THE SAVE OUR SEAS FOUNDATION MAGAZINE

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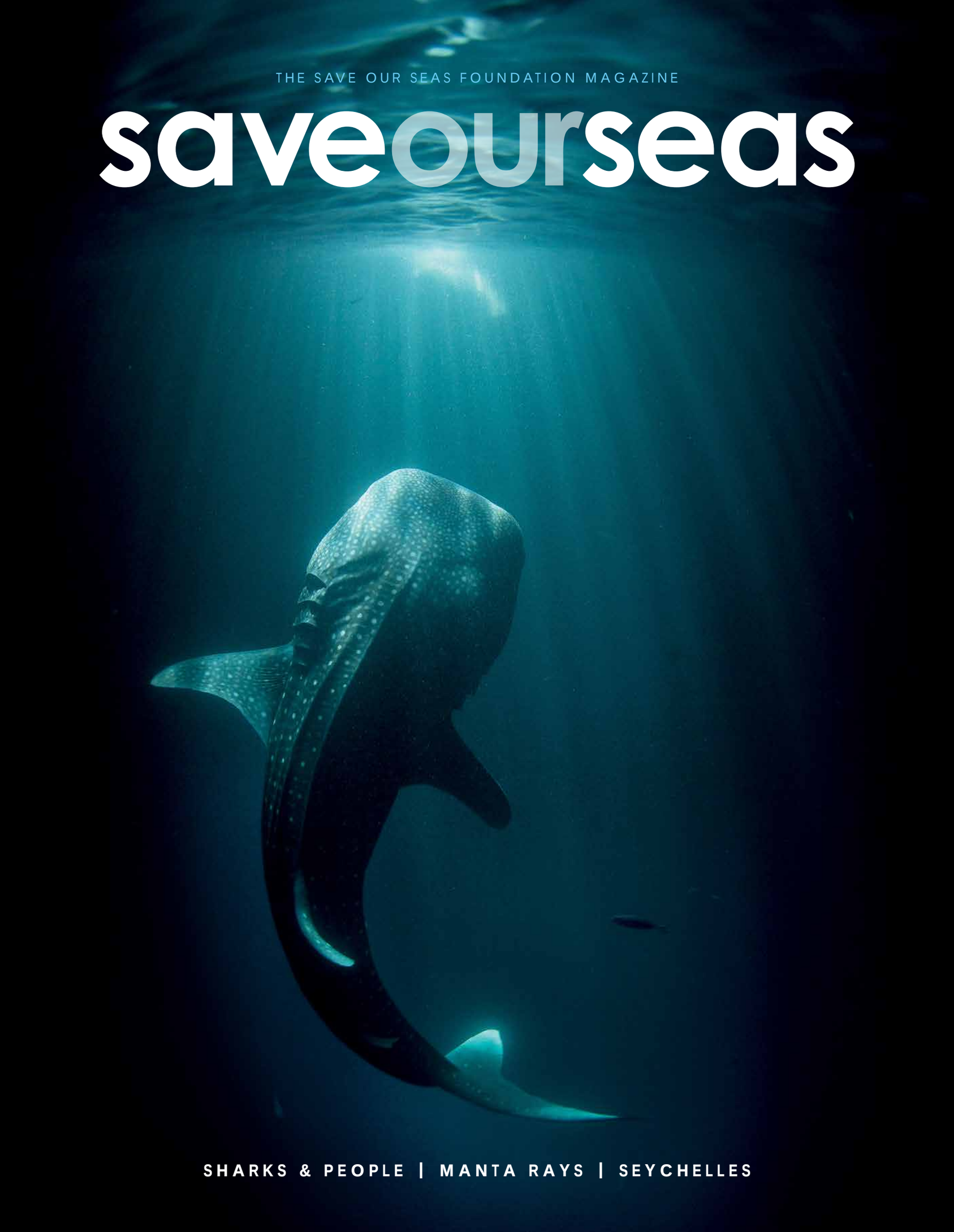

SHARKS & PEOPLE | MANTA RAYS | SEYCHELLES

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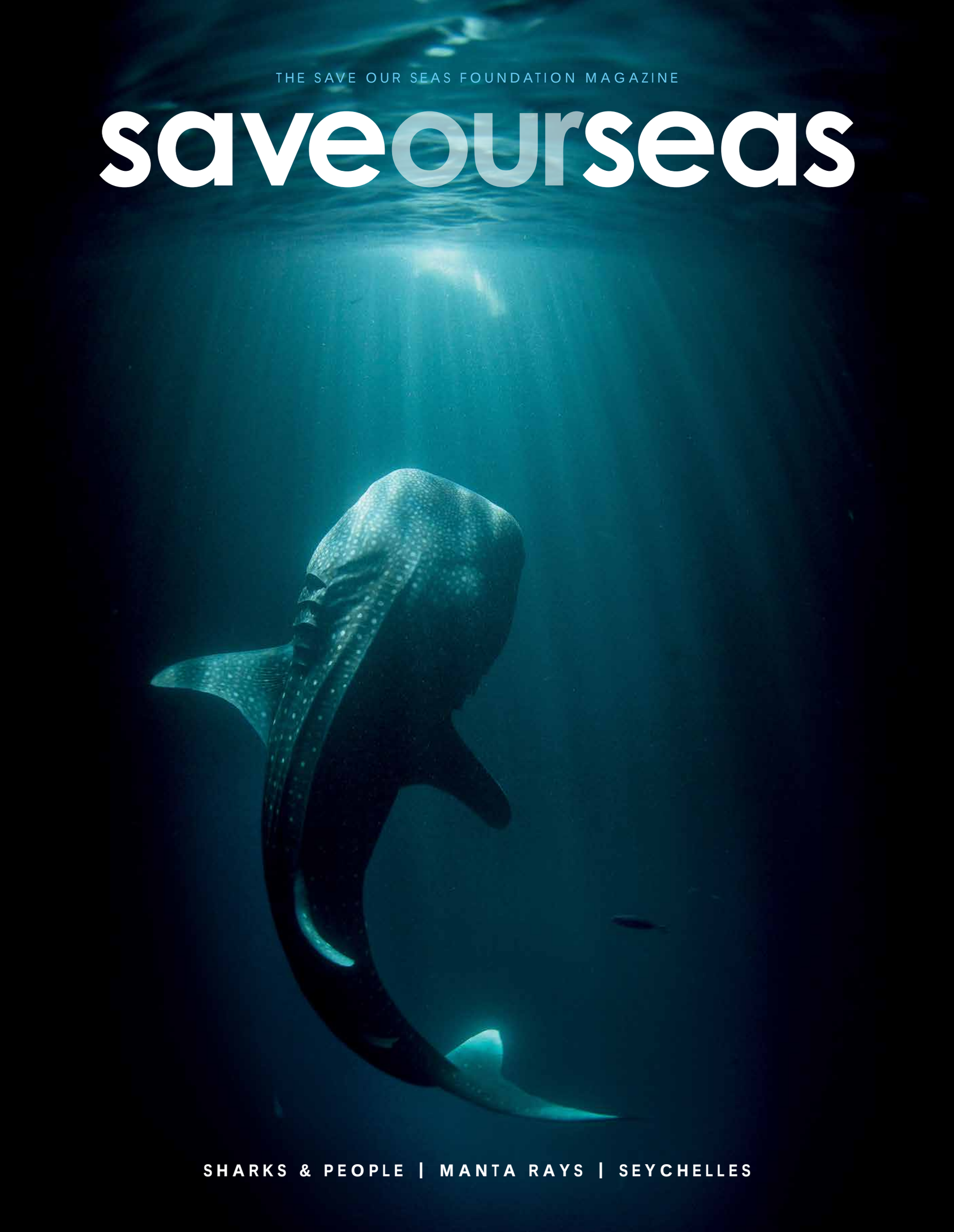

SHARKS & PEOPLE | MANTA RAYS | SEYCHELLES

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PHOTO BY THOMAS P. PESCHAK

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PHOTO BY THOMAS P. PESCHAK

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Professor of marine science at Nova Southeastern University's Oceanographic Center in Florida, and director of the SOSF Shark Research Center.

Sarah Fowler
Principal scientist for the Save Our Seas Foundation and shark conservationist for three decades, serving on governmental bodies and in NGOs.

THE BIOMASS of predatory reef fish is incredibly high at Aldabra Atoll (Seychelles) and Bohar snappers are amongst the most abundant. Large schools aggregate at the mouth of the channels that funnel water in and out of the lagoon and these readily eclipse coral pinnacles.

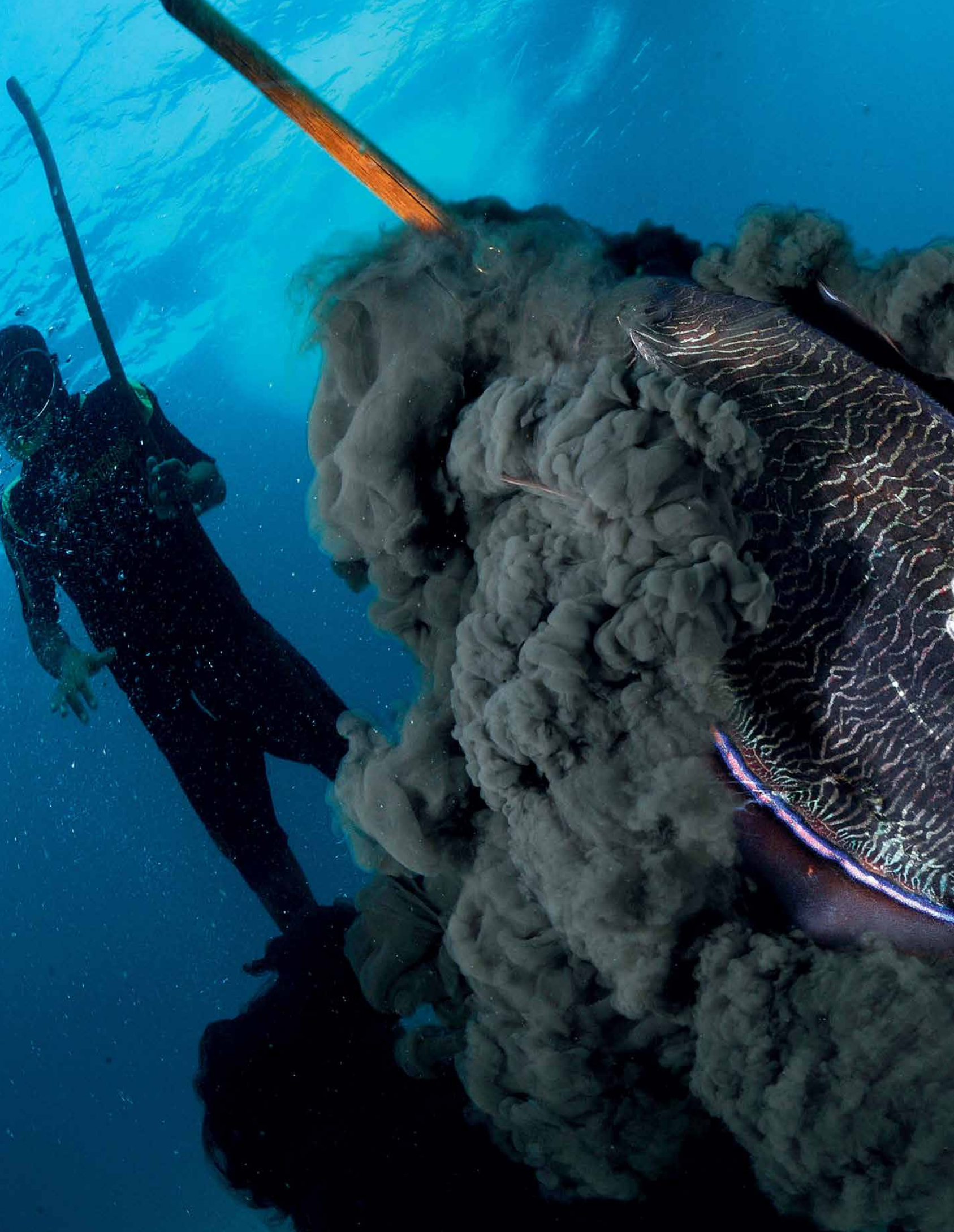
PHOTO BY THOMAS P. PESCHAK

A CAPE GANNET approaches low to land on Malgas Island (South Africa), one of only six nesting locations in the world for this threatened species. During the breeding season this rocky outpost off the South African west coast is carpeted by tens of thousands of gannets.

PHOTO BY THOMAS P. PESCHAK

TODAY STILT FISHING is only practiced by a small number of families along the south-west coast of Sri Lanka and many practitioners died during the Indian Ocean tsunami of 2004. The exact origins of this unique technique are unknown, but it is believed to have begun only after the Second World War as a way for fishermen to access more productive fishing grounds at high tide.

PHOTO BY THOMAS P. PESCHAK



IN OMAN free divers harvest cuttlefish with long hooks. A depth refuge and fast reproductive cycle make this fishery amongst the more sustainable in the region. I came across these fishermen while free diving around some offshore islands and they dragged me behind their boat across their fishing grounds until I was able to photograph the moment they caught a cuttlefish on one of their hooks.

