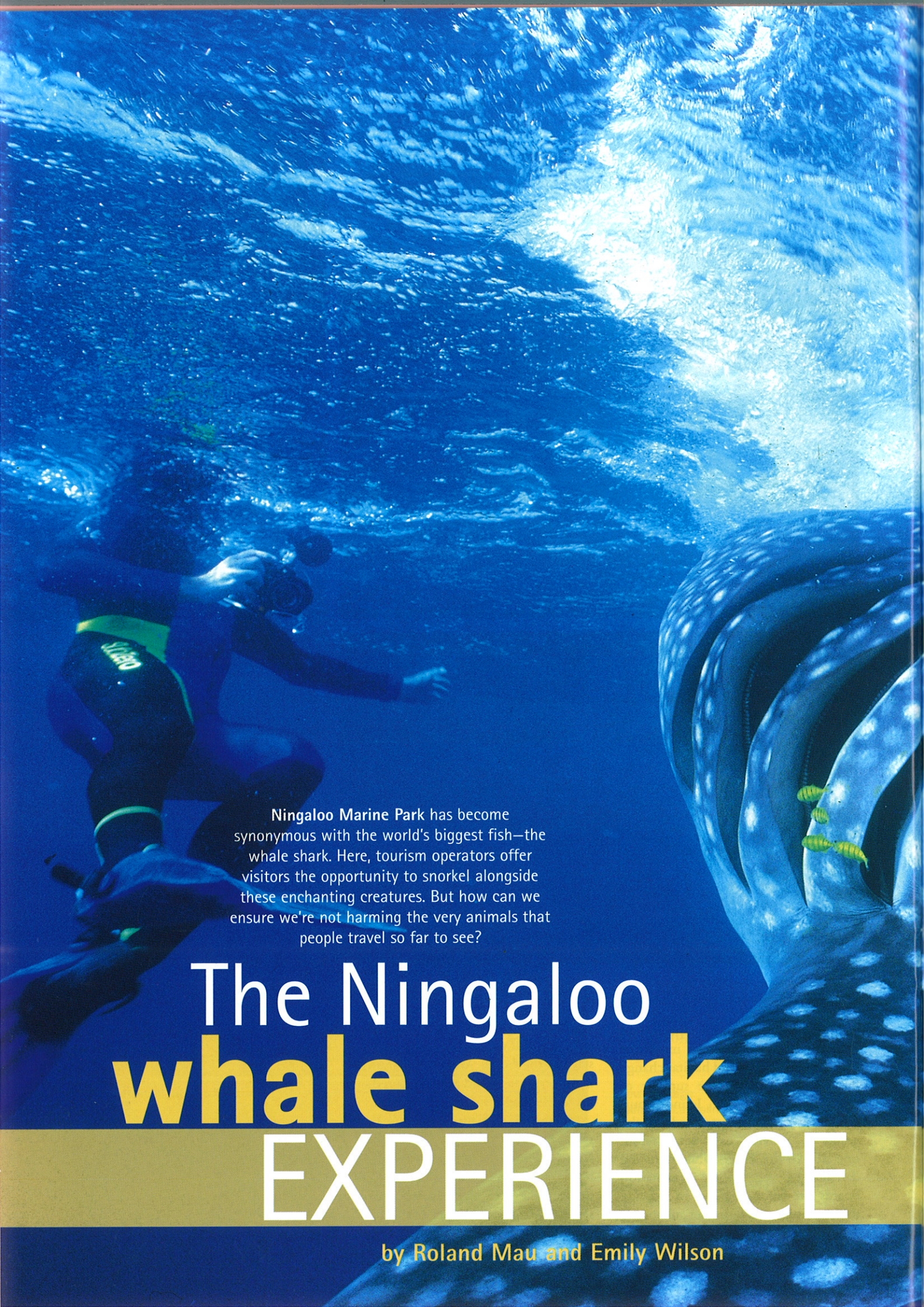