PHOTO BY THOMAS P. PESCHAK

FOUNDER'S NOTE

THE CHALLENGES OUR OCEANS and their inhabitants face today are vast. Since its inception 10 years ago, the Save Our Seas Foundation has funded 160 projects in more than 40 countries across the globe. Each project, in its own unique way, strives for a deeper understanding and therefore better solutions in the areas of marine science research, conservation and education.

The raw ideas upon which the organisation was founded are: a shared passion for sharks and the oceans, a willingness to invest in early career professionals, and a desire to communicate beyond the boundaries of traditional scientific publications.

To celebrate our 10th anniversary, we are launching our new *Save Our Seas* magazine. This publication is a celebration of these principles by showcasing incredible stories from Save Our Seas-funded projects all over the world.

"As long as there are people who care,
we can and will make a difference."

The Founder – Save Our Seas Foundation

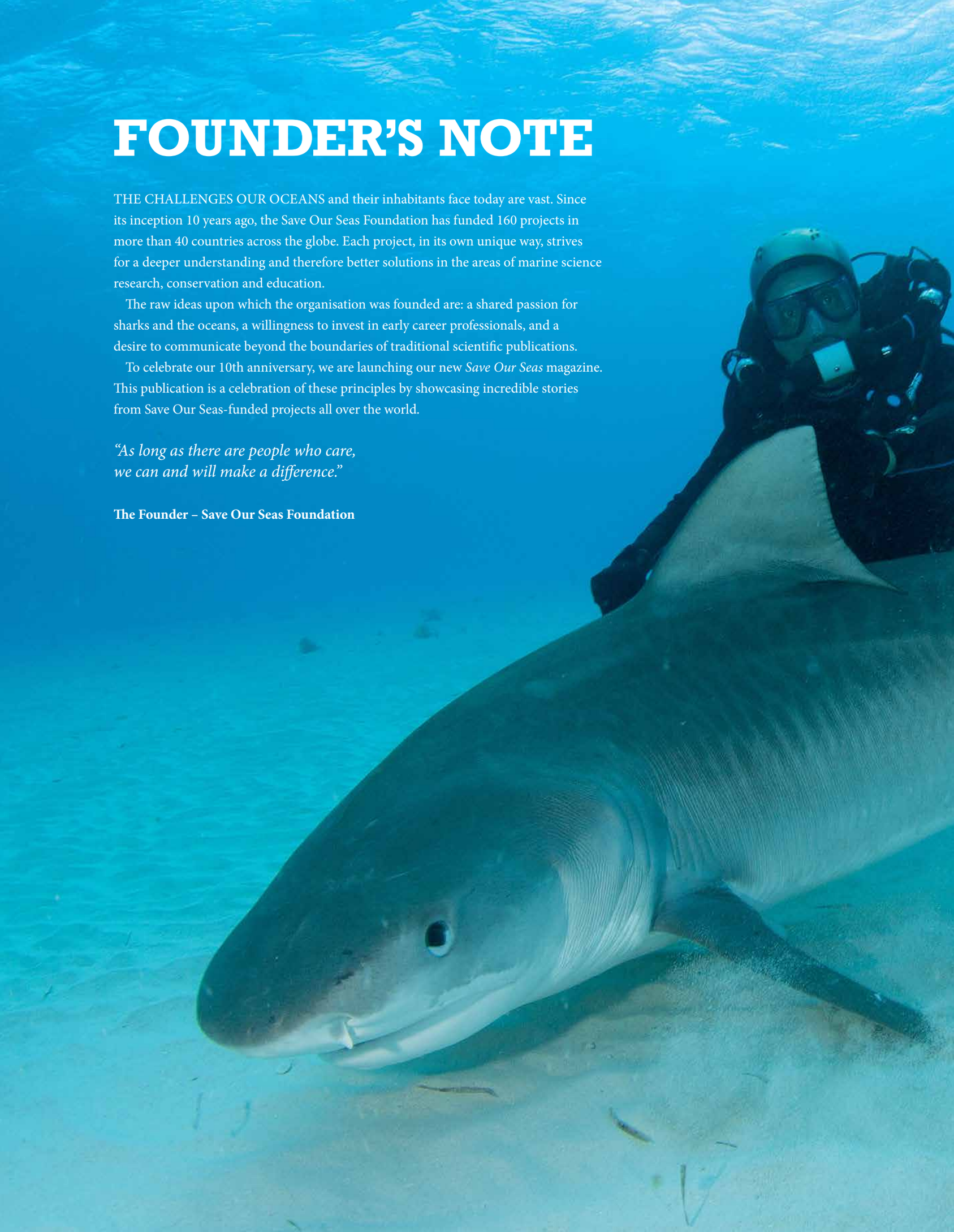


PHOTO BY JIM ABERNETHY FOR DANAH DIVERS

PHOTO BY: THOMAS P. PESCHAK

A NOTE FROM THE CEO

Michael C. Scholl

My earliest memories of sharks come from articles in *National Geographic Magazine* and Jacques Cousteau's documentaries. These elements ignited my passion for the oceans, and especially for sharks.

On September 23, 2003, the Save Our Seas Foundation was created in order to safeguard the future of the oceans, particularly for sharks. A tall order, to be sure, but with every project funded we make positive steps towards realising this goal.

To quote Peter Benchley's infamous bestseller, *Jaws*, 'Sharks have everything a scientist dreams of. They're beautiful. They're like an impossibly perfect piece of machinery. They're as graceful as any bird. They're as mysterious as any animal on earth.' As most of us know, the book, followed by the movie embedded a viral and irrational fear of sharks. However,

since the book was published in 1974, shark-focused research, education and conservation has shifted the image of these animals from terrifying man-eating beasts to fascinating and important animals in need of protection.

The inaugural issue of our magazine is a visual celebration of our work. Today, with more than 160 projects in more than 40 countries, we have supported both emerging and established scientists, conservationists and educators all over the world. We hope that through this magazine, you can get a glimpse of the exciting projects we fund – many of them focused on charismatic marine megafauna.

Through powerful imagery, we highlight the incredible diversity and beauty of nature, but also the impact that we have on the oceans. With this magazine, we strive to be a model in conservation media, bonding compelling visuals with revealing content.

I believe that knowledge is key in creating holistic conservation strategies. In a world that thrives on negative media, we want this magazine to be a driver of optimism – showcasing the ripple effect that one organisation can have in the world of ocean conservation.

ABOUT THE FOUNDATION

In the effort to protect our oceans, the Save Our Seas Foundation funds and supports research, conservation and education projects worldwide, focusing primarily on charismatic threatened wildlife and their habitats. From a small not-for-profit organisation funding just five projects, in less than 10 years, the Save Our Seas Foundation (SOSF) has grown to become a major player in the fight to save the world's oceans and the wealth of marine life they contain. While SOSF itself is not a research institute, its generous contributions of both financial, practical and scientific support have, to date, facilitated more than 160 marine research and conservation projects around the world.

To find out more about the foundation visit: *saveourseas.com*

save our seas foundation

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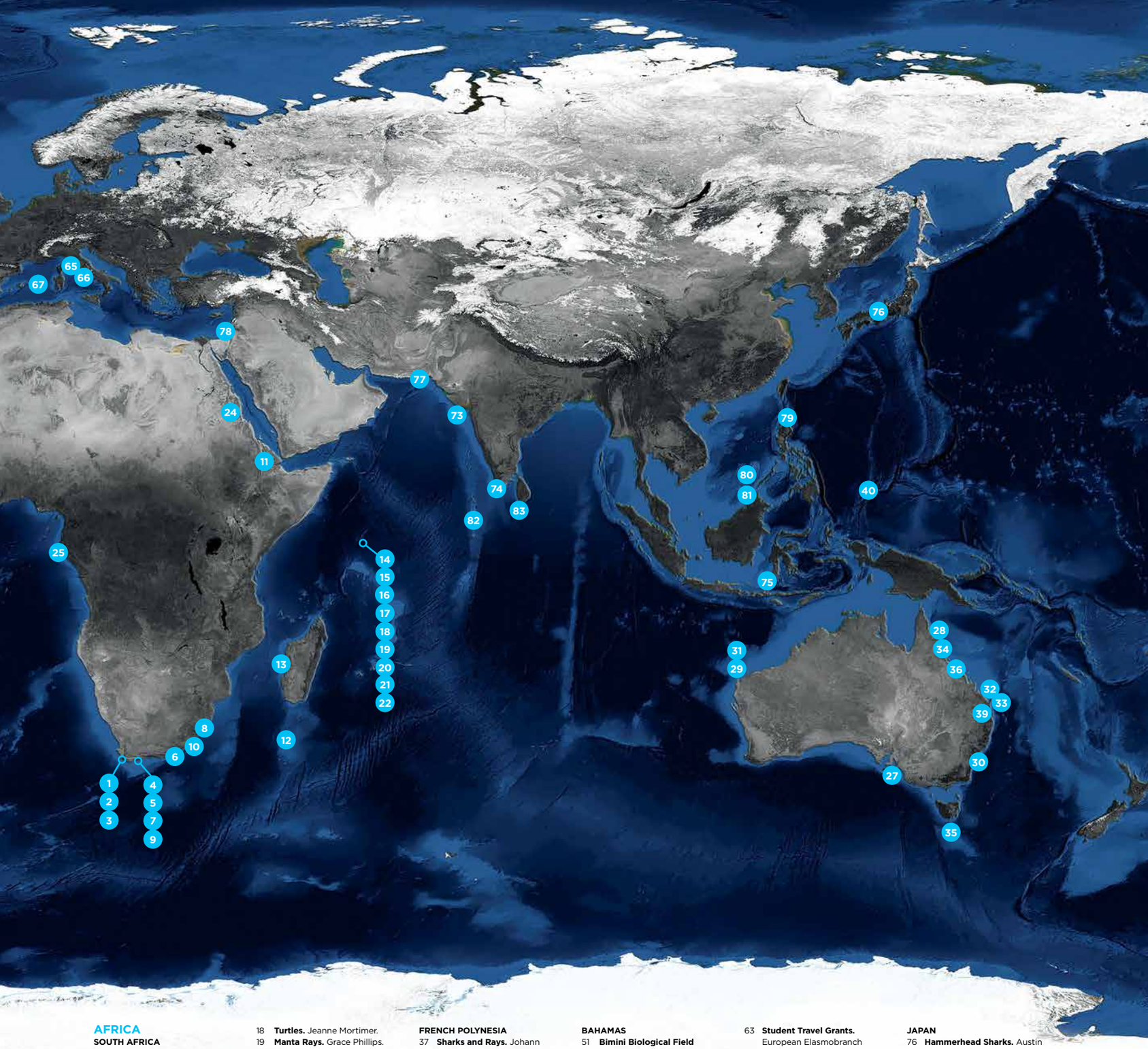
THE SAVE OUR SEAS FOUNDATION was founded in 2003 with a mission to protect our oceans by funding and supporting research, conservation and education projects around the world, focusing primarily on charismatic threatened wildlife and their habitats. In that time, the foundation has sponsored 160 projects in more than 40 countries, proudly supporting outstanding researchers, educators and conservationists who have contributed to the continued existence of more than 60 of our planet's precious marine species. To celebrate our 10th anniversary and to honour our legacy of supporting young scientists and conservationists, we welcome the first 18 recipients of the SOSF Small Grant programme in 2014.

To find out more about our funded projects visit: *saveourseas.com/projects*



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A PLACE TO GO

11° 42’ 0” N, 43° 0’ 0” E

Gulf of Tadjoura, Djibouti

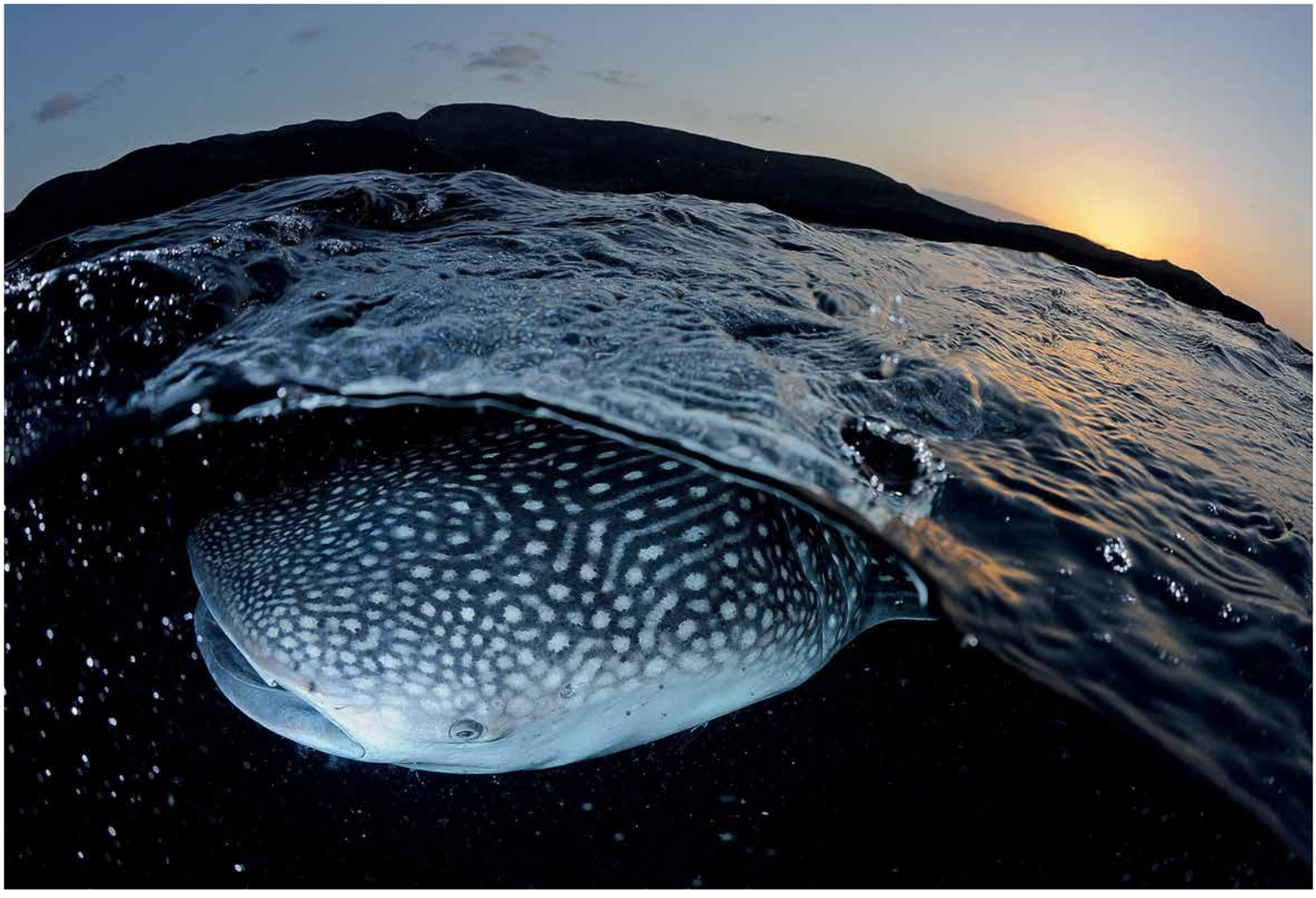


PHOTO BY THOMAS P. PESCHAK

DJIBOUTI IS A SMALL SLICE of Africa that snuggles in between Somalia and Eritrea, just where the Red Sea blends into the Indian Ocean. This makes the Gulf of Tadjoura a diverse and unique habitat where marine life is prolific. Those brave enough to enter the oil-black night-time sea, could have a staggering encounter with the world’s largest fish. This is the only known location where juvenile whale sharks gather and the only place where they are regularly documented feeding at night. This 2.5-metre animal was photographed feeding on zooplankton that had been drawn to the surface by the lights of small fishing boats.

Whale shark
Rhincodon typus
Conservation status:
Vulnerable

A whale shark feeds on zooplankton drawn to the surface by the lights of fishing boats.

Republic of Djibouti
Horn of Africa
Indian Ocean

BIG BRUV IS WATCHING YOU, UNDERWATER

BAITED REMOTE Underwater Video Stations (BRUVS) under the BRUVS in False Bay project, South Africa, will soon be providing the first video-based surveys of fish and sharks across all habitats in False Bay.

Lauren de Vos
BRUV scientist

Other underwater monitoring techniques in South Africa to date, such as SCUBA surveys and controlled angling surveys, have been expensive, reliant on skilled labour, and usable only to certain depths and in particular ocean conditions.

BRUV technology, however, is evolving rapidly as camera technology becomes more affordable and increases in resolution quality. The concept is simple: fish are attracted within the field of view of an underwater camera, and the footage can be brought ashore to be analysed.

Capturing sharks on camera is not about providing hair-raising entertainment, but about adding to the growing body of knowledge that allows us, through improved understanding and perspective, to better protect sharks and fish and live alongside them with respect and consideration.

The ability to monitor the distribution and abundance of slow-growing, slow-to-reproduce species of shark with remote cameras will hopefully offer a low impact option for long-term conservation.

Video footage used as scientific data plays an equally important role in education, making False Bay and its life a tangible reality that the public is both privy to, and responsible for.

As such, the BRUVS in False Bay project offers a phenomenal opportunity to close a gap between scientists, fishers and the public, while obtaining sound scientific data that will guide conservation decisions in one of South Africa's most utilised and valuable coastal bays.

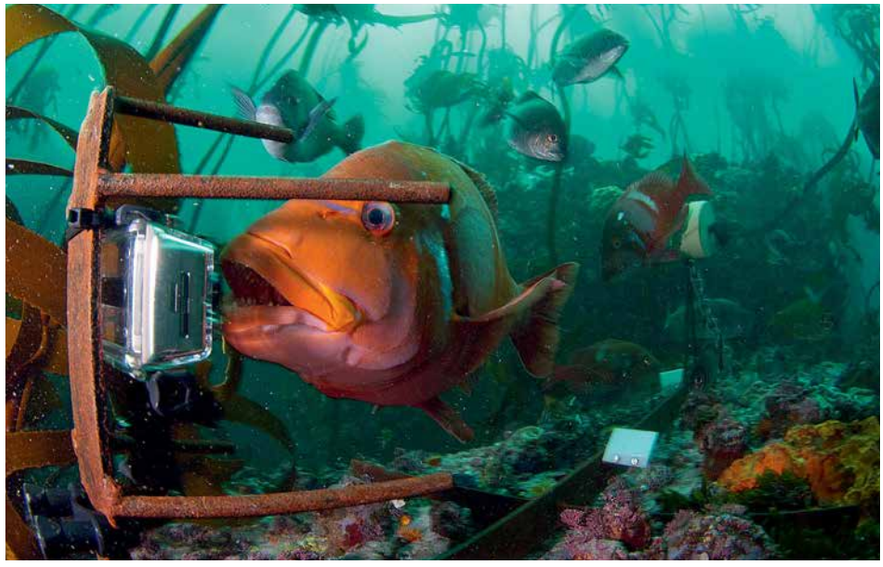


PHOTO BY STEVE BENJAMIN

CAUGHT ON CAMERA To maximise data collection, multiple camera rigs are being set up to film fish and sharks in False Bay, simultaneously, for one hour each.

INDONESIAN MANTA RAYS PROTECTED

New legislation makes manta rays a fully protected species in Indonesia

In late February, Indonesian minister of marine affairs and fisheries, Pak Agus Dermawan, signed an agreement enforcing full protection of manta rays in the country. The legislation was supported by various NGOs and scientists, including SOSF funded Sarah Lewis of the Manta Trust. 'Indonesia has the biggest shark and ray fishery in the world, but the government has come to realise the value of manta rays for tourism. Only a year after they were listed on CITES, the ministry has pushed for their protection.
I feel really proud and inspired by Indonesia and think that this move sends an important message to conservationists around the world to not give up on the animals that they are working to protect'.

Indonesia consists of more than 17,000 islands and a diverse range of marine habitats that provide a home to some of the richest shark and ray populations in the world. Both reef and oceanic mantas thrive in Indonesian waters, but until recently, we knew very little about these animals. Sarah Lewis has lived in Indonesia since 2010. Her research provides significant insights into the ecology, biology and movements of these animals, as well as the manta fishing industry in the country.

>17,000

THE NUMBER OF ISLANDS THAT MAKE UP INDONESIA

MARINE EDUCATION

SOSF SHARK EDUCATION CENTRE

KALK BAY, the quaint seaside fishing village on the southern end of Cape Town has been home to the Save Our Seas Foundation Shark Education Centre since 2008. Over the past five years, the centre has become a hub for marine education, research and dialogue.

'People need to know why we need sharks in the sea. We're surrounded by ocean users in Kalk Bay and many of them don't know much about conservation. This centre in an awesome resource in a very relevant location,' explains facilities manager Heidi Thormählen.

The community of Kalk Bay has been determined by rising and falling ocean tides for centuries. The town's name is derived from the Dutch word for lime. The village's first residents were 17th-century lime-burners who extracted lime from sea-shell deposits. Later, in the 1840s a Filipino ship was wrecked off Cape Point. The survivors settled in Kalk Bay and it grew into a thriving fishing village. Many colourful commercial boats are still docked in Kalk Bay harbour and tourists visit the town to watch fishermen offloading catches of yellowfin tuna, yellowtail and snoek.

The area is also South Africa's oldest ocean research and education hub. In 1902 the country's first Marine Aquarium and Research Station was established in nearby St James. Sadly, the Marine Aquarium was demolished in 1954. It seems very appropriate that the Save Our Seas Shark Education Centre should fulfill this valuable role in modern day Kalk Bay.

In early 2013, the centre refined its mission 'to connect the public to the marine environment through experiential education programmes focused on sharks and local marine ecosystems, in order to nurture ocean awareness and environmentally responsible actions.'

On most weekday mornings, the building is filled with curious children. Like a huge, gurgling magnet, the aquarium immediately draws them in. They push each other aside to get a better look, pressing their hands and faces up against the glass. 'They're just swimming round and round,' a Grade 2 pupil says dismissively. His friend is indignant: 'That's what fish think of the human world. Just walking round and round!'

Paul Millar, the centre's chief educator loves seeing these kinds of interactions amongst learners: 'I enjoy being involved in what for many kids is the awakening of a new way of seeing the world as a beautiful and fragile home to be nurtured. For the children who already see the world this way, I enjoy sharing their excitement and fascination for marine life.'

Shark Centre educator Paul Millar explains the wonders of tidal pool systems to a group of enthusiastic young learners.

Cape Town
South Africa

After a 30-minute talk about rock pool ecosystems, the children trail out of the building for a few hours of hands-on rock pool discovery. They are immediately captured by the starfish and try to remember the names of the different species. One little girl squeals, pointing at a purple anemone: 'It's like a cup with hair on top!'

Maria Doyle, a teacher at Forres Primary watches as child after child picks something up for Millar to

PHOTO BY SOSF/PETER VERHOOG

identify and explain. He is careful to ensure that each little sea creature is put back exactly where it is found. 'This is my favourite outing,' says Doyle. 'We used to take them to the aquarium but it's dark and everything is contrived. Here they really get an interactive, authentic experience.'

The swarm of eight-year-olds is being led closer and closer to the kelp by Millar. One little girl trails at the back, thinking carefully about every footfall. Doyle watches her, 'It's funny. She lives 20 minutes from the sea, but I don't think she's ever learnt to walk on rocks.'

South Africa's complex history has created an unjust and largely dysfunctional social structure. It is a country where your education, wellbeing and even understanding of nature are determined by where you fall on a steeply graded socio-economic scale. Walking from one end of Kalk Bay to the other, you will see SLR wielding tourists browsing boutique galleries and chatting in precocious coffee shops. You will also notice barefoot, ragged children banging on home-made instruments and belting out 'When the Saints go marching in', in a desperate attempt to earn some money.

With an unemployment rate of 25 percent, many children cannot rely on their parents for food and clothes, let alone an introduction to the natural world and the animals they share it with. 'Most people from the township are scared of sharks. They tell their children not to go into the sea because they'll be eaten by sharks,' explains Zanele Mayiya, the Shark Centre's assistant educator.

Thousands of Cape Town's children live within walking distance of the sea but only set foot on the sand once or twice a year at Christmas time. It is a reality that saddens Millar, who believes that marine education is as important for the environment as it is for the children themselves: 'More and more South African children do not have a direct connection to nature. Apart from the emotional and health benefits of living a life that is connected to the natural world, individuals who grow up engaging with nature are more likely to understand the importance of healthy natural systems and make environmentally responsible choices.'

MARINE
EXPLORERS CLUB

MARINE EXPLORERS CLUB LAUNCHES

IN LATE 2013 a group of 11 enthusiastic and intrepid 12-year-olds from Capricorn Primary School took part in a new Shark Education Centre initiative called The Marine Explorers Club. The project is run by educators Paul Millar and Zanele Mayiya, and aims to give youngsters from underprivileged backgrounds their first hands-on experience of the ocean by teaching them to snorkel. The children were from Capricorn Primary School and all live within easy walking distance of the beach.

Over six weeks, and under the expert guidance of trainers from Padi Dive School and UCT Diving Club, they were transformed from tentative swimmers into capable snorkellers. During the course, the children learned basic diving skills as well as important lessons about the ocean. 'I love it when we duck dive and I want to see a leopard shark, catshark, blue shark and ragged tooth shark,' said an excited Steven Sankoma.

'The hope is that exposing children to the sea in this way will inspire a love of the ocean and encourage environmentally responsible behaviour – all kids know they shouldn't litter, but by creating a bond between them and the ocean we're giving them a reason to look after nature,' explains Millar.

OF SMART PHONES AND FISHERIES

SOSF funding has enabled Blue Ventures to do the first ever trial with Madagascan communities to collect shark fishery data using smartphones, writes Frances Humber

For six years a research and conservation programme supported by the SOSF, called Blue Ventures, has been working with the Vezo communities of southern and western Madagascar to collect data on shark landings. Training and employing a network of community-based data collectors has enabled them to gather comprehensive data on the traditional shark fishery across hundreds of kilometres of remote coastline. The programme has also employed the use of digital cameras in order to provide a visual record of shark landings in each village, to help with ID, and provide a means to verify data.

However, the delay in data from the field to researchers can range from two to six months. It is this delay, and seeing the rapid expansion of the mobile phone network in Madagascar, that led them to consider whether using smartphones to collect fisheries data would reduce the delay in receiving information from the field.