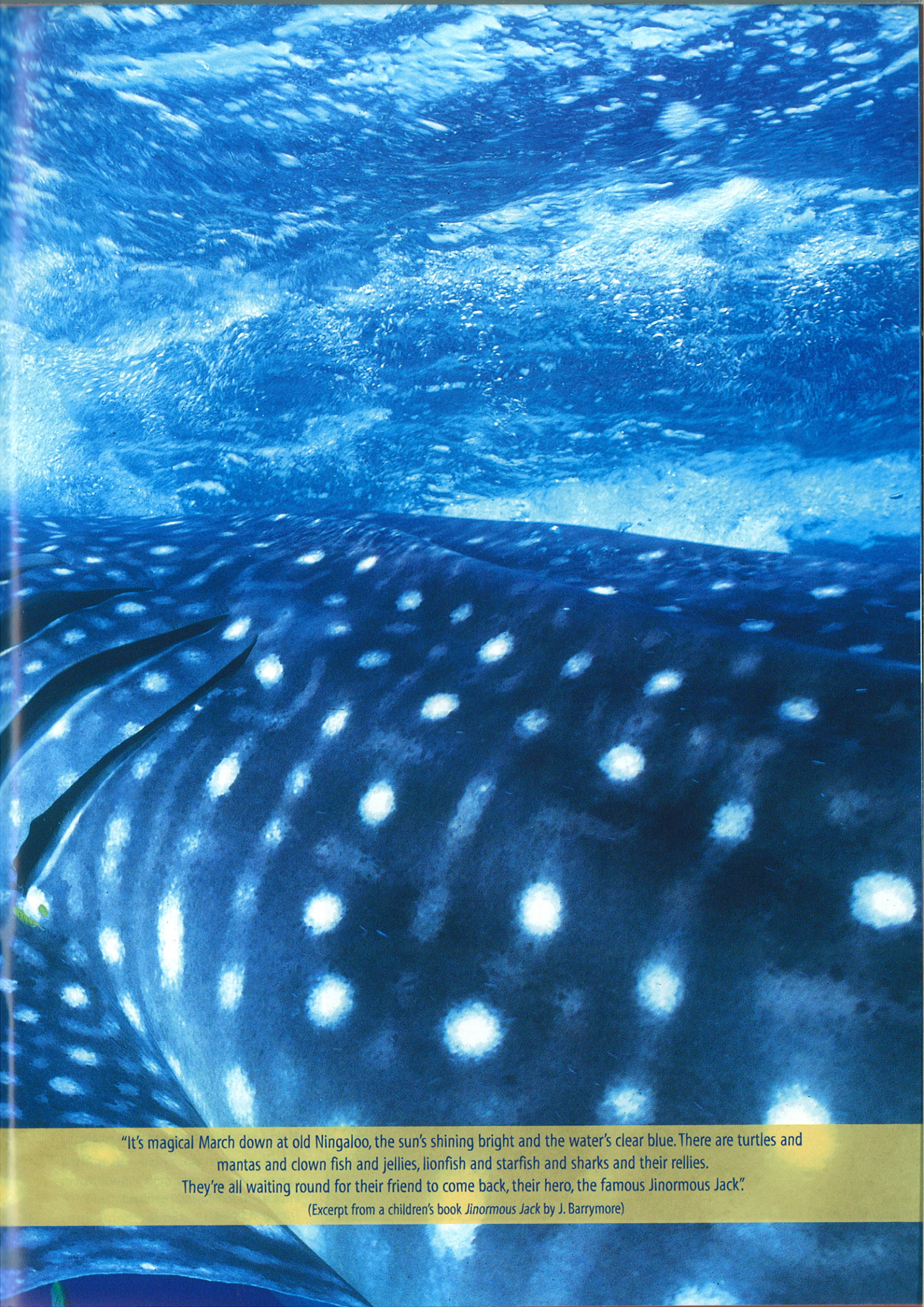