To this end, an app is being developed and trialled with seven community data collectors in two regions of Madagascar. The app allows for standardised data entry through a system of menus and hints, for photographs to be taken of each animal landed, and for data to be sent as soon as it is collected via the 3G network to an online database.

Training sessions are being held to facilitate familiarity with smartphones and using the app, and data collectors are also being provided with a personal credit allowance each month to further encourage phone use.

Speaking of the potential to use the technology for other applications, and for other fisheries and Blue Ventures' projects in Madagascar alike, Blue Ventures project leader Frances Humber says, 'We believe this technology could be used by a wide range of organisations and disciplines to increase information flow in and out of remote areas.'

As proof of the progress so far, and after six years of religiously filling in copybooks, data collectors in London have now witnessed the first shark fisheries data sent directly via mobile phone from a remote village 9,000 kilometres away in Madagascar.

Frances Humber says, 'We've been able to demonstrate that the benefits of new technology can be harnessed in the most remote communities to improve understanding of local fisheries.'

ARTWORK BY ALESSANDRO BONORA

NEW TECHNOLOGY
Filling in fisheries data on a smartphone.

PHOTO BY JIM ABERNETHY

ALL THE LITTLE THINGS

JEANETTE WYNEKEN runs the Florida Atlantic University Marine Lab's sea turtle programme. It is the only lab in the world that routinely raises leatherback turtles for study. This species is exceptionally difficult because of its unusual diet (jellyfish and their relatives), behaviour (leatherbacks swim almost constantly and don't recognise barriers such as tank walls) and fragile health.

Once the little turtles are big enough, they are tagged and released offshore. Tracking imperilled animals is key to conservation. Along with colleague Kate Mansfield and several students, Jeanette tracks where the little turtles travel to and uses other ocean information to identify whether they are in a 'safe' neighbourhood or a 'bad' one.

We can't prevent animals from travelling to high-risk areas, but we can identify hotspots or key time periods that need conservation and management attention.

FROM THE FIELD

GUY STEVENS

A short interview

What is the first thing you see when you open your eyes?
Usually my alarm clock, which I always turn to snooze…
I'm not a morning person!

How did you come to live and work in the Maldives?
My Dad gave me a £25 gift voucher for Waterstones bookshop when I was at university. I bought a book on the fish of the Maldives even though I had no idea where this country was at the time, or anything about manta rays (I just liked fish). I guess it was fate that I ended up getting a job as a marine biologist after university to work on a dive liveaboard vessel in the Maldives.

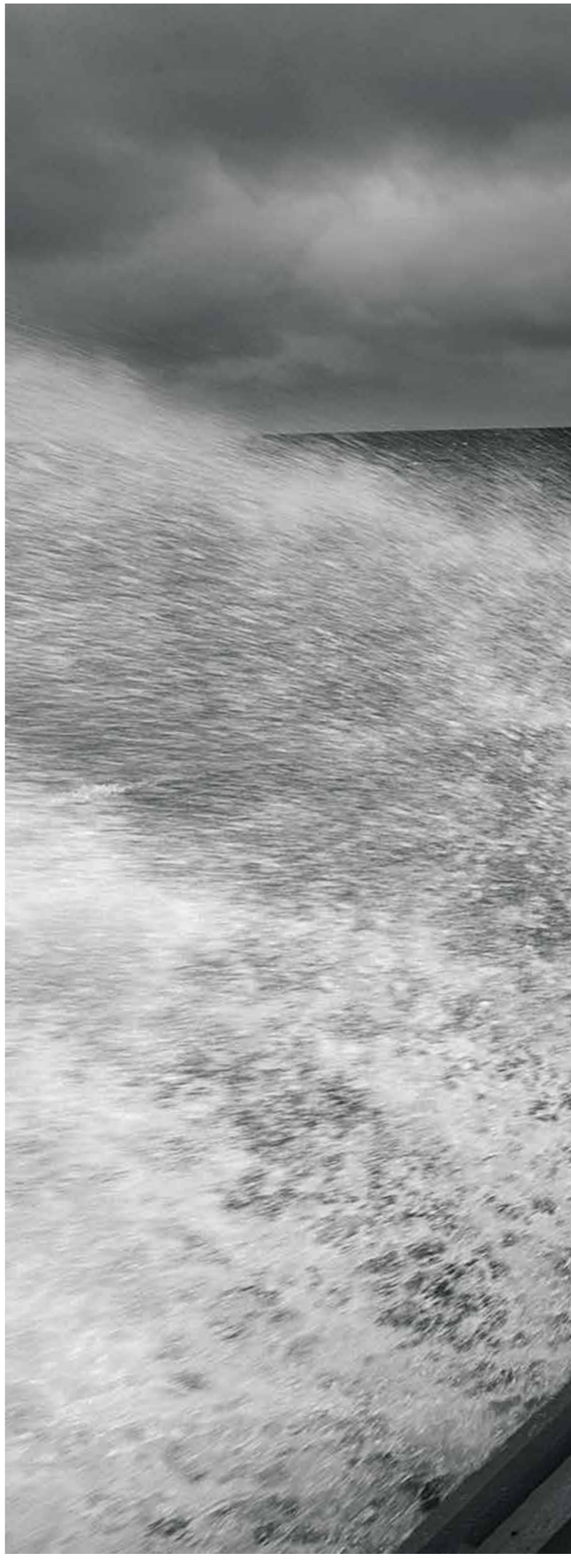
What do you feel is unique about being based in the Maldives?
The Maldives is a tropical paradise, comprised of 1,200 islands. It's a country of tiny specks of land in the vast Indian Ocean; an oasis for manta researchers.

What captivated you the first time you saw a manta ray?
Its grace, its size and its inquisitive nature. When you look into the eye of a manta ray and wonder what it's thinking, you always get the feeling it's looking back at you and pondering the same question.

What are your biggest fears for these animals?
That by the time I have kids of my own (although many people told me it would be better if I didn't) and they're old enough to have their own encounters with these amazing animals, there won't be any left in our oceans.

Describe your most exciting moment as a manta researcher
Diving alone in the middle of a spiraling mass of 150 cyclone feeding manta rays at Hanifaru Bay in the Maldives. Everywhere I looked mantas the size of small cars sped past within inches of my face, their massive mouths agape, hoovering up the dense plankton.

What is your favourite place in the world?
Ha ha… anywhere there are manta rays. But if I had to pick one place, it has to be Hanifaru Bay in the Maldives. There's nowhere else like it on this planet.



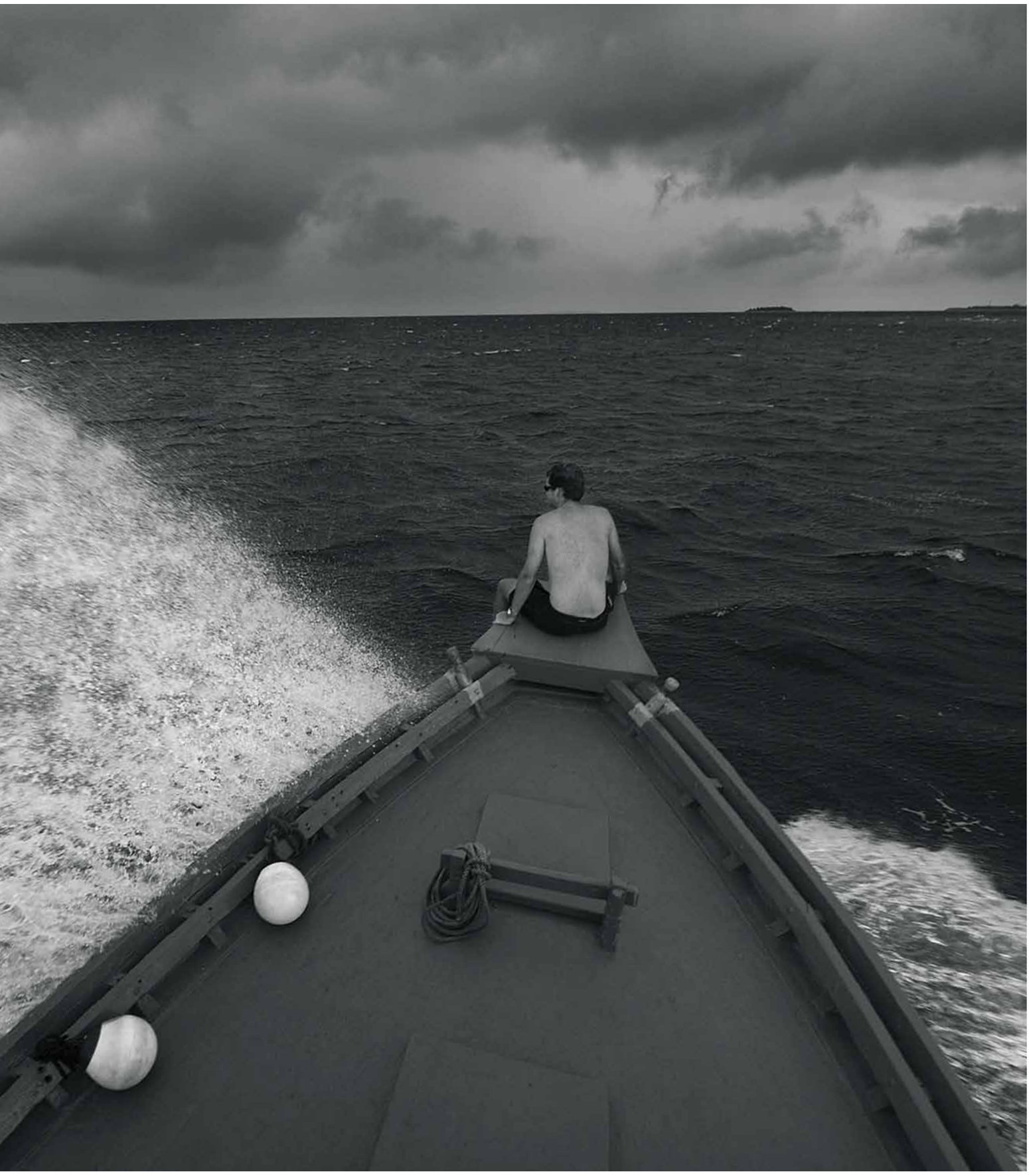
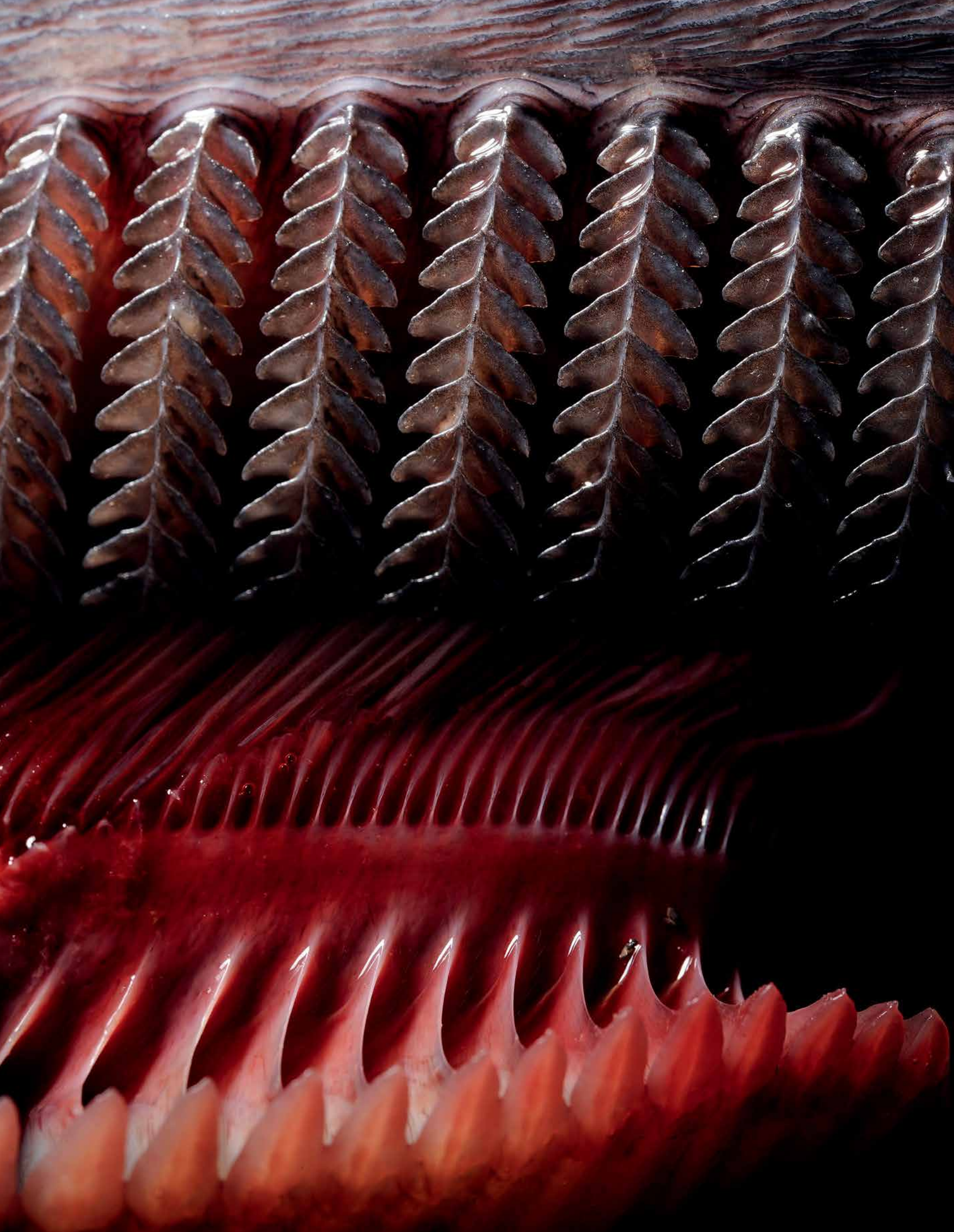
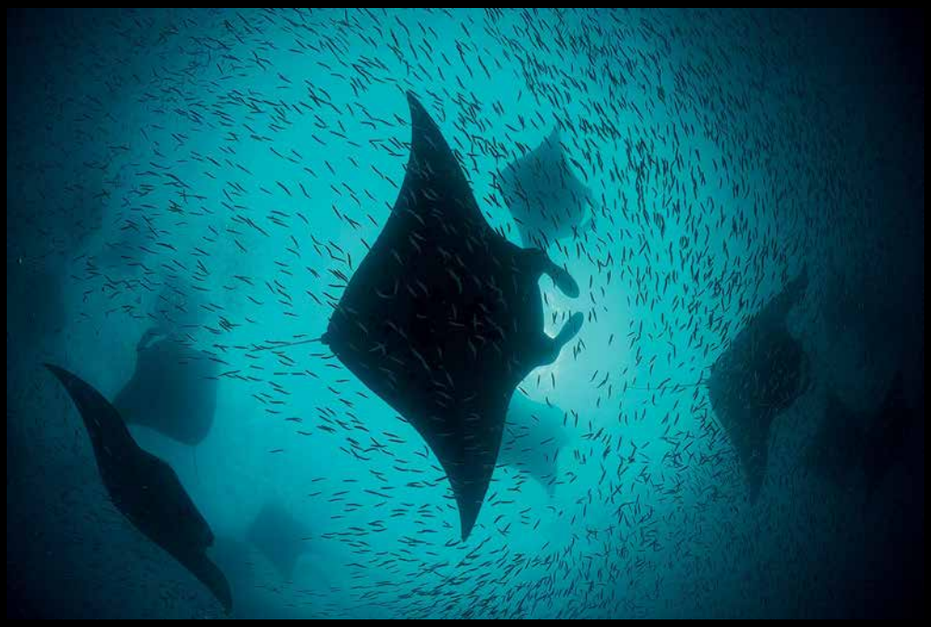


PHOTO BY THOMAS P. PESCHAK





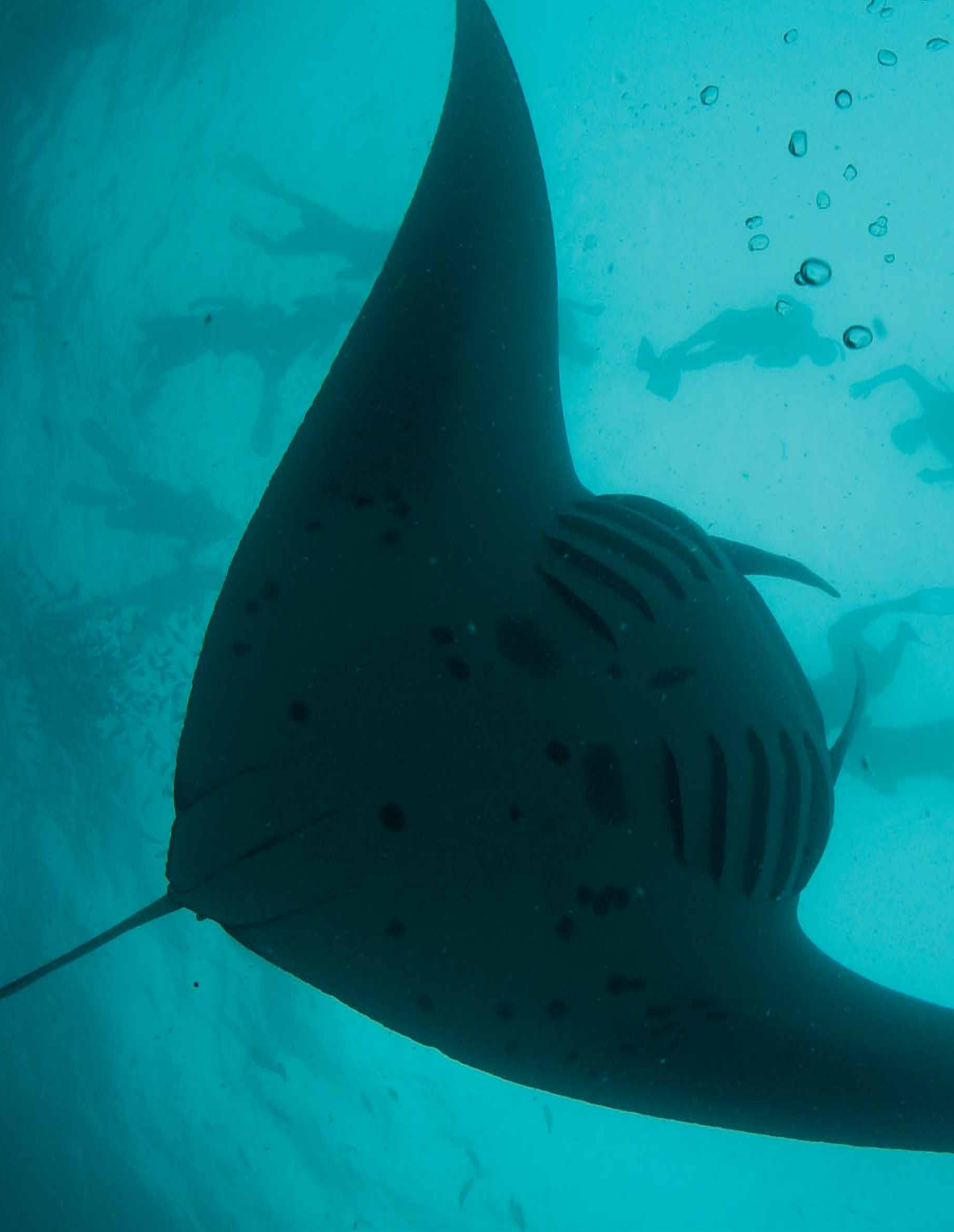
DEVIL FISH

MANTA RAYS OF THE MALDIVES

Chief executive of Manta Trust **Guy Stevens** has spent a decade unravelling the lives of the manta rays that inhabit the coral reefs of the Maldives. Here is some of what he has seen and learnt.

Words by Guy Stevens
Photography by Thomas P. Peschak

Fishermen and market traders weave their way through islands of fish that are sold to the highest bidders. The manta and mobula rays, being the lowest valued commodity, are the last to sell.



A reef manta ray (*Manta alfredi*) swims in tight backward somersaults, looping over and over again as it feeds on a dense patch of planktonic prey, while snorkellers above watch the performance.

Storm clouds loom on the horizon as the monsoon currents whip up the waves and drive plankton into the shallows where the mantas gorge themselves on the ephemeral windfall.

Spectacular mass feeding events like this occur about a dozen times a year inside Hanifaru Bay, where as many as 200 individual mantas feed together inside this small natural cul-de-sac of reef.

Specialised cephalic ‘head’ fins funnel plankton-rich water into a huge gaping mouth, where feathery plates line five pairs of gills that sieve the tiny planktonic manta food from the water.

“Manta rays are the embodiment of nature’s majesty, they are the vehicle which draws people through the looking glass…”

Indian Ocean
The Maldives

PEOPLE OFTEN ASK ME why I decided to study manta rays. Why would a British marine biologist move halfway around the world to devote a decade of his life to unravelling the lives of the manta rays that inhabit the coral reefs of the Maldives? It is a good question, a seemingly simple question, yet one which I had not truly stopped and taken the time to consider until I was first asked many years ago. It is a question I still find difficult to answer satisfactorily with words today. Certainly, manta rays are beautiful creatures: their grace and inquisitive nature is captivating; they engage and stir my natural curiosity like no other marine creature, driving my desire to protect and learn as much about these poorly studied animals as possible. Yet to me these words never seem to fully express my passion, or satisfactorily project the empathy and connection I feel towards manta rays and their marine world. This is why my favourite answer does not require words, but simply an introduction between those who wonder why, and the manta rays themselves. For me, manta rays are the embodiment of nature’s majesty, they are the vehicle which draws people through the looking glass, opening eyes and minds. They captivate and connect people to our oceans, symbolising what is at stake if we choose not to respect and protect our natural heritage.

In 2005 I founded the Maldivian Manta Ray Project (MMRP) which is now one of the longest running manta ray research and conservation initiatives in the world. The MMRP was formed with a view to collecting long-term, robust data records on manta rays throughout the Maldivian archipelago to further their conservation. In addition to collecting data on the mantas encountered, the MMRP also collects data on environmental and climatic factors as well as tourism and human interactions, all of which influence the manta population.

Family history and distribution

Like all cartilaginous elasmobranchs manta rays and their close relatives the mobulas have a skeleton comprised of flexible, fibrous and light cartilage as opposed to the dense bony skeletons of the vast majority of all other fishes. A close relative of all sharks and rays, mantas must constantly keep swimming forward in order to ensure a steady supply of oxygen-rich water flows over their gills; they can never stop to sleep or rest on the seabed.

The first rays appeared in the oceans approximately 170 million years ago, radiating from shark-like ancestors but adapting to a more benthic mode of life. The flattened body shape of rays is essentially a squashed version of the archetypal shark, with internal physiology very similar to that of their shark cousins. It was from these bottom-dwelling rays that the ancestors of today’s pelagic mantas and mobulas evolved, taking to the open water around 20 million years ago.

The defining feature of the manta and mobula family is that of filter feeding – they use their cephalic fins (head fins), huge mouths and modified gill plates to strain plankton and small fishes from the water. The cephalic fins, which when rolled up look like horns projecting from their heads, have given them the name ‘devil rays’. In general mobula rays are much smaller than mantas and can be distinguished by morphological differences in their mouths. Mobula rays have a bottom jaw which is undercut, so that when their mouths are closed the edge of the lower jaw rests much further back than the upper, whereas manta rays jaws are aligned evenly.

OPPOSITE The big and the small all take advantage of the planktonic feeding bonanza that is born upon the monsoon currents and driven into the shallow coral reefs of the Maldives.

PAGE 26 Feathery gill plates encircle a manta’s gills and filter particles from the water that are larger than grains of rice.

Manta rays give birth to live young that are miniature versions of their parents.

TOP A researcher attempts to attach an acoustic tag to a reef manta in order to track its movements and identify areas of key habitats.

ABOVE The rich lattice of coral reefs in the Maldives are the building blocks of the 26 geographical atolls that together comprise this tiny island nation in the middle of the Indian Ocean.

The devil ray family contains 11 species of plankton- and fish-eating rays. Within this family there are two genera: Mobula and Manta. Very little is known about the mobula rays which, unlike the mantas, are generally very shy towards divers and make it hard for scientists to observe their natural behaviour in the wild. Like mantas they are found throughout tropical and sub-tropical oceans. Sometimes aggregating in vast shoals of many hundreds they come together possibly to feed or to seek safety in numbers. These aggregations may also occur more frequently at breeding times and it is not uncommon to encounter these large groups attracting attention at the surface as the rays leap several metres out of the water. There are currently nine described species of mobula rays, but the taxonomy of this genus is likely to change in the coming years as advances in genetics allow scientists working on these poorly studied animals to further define the true nature of the species composition within the genus.

Within the genus Manta there are currently two recognised species, *Manta birostris* (the giant oceanic manta) and *Manta alfredi* (the resident reef manta). These two species have much in common, but a few differences exist between the two. Mantas were re-classified as two separate species in 2009 based on a number of slight morphological features as well as differences in habitat utilisation and behaviour. Genetic work is continuing to further define the true nature of this separation.

Life history

Like all elasmobranchs, but unlike nearly all the other fish in the sea, manta rays reproduce through internal fertilisation, which means male and female must come together to mate. They give birth to live young that are miniature versions of their parents; ready to fend for themselves, they are completely independent from birth. Courtship rituals and actual mating events are relatively infrequently observed and the only documented accounts of a birthing manta ray come from a female housed in the Japanese aquarium at Okinawa. Many gaps still remain in our knowledge of the sexual lives of these fantastic creatures, and what little we do know is based on very little hard scientific data.

Mantas are ovoviviparous, meaning that once they have mated the fertilised egg grows within the female's uterus until it has developed into a fully functioning

PHOTO IDENTITY

The Maldives has the world's largest known population of reef manta rays (*Manta alfredi*). Since the MMRP began its research it has identified more than 3,000 individual manta rays from some 25,000 photo-ID sightings. It is possible to identify every individual because each manta has its own unique pattern of black spots on its predominantly white belly. These patterns do not change throughout the lives of the mantas, enabling us to track each individual as it is sighted over the decades. Every manta sighting – whether of a new manta or a re-sighting of an individual that is already known – is an important piece of a huge jigsaw puzzle enabling us to better understand the population size, composition, migratory routes, reproductive output and areas of critical habitats, all of which is crucial information in developing effective management and conservation strategies for these increasingly vulnerable animals.