Ningaloo Marine Park has become synonymous with the world's biggest fish—the whale shark. Here, tourism operators offer visitors the opportunity to snorkel alongside these enchanting creatures. But how can we ensure we're not harming the very animals that people travel so far to see?

The Ningaloo **whale shark** EXPERIENCE

by Roland Mau and Emily Wilson



"It's magical March down at old Ningaloo, the sun's shining bright and the water's clear blue. There are turtles and mantas and clown fish and jellies, lionfish and starfish and sharks and their rellies.
They're all waiting round for their friend to come back, their hero, the famous Jinormous Jack".

(Excerpt from a children's book *Jinormous Jack* by J. Barrymore)

The whale shark (*Rhincodon typus*) is recognised as a threatened species in Western Australia and is protected under State and Commonwealth legislation. It is listed as vulnerable under the World Conservation Union Red List of Threatened Species. The species' threatened status makes it imperative that whale shark tourism doesn't negatively affect populations. The Department of Environment and Conservation (DEC), and its predecessors, has been managing whale shark tourism at Ningaloo Marine Park since shortly after the industry kicked off in the late 1980s (see 'A whale of a shark', *LANDSCOPE*, Summer 1994–95). Initially, department staff were concerned tourist interaction with the sharks could result in disruption of feeding behaviour, displacement from important feeding areas, disruption of mating, reproductive and other social behaviour, abandonment of preferred breeding sites, changes to regular migratory pathways to avoid human interaction zones, stress, injury, and, at the extreme, mortality. Years of consequent research has provided information to help allay these concerns.

Key to this research is a major photo identification project which is helping to assess whether whale sharks are displaced by tourism activity. Whale sharks are not only prominent due to their size but also their skin patterns—each pattern is unique in much the same way that humans have unique fingerprints. This fact has provided an opportunity to identify individual animals each year using photographs taken by tourists, dive guides and researchers. Photo identification has shown that individual sharks do return to the Ningaloo Marine Park, although not all animals are recorded every year. The longest period during which an individual whale shark has been resighted at the reef has been 14 years. Preliminary results from photo identification data suggest that at least some of the animals are not displaced by the current level of tourism interaction.

Disruption of behaviour

Worldwide, the diet of whale sharks appears to be reasonably diverse, with food such as algae, jellyfish, squid, snapper spawn, small fish and schools of anchovy forming most of their diet. At Ningaloo, whale sharks appear to favour the tropical krill, *Pseudeuphausia latifrons.*

Research at Ningaloo has indicated that whale sharks only rarely feed during the day. Feeding at the surface is most likely to occur in the late afternoon. Using tracking devices, scientists were able to show that whale sharks engaged in extensive vertical movements during the day were most likely searching the water column for food. These findings give some reassurance that tourism interaction, which occurs between 9.30am and 3.30pm at the surface only, is unlikely to cause any major impacts on the feeding behaviour at Ningaloo.

Additional research has shown that tourism interaction is unlikely to be affecting whale shark breeding behaviour. Analysis of whale shark tourism operator logbook data from 1996 to 2005 indicates that the average estimated length of animals sighted was six metres and between two and three males were encountered for every female. As it is thought sexual maturity in both sexes may not occur until the sharks are between eight and nine metres in length, it would appear that most whale sharks encountered at Ningaloo are immature males. As there has been no formal record or observation of mating or competitive behaviour, it seems unlikely that the

Previous page
Main A snorkeller photographs a whale shark.

Left Whale shark.
Photos – Geoff Taylor/Lochman Transparencies

Background above A school of Australian anchovy, a popular food source for whale sharks.
Photo – Eva Boogaard/Lochman Transparencies

Above Map showing the migration of a tagged whale shark.

Ningaloo area frequented by tourism operators has any direct significance in the reproductive biology of whale sharks.

Even if tourism were impacting on the sharks, they have one advantage over mammals and reptilian megafauna such as whales, dolphins and turtles—they can avoid human interaction by submerging because they do not need to surface to breathe.

However, given the difficulties in understanding whale shark behaviour, precautionary principles have guided the management of interactive tourism in the Ningaloo Marine Park. For this reason, existing restrictions regarding the approach distances of vessels and snorkellers and the time spent with each whale shark have been consistently maintained during the past nine years.

Despite the precautions, some changes have been noted. Whale shark operator logbook data recorded by dive guides shows that the average estimated length of whale sharks has decreased from an average of about seven to five metres since 1996. Male and female average lengths follow the same trend, with males being on average half a metre longer than females.

This finding has led to media conjecture about the lack of bigger animals, with recent focus on the potential impacts of whale shark hunting in other countries. However, this result may also reflect sampling errors associated with length estimations as the records are made by people with various experience and, at times, no formal training.