The long-term data collected by this project means the population of manta rays throughout Maldivian waters is one of the most intensively studied populations of manta rays globally, and allows the MMRP's researchers to record and identify key trends and patterns within this population over time. Manta rays are an incredibly important economic resource for the Maldives, attracting tens of thousands of people to the country each year to dive and snorkel with them and generating millions of US$ for the economy annually. Being able to pinpoint the reasons for any observed trends in, or threats to, the Maldivian manta ray population and improving our understanding of these animals is crucial for the on-going management and protection of these animals, not just in the Maldives, but globally.

ABOVE AND RIGHT
The ocean is an itchy place, especially for flying dinner plates like manta rays, which attract a host of unwanted parasites that attach themselves to the mantas' bodies. Luckily for the mantas small 'cleaner' fishes, like these green moon wrasse and blue-streaked cleaner wrasse, perform a full body cleaning service. The mantas visit specific 'cleaning stations' where the cleaners live, hovering above the reef while the little fish search every nook and cranny of the mantas' bodies for a tasty morsel; their food is literally delivered to them on a giant flying plate.

manta pup. In aquaria the time between mating and pupping has been observed to take around one year. Mantas usually give birth to a single pup, but occasionally two developing embryos have been recorded inside a pregnant female during autopsies. At birth mantas measure around 1.5 to 2 metres from wing tip to wing tip. It is thought that mantas are probably born at night, but to date no wild births have ever been recorded. It is believed that mantas become sexually mature at around 10 to 15 years of age, possibly even longer for females.

Courtship in mantas can last days or even weeks and is an intricate process led by the female. The males compete to mate with the female, following her around the reef in what is known as a mating train; as many as 30 males may line up behind a single female. Watching a mating train of mantas is an enthralling experience, with the female leading the males as she races, twists, turns and dives around the reef with each male following her every move. In doing this the female tests the fitness of the males as they try to keep up with her and gain the first place in the train. At the end of this process the female selects a single male and the two mate as a pair, belly to belly in the mid water, the male biting down on the female's left wing to secure them together. These bites leave permanent mating scars on the ends of the female's pectoral fins where the 'wing-tip' is

TOP Powerful pectoral fins drive the manta through the water.

ABOVE A cloudy gill-full of detritus and trapped plankton is coughed up by a manta as it hovers above a cleaning station, providing an extra tasty treat for cleaner fishes.

gripped by the male's muscular pharynx at the back of his mouth. Just like humans, manta rays exhibit signs of lateralisation, with nearly all observed mating scars occurring on the left hand side of the females, suggesting the males favour this side of their body.

Feeding and cleaning

Manta and mobula rays are known as filter feeders and this term most accurately describes the way in which these animals are able to consume their microscopic food. Ingeniously designed, devil rays are efficient and expert foragers, roaming the seas and oceans in search of food. Upon finding an abundant food patch the rays transform into feeding machines, unfurling their horn-like cephalic fins from either side of their giant mouths to act as a funnel. The once flattened body and mouth becomes a giant black hole with wings powering the manta through the water as countless litres flow in through the mouth and stream out over the five pairs of gill slits that line the throat of the animal. Plankton and small fishes (depending on the ray species) flowing over these gills are sieved out of the water and trapped by feathered gill plates. Once the plates have netted a

BIRTH & DEATH

Currently it is not known how often females give birth, but the latest research suggests birth rates average around one pup for each mature female every two to five years. This extremely slow rate of reproduction, coupled with the long gestation period, late maturity age and small litter size, makes manta rays very vulnerable to exploitation. Research indicates that mantas probably live for around 50 years. However, until scientists have been studying these

The oceanic mantas are the last to be sold each morning. Gutted and chopped in half at sea in order to allow such a huge fish to be hauled onboard the fishing vessel, the two halves of the ray are temporarily re-united before the purchased carcass is butchered and the valuable gill plates removed from its head.

ABOVE AND BELOW The pectoral fins are first cut from the body of the manta and mobula rays (to be sold as low quality food), exposing the more valuable gill plates that line the throat and mouth of the rays.

ABOVE AND BELOW The valuable feathery gill plates are individually stripped from the rays, while the flesh is often chopped into strips, salted and laid out to dry in the tropical sun for several days.

The ray's feathery gill plates have become a product generating an estimated market value of US$11 million annually.

mouthful of food, the ray closes its mouth and coughs, back flushing the trapped food from the gills into the back of its mouth before swallowing its mouthful of highly nutritional prey.

As well as their physiological feeding adaptations the rays also employ a variety of behavioural feeding strategies and techniques to maximise the amount of food they can funnel into their mouths at each feeding event – manta rays barrel-roll through dense patches of plankton while speedy fish-eating mobula rays lunge at their faster moving prey with powerful beats of their pectoral fins.

Unlike the mobula rays, which often feed more on larger prey items, the plankton-eating mantas spend a lot of time swimming around with their mouths wide open. As a result particles of food and detritus become lodged in their gills creating an unwanted build-up of dental detritus. Manta rays have no hands or appendages with which to clean or groom themselves, so instead they visit specific locations on a reef to have their bodies cleaned of parasites and dead tissue by small fish known as cleaners. These cleaner fish are commonly wrasses although other fish families, such as angelfishes and butterflyfishes, also perform this task. The relationship is mutually beneficial to both the manta rays and the cleaner fish, which receive their dinner served on a giant flapping plate.

Fishing for profits

The flesh of manta and mobula rays has always been considered to be of relatively poor quality by humans around the world. As a result these animals have not been widely targeted for human consumption through commercial fisheries in the past. However, in recent years this has changed. Manta rays and their close relatives are now rapidly becoming a more desirable product, making them a target for fishermen in the tropical and temperate oceans of the world. The reason for this sudden change of fortune for these unfortunate rays is a tale of depressing repetition played out in our oceans and throughout our planet on a regular basis. The difference this time is that the latest targets are the mantas, which are paying the price of becoming the latest commodity in the often senseless and environmentally destructive Chinese medicinal trade. The ray's feathery gill plates have become a product generating an estimated market value of US$11 million annually.

In the Maldives manta rays have never been fished commercially and are not consumed locally because their flesh is considered poor quality and there have always been ample stocks of more desirable food species. Since 1995 it has also been illegal to export any ray products from the Maldives, thus effectively preventing any gill plate export fishery from occurring there. Unfortunately, a short distance across the Indian Ocean in Sri Lanka manta rays and their close relatives do not receive the same level of protection and are being targeted in vastly unsustainable numbers – they are selling the low quality meat for local consumption and exporting the gill plates to supply the medically spurious Chinese medicinal trade.

Data collected on this fishery in Sri Lanka estimates many hundreds of manta rays and tens of thousands of mobula rays are being killed each year by this country's fishing fleet, which travels far into the Indian Ocean in search of fresh fishing grounds. When certain aspects of manta and mobula rays' biology – such as their low reproductive rates, slow growth and late maturity – are taken into account, these high catch rates are likely to have significant impacts on the respective populations in this region. If the fishing of manta and mobula rays carries on at its existing levels globally it is highly likely there will be population crashes of these species within a few years. Regional

OPPOSITE AND ABOVE Divers and snorkellers flock to manta ray cleaning and feeding sites, collectively spending more than US$8.1 million annually in the Maldives alone in search of their own underwater encounter with these captivating animals.

population crashes have already been documented in the Gulf of Mexico and Indonesia, where boom and bust fisheries for these species have occurred in recent decades.

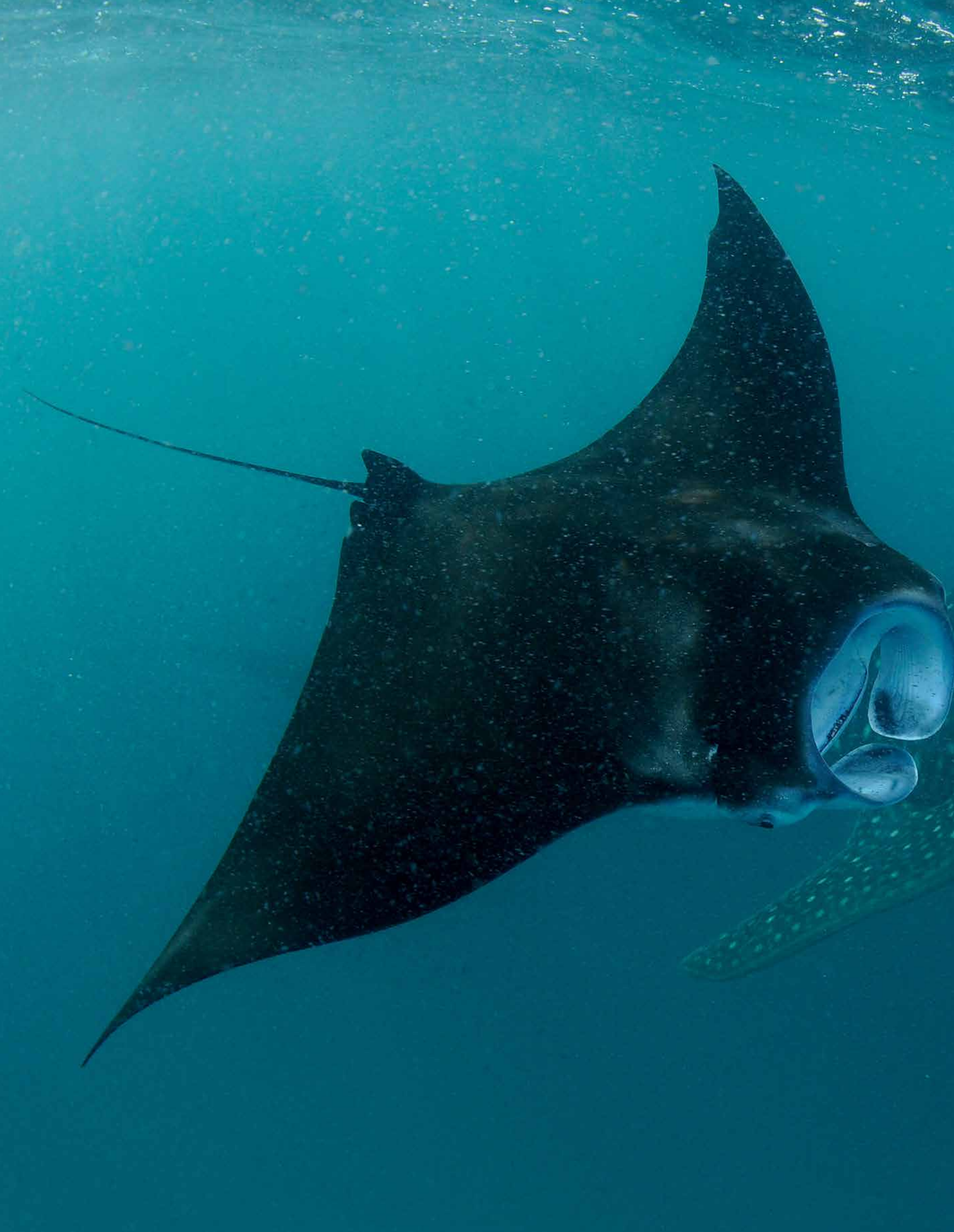
Sustainable solutions

The mantas' giant size, inquisitive and peaceful nature and their propensity to frequent tropical shallow reefs has facilitated a burgeoning tourism industry in many nations around the world where enthralled divers and snorkellers seek out the thrill of an underwater encounter with these fascinating creatures. Globally it is estimated that this tourism industry generates US$140 million annually, with the Maldives' manta ray tourism industry alone generating more than US$8 million annually through direct revenue from manta dive and snorkel excursions.

Unfortunately, in today's commercial and increasingly crowded world a country's marine resources must pay their way. It is just not realistic to expect governments or communities to protect a species and its habitat for its intrinsic or ecological value alone. There must be a short-term financially viable alternative to incentivise a move away from destructive and unsustainable practices, regardless of the long-term ecological and economical losses of such practices. By looking at the Maldives as an example we can see that while tourism does bring with it its own set of new problems, these are vastly more acceptable alternatives to the current rapid depletion of the country's marine resources through direct fisheries.