Current research on population dynamics and growth rates using photo identification, genetic modelling and tagging should improve our understanding of the life cycle of whale sharks and shed more light on these potentially concerning observations.

Migratory pathways

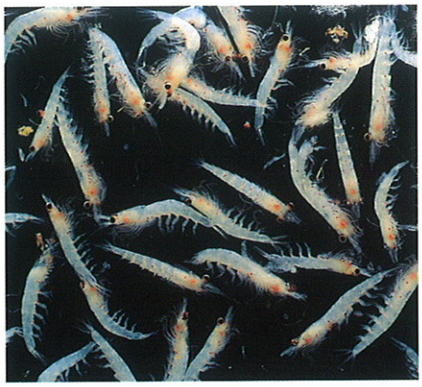
Early results of photo identification monitoring certainly do not support concerns that whale sharks change migratory paths to avoid human interaction zones. Individuals are resighted at the same and different locations both within a season—which occurs from about April to July each year—and between seasons. Ongoing work by several researchers has also shown some level of site fidelity. For instance, whale shark industry guides have predicted finding an individual called 'Mr Happy' at a particular location on a certain day—an observation confirmed by DEC staff.

These observations show that some whale sharks do have some degree of regular and predictable movement patterns while at Ningaloo.

Tagging studies also lend support to the belief that tourism contact is not significantly altering the movements of some whale sharks close to Ningaloo Reef. Tagged individuals have been sighted while tourists were swimming with them, and did not respond to tourism interactions in a negative way.

More work needs to be done to gain a better understanding of what oceanic processes are influencing whale shark migratory patterns and behaviour. A link between whale shark abundance and *La Nina* years has been revealed, with more whale sharks visiting during *La Nina* years.

It is important to gain an understanding of what natural factors affect the number of whale sharks visiting Ningaloo Marine Park and to what extent the impacts from tourism interaction, if any, can be quantified.



Above Tropical krill forms part of the whale shark diet.

Right Scientist measuring dorsal fin.
Photos – Geoff Taylor/Lochman Transparencies

Stress

In 1995, the then Department of Conservation and Land Management sponsored an aspiring Western Australian marine scientist, Brad Norman, to conduct a study examining behavioural responses of whale sharks to tourism interactions. Brad is now internationally recognised for his whale shark research efforts and his research foundation, Ecocean. At the time, Brad identified a list of short-term responses that whale sharks made to snorkellers and vessels. These included banking (turning the tougher-skinned upper body towards the disturbance), eye-rolling, shuddering, porpoising (diving up and down) and diving out of sight.