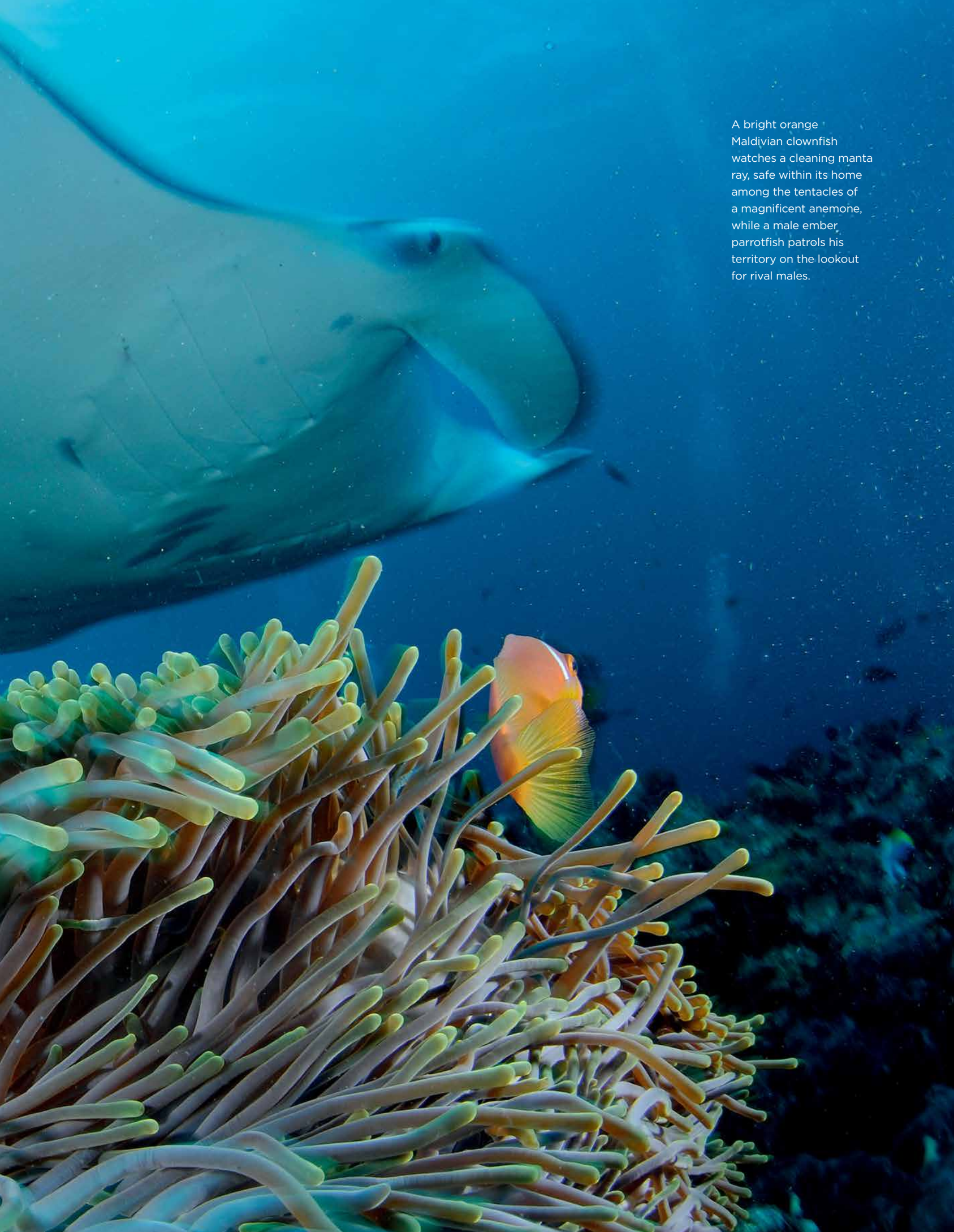
The future

In the past 10 years scientists have made a good start at uncovering the secret lives of manta rays, however we are only just beginning to glimpse below the surface. Much still remains to be found out about even the basics of their biology, and with the largest brain to body ratio of all the world's fishes, there is much still to understand about their intelligence, curiosity and social interaction. Learning more about these species is vital to being able to provide them with effective protection and ensuring their persistence in years to come. I hope I never tire of seeking the answers to the unanswered questions, and that by sharing my knowledge and passion I can promote imaginative thought and empathy in others, so that together the science and conservation of manta rays will be driven forward.



Feeding giants! Both manta rays and whale sharks feed on some of the ocean's tiniest creatures.

A school of neon fusiliers part to form a halo of shimmering blue around a feeding manta ray, while a giant whale shark cruises the shallow waters of Hanifaru Bay, hoovering up the dense clouds of plankton.



A bright orange Maldivian clownfish watches a cleaning manta ray, safe within its home among the tentacles of a magnificent anemone, while a male ember parrotfish patrols his territory on the lookout for rival males.

Manta rays deploy a variety of feeding techniques to maximise their feeding rewards. Some barrel-roll through dense patches of plankton backwards, like a dog chasing its tail, while others swim in straight lines along current lines that concentrate the plankton.

PHOTO BY THOMAS P. PESCHAK

ALISON KOCK

AND THE ISLAND OF GIANTS

For marine biologist Alison Kock, False Bay's Seal Island has become a scientific holy land. **Philippa Ehrlich** finds out more about her connection with this iconic landmark and its famous residents.

Words by Philippa Ehrlich

FOR MOST FALSE BAY residents, Seal Island is a rocky silhouette 17 kilometres away from the land that only looms into view on crystal clear, calm days. It is a place shrouded in both fascination and abject terror. Its jagged shores are home to 75,000 Cape fur seals and five species of sea birds. It is also the mythical hunting ground of the most dreaded and talked about member of False Bay's vast ecosystem: the great white shark.

For marine biologist Alison Kock, the island has become a scientific holy land. Over the past 12 years she has made hundreds of pilgrimages to its hallowed waters and has dedicated most of her waking hours to learning about great whites in False Bay and examining their relationship with local ocean users.

For South Africans her name has become associated with everything shark; Shark Spotters, shark science, shark conservation, shark nets and shark attacks.

Kock's connection with the most misunderstood fish on the planet was forged completely unexpectedly and kilometres from the sea. Fifteen years ago, whilst studying marine biology at UCT, she spent her weekends managing a car wash in Table View. One very busy Saturday morning she walked over to yet another car, opened up its boot and saw something that stunned her: a pile of photographs of a great white shark fully airborne just off Seal Island. She could not believe what she was seeing, 'Oh my gosh! Is that real? These big white sharks totally out of the water! Is that doctored?'

She had been studying marine biology for three years but had never heard a whisper about great whites breaching. That image electrified a string of questions that would propel the next 15 years of her life.

She investigated the source of the photograph and was determined to get herself a spot on his boat. A few weeks later, she found herself on the deck of Chris Fallows' and Rob Lawrence's shark-watching vessel. For Kock, it would be the first of hundreds of real life encounters with great whites: 'I went out there and saw these sharks flying out of the water and attacking seals right next to the boat and I couldn't believe this was right on my doorstep.'

From that very first trip, she became a volunteer on Fallows' and Lawrence's boat, and for the next two years she guided tours, washed boats and worked in the office, but a new goal was taking shape. Every day she would go out to sea with a boatload of tourists who were equally amazed by the animals, and with their awe, came curiosity. At the time, there was very little scientific information on South African great whites. Apart from a few statistics based on the number of animals caught by shark nets in KwaZulu-Natal, we did not know how big South Africa's great white population was and there was not a shred of research about their behaviour. 'I just realised that we knew nothing about these sharks. There was no literature. The clients continually asked us questions and we just couldn't give them any answers,' Kock remembers.

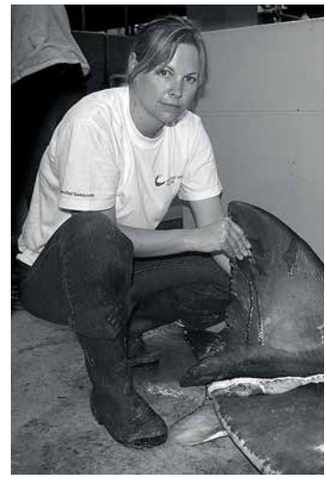


PHOTO BY MORNE HARDENBERG

ABOVE Marine biologist Alison Kock holds the fin of a great white shark.

OPPOSITE The impressive teeth of the great white shark.

◂ *Simonstown*

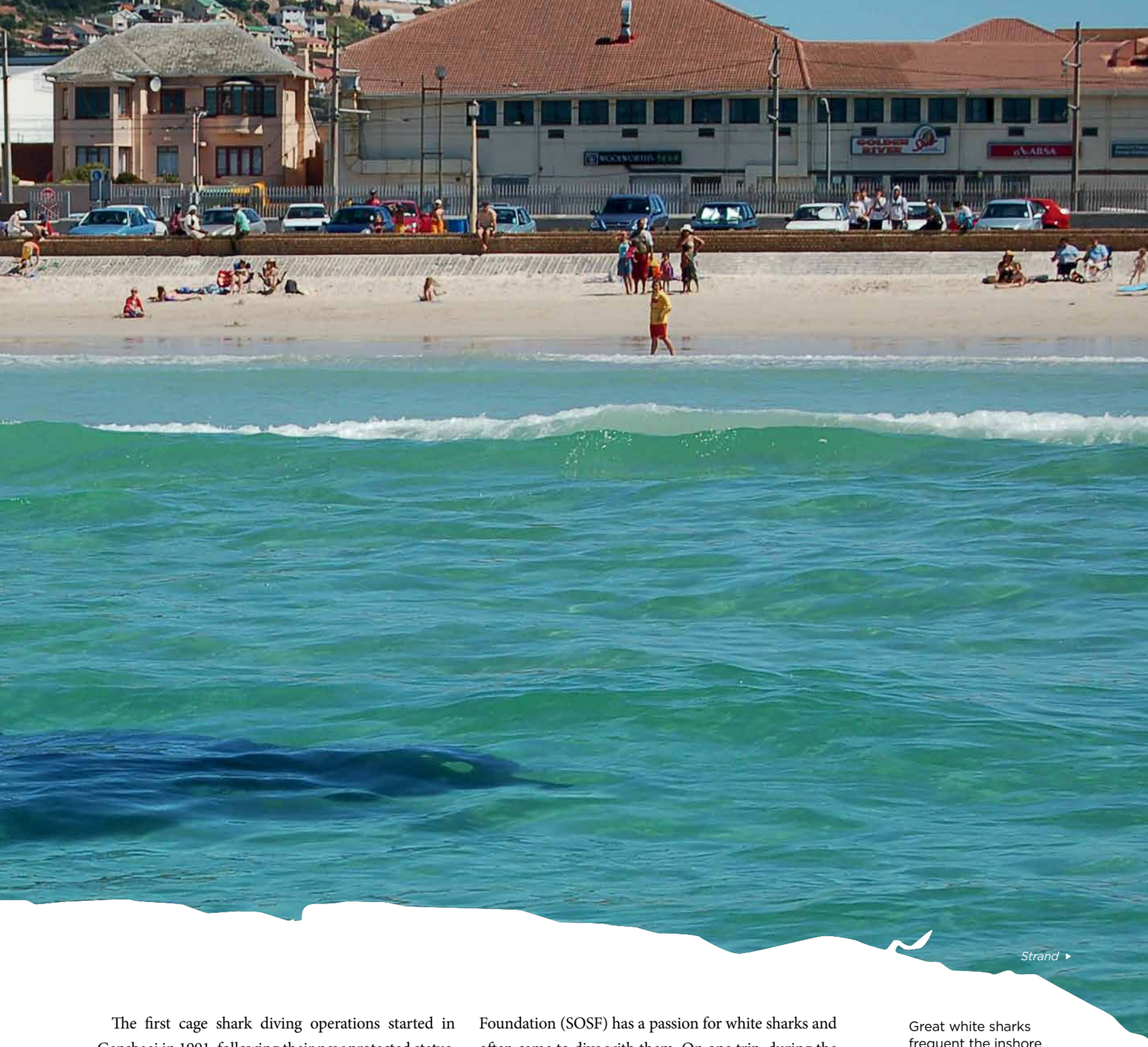
False Bay
South Africa

In 2003, after completing her Honours degree, she enrolled for a Masters under the supervision of Leonard Compagno, one of the foremost shark experts at the time. Compagno was the scientist who helped to design the mechanical shark used in the filming of *Jaws*, but more importantly it was his lobbying that led to the incredibly progressive conservation policies that have protected great whites in South African waters.

In 1991, under Compagno's guidance, the government showed admirable foresight by becoming the first country to ban the commercial hunting of these sharks. They knew the population was vulnerable because of slow reproduction rates and the global demand for their jaws. Their actions 22 years ago provided Kock with one of the largest great white populations in the world on which she has been conducting pioneering research for the past 12 years.

Undaunted by the controversial, her first study focused on shark behaviour around Seal Island and together with her Canadian research partner, Karl Laroche, they looked at the implications of shark cage diving and chumming. The chumming of sharks for viewing purposes is prohibited in the USA, but South Africa has built up a highly profitable industry that is reliant on attracting great whites to boats by chumming them to the surface.

Seal Island, False Bay



Great white sharks frequent the inshore waters of the False Bay coast in summer.

PHOTO BY ALISON KOCK & ENRICO GENNARI

The first cage shark diving operations started in Gansbaai in 1991, following their new protected status. At the time of the ban, operators who had originally made an income by hosting sport fishing trips to catch great whites turned to cage diving. At first the industry focused on adventurers and filmmakers, but in 1996 an operation started in False Bay and the industry grew increasingly accessible to the general pubic.

At first Kock struggled to find sponsorship. She approached government, NGOs and the private sector, but funding was limited and for the first year she conducted research from her father's small fishing boat. Fortunately, the founder of the Save Our Seas Foundation (SOSF) has a passion for white sharks and often came to dive with them. On one trip, during the early days of establishing the SOSF, they interviewed Compagno, who suggested that Kock apply to them for funding. She emailed the foundation, but at first support was not forthcoming. 'I sent about 15 emails before I got a reply. I was kind of persistent,' she reflects. Finally, in mid 2003, Kock's research became one of the first six projects supported by the SOSF. They supplied her with funding for general running costs, a new research boat and acoustic tags and receivers to implement what was at the time the largest acoustic array for tracking great whites in South Africa.

"I get this feeling that what I do is very special and I am very fortunate to work in this magical place."