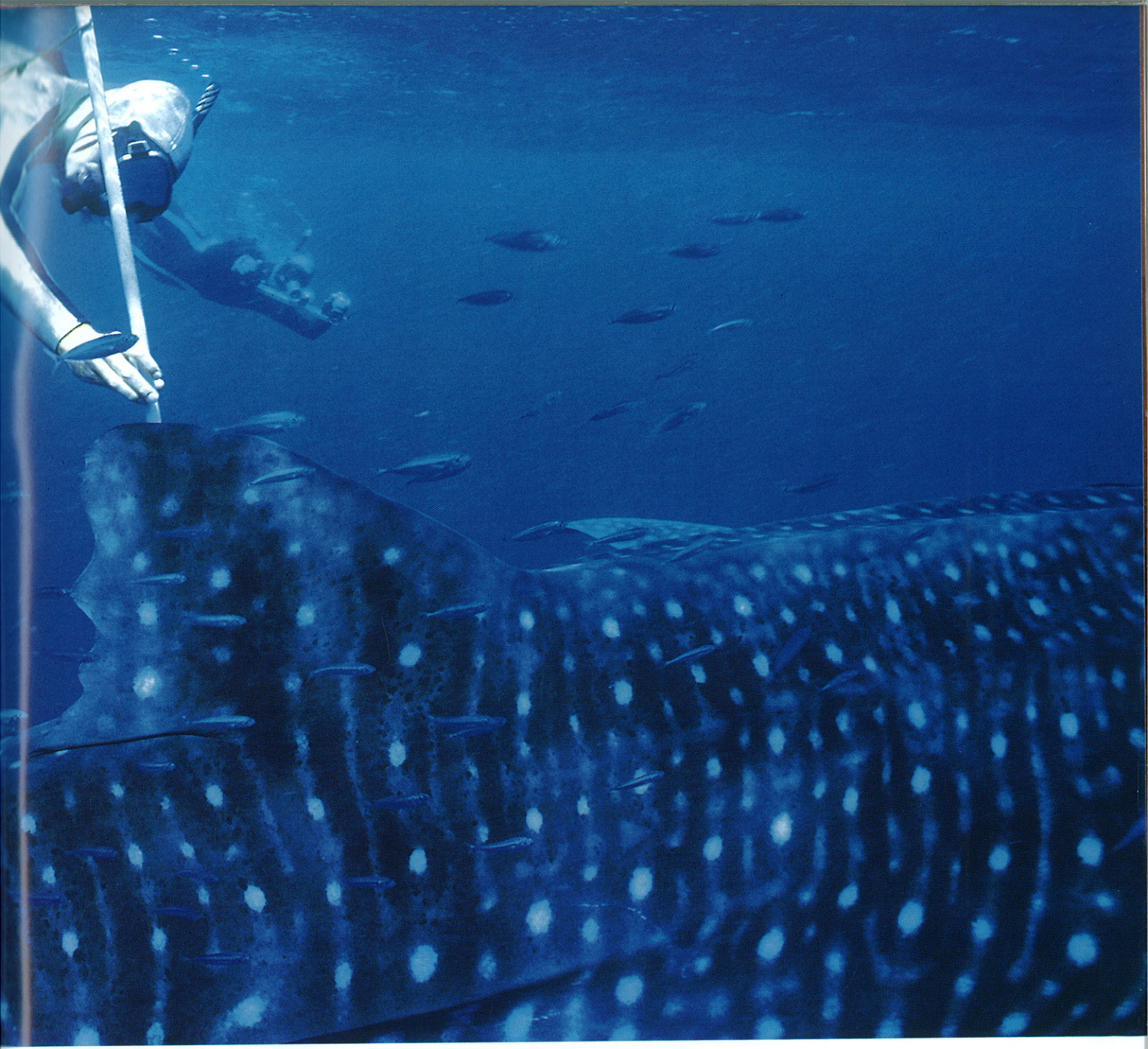
Behavioural indicators of stress can be difficult to quantify in animals like the whale shark. Although the extreme 'dive' response has been recorded when vessels or snorkellers have become close to whale sharks, whale sharks have voluntarily approached vessels and swum around snorkellers for considerable periods of time. This response seems to be situation-specific, with the diving response most frequently occurring when the animal is startled or surprised. At the whale shark's discretion, an extended close encounter is common at Ningaloo.

Habituation of whale sharks to friendly visitor interactions may reduce the level and likelihood of subsequent stress responses. The whale shark tourism industry certainly recognises popular individual whale sharks returning to Ningaloo annually. Unfortunately, this type of habituation may lead to an indirect negative impact on the whale sharks' health—lack of fear of people such as fishers targeting whale sharks for their fins and meat outside of Australian waters is not a positive survival trait..

Injury and mortality

It has been estimated that whale sharks at Ningaloo spend about 17 per cent of daylight hours at the surface. There is therefore a real risk from propeller strike from tourist and visitor boats moving off the reef front. Photos showing fresh propeller scars have been submitted to DEC and the Ecocean photo library (www.whaleshark.org). A recent scientific publication has estimated that 27 per cent of whale sharks at Ningaloo have some level of scarring, albeit not all from propeller cuts.

Whale sharks have a good ability to recover from injury. This was most evident from photos taken at Ningaloo over two years which showed the recovery of a five-metre whale shark from what appeared to be great white or tiger shark bites to its dorsal fin and left tail flank. The initial pictures showed raw tissue indicating a fresh wound. One year later, the wounds had healed well and the whale shark appeared to otherwise be in good health. 'Chompy', as he is now known by the industry, has been sighted every season since the attack.



Elsewhere in the world, juvenile whale sharks have been recorded in the stomach of a blue shark from the tropical Atlantic and another juvenile was found alive in the stomach of a blue marlin caught off Mauritius. In the Gulf of California, predation on an adult whale shark by two orca whales has been documented.

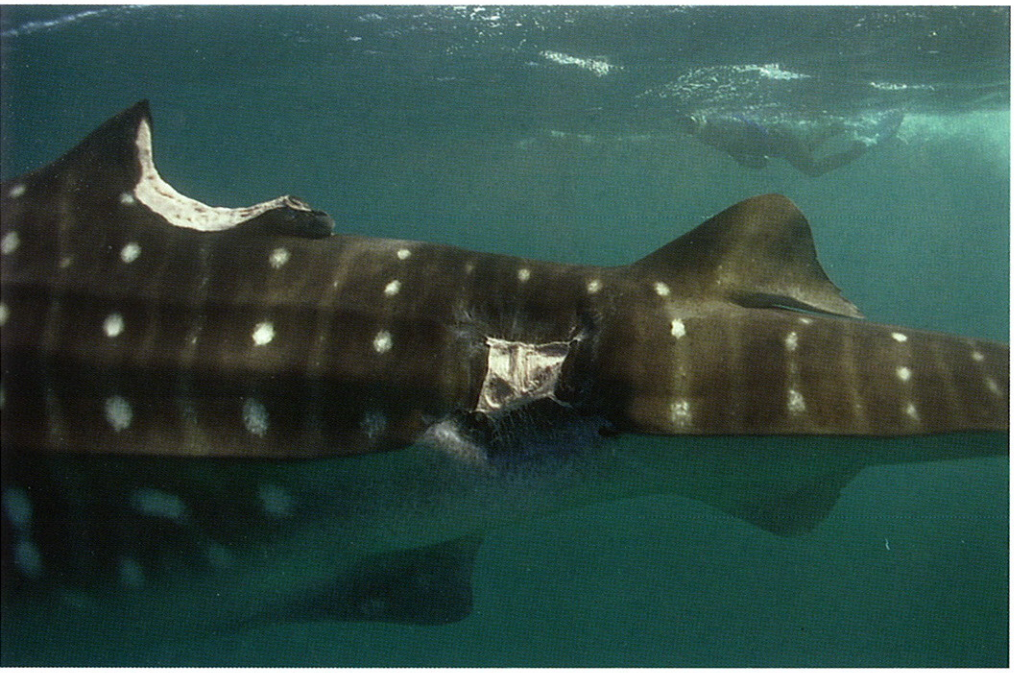
Beyond Ningaloo

Much effort has gone into determining where whale sharks go after they leave Ningaloo Marine Park. The long-term movement patterns of eight whale sharks tagged at Ningaloo showed that these sharks travelled north-east into the Indian Ocean after leaving Ningaloo Reef. The sharks used both inshore and offshore habitats and made frequent vertical movements to at least 980 metres deep. They experienced water temperatures ranging from 4°C to 29°C.

Broader international interest in whale sharks during the past 20 years has led to an improved understanding of their global distribution. Other whale shark aggregation areas have now been identified at Belize, Honduras, the Sea of Cortez, the Seychelles, KwaZulu-Natal, Kenya, Tanzania, Mozambique, Madagascar, the Galapagos, Veraval in India, Mexico, the Philippines, Taiwan and the Maldives.

Recent publicity has focused on the hunting of whale sharks for their fins and meat. In the late 1980s and early 1990s, a traditional whale shark fishery off Verval, India, used hooks to catch the sharks. They used the sharks' liver oil for sealing timber boats. From 1988 to 1991, 647 whale sharks were caught. The meat was initially discarded until after about 1991, when demand for whale shark fins increased in Asian markets.

In Taiwan in the 1970s and early 1980s, 30 to 100 whale sharks were caught each season. By the 1990s, up to 100 sharks a year were being taken off the east coast of Taiwan, where sharks seem to be year-round residents, while about 60 a year were being captured off the west coast where this shark only appears in summer. Catches were higher in the mid-1980s and lower in the mid-1990s.



Left Whale sharks appear to recover quickly after injuries such as shark bites. *Photo – Steve Gibson*

Reports of whale shark hunting also exist for the Philippines with the most important areas being Pamilacan Island and Guiwanon. Catches from all areas ranged from about 20 to 150 individuals a year between 1990 and 1997. In addition to being a target species in certain areas, whale sharks are also taken as by-catch, notably in gillnet and purse seine fisheries.

In Indonesia, surveys conducted by researchers from Murdoch University between April 2001 and October 2005 found four whale sharks had been caught in southern Bali. The fins were removed at sea and the carcasses were not retained. It was suggested that whale sharks were also landed at numerous other fish landing sites throughout Indonesia. However, calculating an approximate number taken on an annual basis in Indonesia was considered to be difficult, if not impossible, to determine. Are these the same whale sharks that visited Ningaloo?

Thankfully, no targeted fisheries remain, with Taiwan agreeing to close its fishery in 2007.

Whale shark tourism is developing globally, often as an alternative to hunting. Western Australia is perceived as 'best practice management' with management agencies looking to, adapting and modifying guidelines and interaction protocols from the Ningaloo model to suit their aggregations and industries.

Future of Ningaloo whale sharks

Despite its very large size, conspicuous skin pattern, and predictable seasonal occurrence in coastal waters at certain sites, the whale shark remains poorly known biologically. The migratory tendencies of whale sharks make long-term direct observation in the oceans extremely challenging.

Whale shark ecotourism operators and visitors are well placed to help conservation managers and researchers gather information on the species that can provide the foundations for more focused research, as well as valuable insights into whale shark behavioural ecology and life history. At Ningaloo, operator logbook data and video images have already helped establish the seasonality of whale shark aggregations, local food types and faunal associations, and their distribution in space and time. They have also helped to identify individuals and develop population models based on resightings.

The Ningaloo whale shark experience has become a successful wildlife interaction program managed by DEC—a government conservation department—based on a non-consumptive use. DEC will continue to seek scientific information that will assist in the conservation and recreation management of the whale sharks through photo identification, behavioural studies, genetic population modelling and tagging. These studies will assist in determining the health of the Ningaloo population and to establish whether numbers are stable, or increasing or decreasing. Behavioural studies will assist in reducing disturbance levels to whale sharks during interactions through continual monitoring, improvement and training in the interaction guidelines. By establishing migration routes, we will gain a better understanding of where the Ningaloo population goes outside of the peak season. This will assist with international protection efforts and in turn ensure whale sharks continue to visit Ningaloo Marine Park.

"The whale sharks swim down
To their hideouts below,
Their most secret places
Where only they go".
(J. Barrymore, *Jinormous Jack*)

Emily Wilson is a Department of Environment and Conservation (DEC) whale shark conservation officer in Exmouth. She can be contacted by phoning (08) 9947 8006 or by email (whaleshark@dec.wa.gov.au).

Roland Mau is DEC's acting District Manager, based in Exmouth. He can be contacted on (08) 9947 8003 or by email (roland.mau@dec.wa.gov.au).

Volume 24 Number 2 SUMMER 2008-09

contents

50 The Ningaloo whale shark experience
Research examines the effect of tourism on whale sharks at Ningaloo.

57 Missing mammals: a 100-year-old mystery
A scarcity of mammals puzzled an English researcher in WA 100 years ago.

Regulars

3 Contributors and Editor's letter

9 Bookmarks
Perth Western Australia: from dawn till dusk
Albatross: their world, their ways
Shark Bay: twin bays on the edge

25 Endangered
Tumulus Spring Ecological Community

38 Feature park
Gloucester National Park

62 Urban Antics
Delicate as ...

Publishing credits
Executive editor Kaye Verboon.
Editors Samille Mitchell, Rhianna King, Carolyn Thomson-Dans.
Scientific/technical advice Kevin Kenneally, Paul Jones, Keith Morris.
Design and production Natalie Jolakoski, Tiffany Taylor, Gooitzen van der Meer.
Illustration Gooitzen van der Meer.
Cartography Promaco Geodraft.
Marketing Cathy Birch
Phone (08) 9334 0296 *Fax* (08) 9334 0432.
Subscription enquiries
Phone (08) 9334 0481 or (08) 9334 0437.
Prepress and printing Lamb Print, Western Australia.
© ISSN 0815-4465

Please do not send unsolicited material, but feel free to contact the editors.

Visit www.dec.wa.gov.au

Published by the Department of Environment and Conservation, 17 Dick Perry Avenue, Kensington, Western Australia.

Department of **Environment and Conservation**
Our environment, our future