One of the hypotheses Kock and her co-workers had was that chumming changed the behaviour of great whites. Surprisingly, and to the indignation of many anti-shark cage diving lobbyists, Kock found that the meager offerings that were being tipped into the sea could not compete with a shark's preferred prey: 'Unless you're going out there and providing what is equal to or better than what the seals provide, you probably aren't going to have a long-term impact on them. Essentially, our theory was totally wrong, as science goes,' she laughs.

Studying massive marine predators is extremely demanding and challenging. Kock recognises that a vital key to her success was the guidance and support she received from the teams of advisors, colleagues and students she worked with. She emphasises that, 'As a young woman scientist I received an extraordinary amount of support and encouragement for what I was aiming to do. This ranged from support of my co-workers, to local and national government, and even from the SA navy. I have forged life-long relationships because of this, and without those people I would not be where I am today.'

Ten years into her career, after thousands of trips across the constantly fluctuating expanse of False Bay, Kock is starting to paint a fairly comprehensive picture of what great whites are up to above and below the surface. She has tagged more than 80 white sharks (as well as 17 sevengill cowsharks), burnt thousands of litres of boat fuel and deployed dozens of acoustic receivers. Her PhD thesis analysed half a million data points collected between Cape Point and Hangklip.

Having published 10 scientific and technical papers on white sharks to date, Kock is now regarded as one of the leading great white experts in South Africa, and worldwide. Together with her co-workers, their research has answered a myriad of questions about the sexual segregation of great whites, their hunting techniques, seasonal habitat preferences, environmental influences and even their reaction to electric shark deterrents. She is also leading the research on a recent trial shark exclusion net in Fish Hoek and supervising the publication of two more papers that will be released in the next few months, but she knows there is still a lot to be revealed: 'The funny thing about science is that you complete a study, publish a whole paper answering a key question, and then the first thing someone asks you is a new question you don't have the answer to.'

Kock has found that whilst the public appetite for insight into these feared and revered ultra predators is insatiable, it is also refined. People are interested in science they can relate to. This is why her most popular studies so far are her research on the inshore movements of female great whites and her cage diving paper. There is one serious criticism that Kock has of the industry: 'Part of the problem with cage diving is that because it is expensive, most South Africans don't get the opportunity to experience it. All they get to see are sensationalist documentaries, which give a very skewed perception of what's going on out there. People don't get to have that phenomenal experience and only interact with the negative side – the 'shark attacks' side.'

In 2005, after a few relatively uneventful years, there were two fatal incidents in less than 20 months. It was because of her exclusive profile as the only expert on False Bay's sharks that Kock's role evolved from scientist to spokesperson. She remembers the uncomfortable transition: '2005 was when we got thrown into the deep end. People wanted to know what was happening. Something was happening and we were the only ones who had information about the population. As a biologist, you aren't trained to deal with conflict in that way.'

The first few years in this new role were extremely challenging and Kock found herself under constant attack in the media. It took time to learn that the irrational and pervasive fear of sharks is not something that can be appeased with science, no matter how solid it may be. She explains that, 'As a scientist you need to be rational and logical, but I had to recognise that people are emotional at that stage and hearing someone simply say "shark attacks are rare" doesn't help very much. You have to build a relationship of trust with the public, and it's not easy. I've made mistakes along the way, but you have to learn from them and earn that trust.'

In 2008, she took on an even bigger role with regards to the shark/human interface, that of chief scientist for the Shark Spotters – an ocean safety organisation that aims to protect ocean users from sharks by warning them when the animals are in the area. All along False Bay and the Cape Peninsula, shark spotters are stationed on the mountainside, wearing polarised

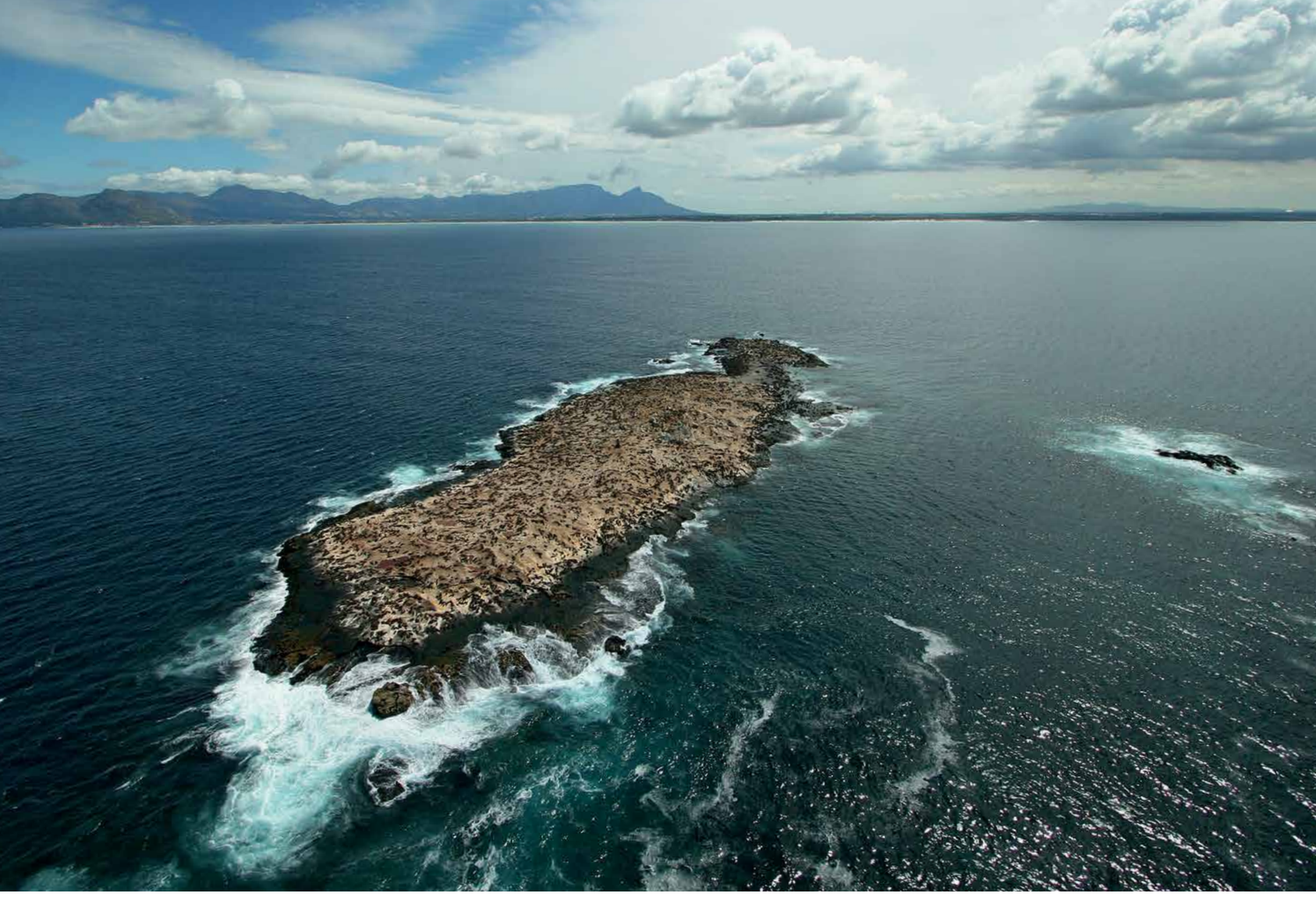


PHOTO BY ANDY B. CASAGRANDE

Seal Island lies just 17 kilometres from land and one of Cape Town's most popular beaches. It is home to 75,000 Cape fur seals, five seabird species and renowned for its great white sharks.

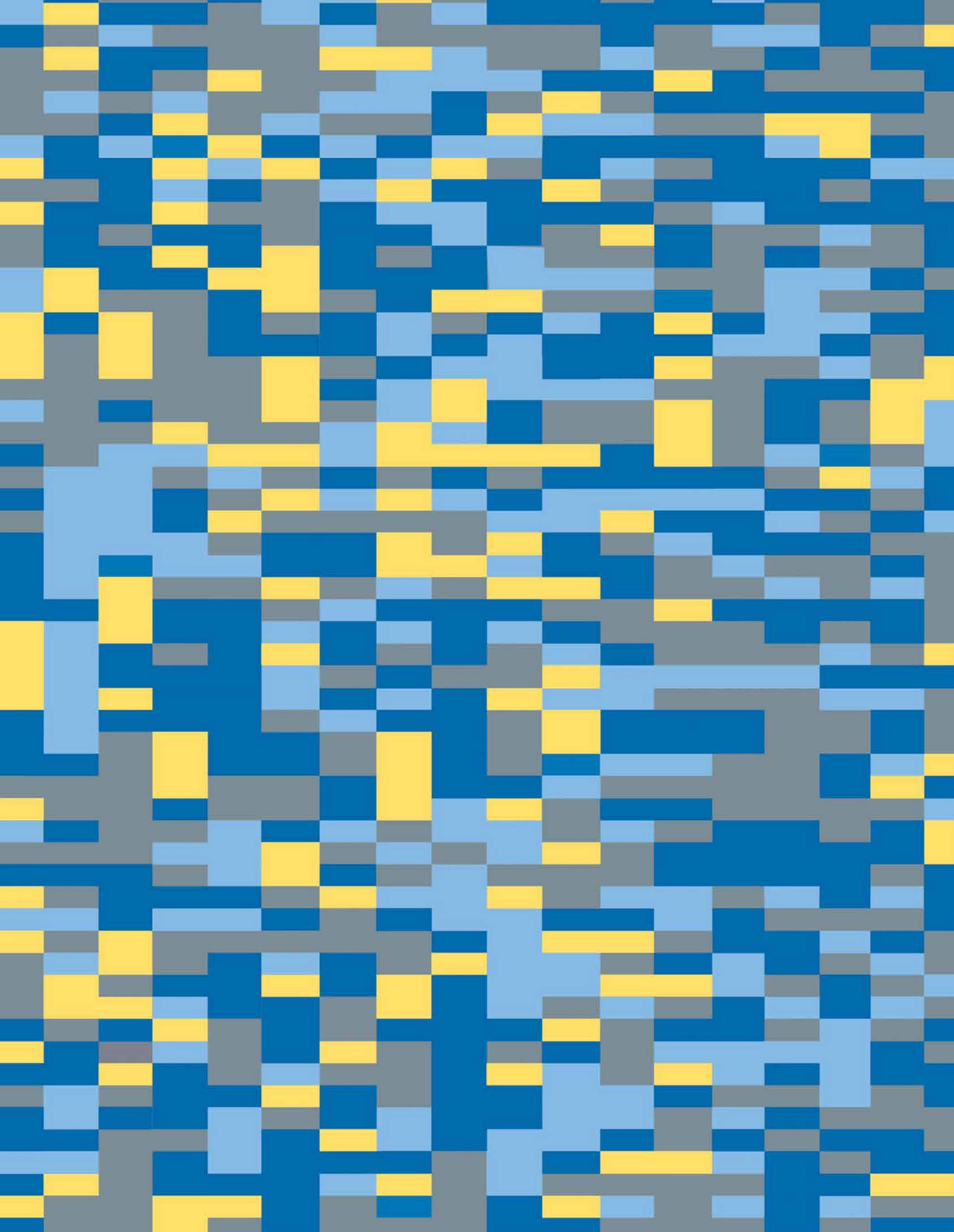
sunglasses and scanning for sharks. Beachgoers are warned with a siren and a number of colour-coded flags signifying the likelihood of incidents according to conditions such as visibility.

After five years at Shark Spotters she has found that it is vitally important to balance the concerns and safety of ocean users with the advocacy of sharks: 'It can't be one or the other, it needs to be both for conservation to work'.

Shark Spotters is a conservation organisation, but rather than aggressively campaigning for sharks, Kock believes in a subtly informative approach that allows people to share in her fascination with the animals whilst arming them with the facts they need to take personal responsibility and mitigate risks. Before entering the water, ocean users should be observant and make an assessment. 'I don't think you're ever going to convert everyone to start loving sharks, but I do think you can turn that fear into respect and acceptance,' she comments.

Kock's own respect and enchantment for great white sharks continues to grow. She realises she is privileged to be studying one of the largest populations in the world with the biggest average-sized sharks. She also knows that with this privilege comes a serious responsibility: 'This area is a crucial habitat for great whites, all year round. It is vital, especially for the females on the inshore. We don't know where these sharks go and what threats they face when they leave False Bay, but we do know they're our future breeding stock. The conservation of a much bigger and wider ranging population depends on the protection of this habitat. It's incredibly important to get that message across.'

Today, even after countless pilgrimages to the edge of Seal Island, this is where some of Kock's favourite moments are spent. On icy winter mornings, her feet planted firmly on a bobbing research boat, often surrounded by whales or sharks, she stares back across False Bay to the land, watching the twinkling lights of morning traffic as people make their way to more conventional offices: 'I get this feeling that what I do is very special and I am very fortunate to work in this magical place. That is not something I take for granted.'



HIGH-TECH CONSERVATION

Professor **Mahmood Shivji** explains how scientific research being carried out by the Save Our Seas Shark Research Center in Fort Lauderdale is having a global impact on shark conservation.

Words by Mahmood Shivji

THE SAVE OUR SEAS Shark Research Center USA (SOSSRC), one of three named centres supported by the Save Our Seas Foundation (SOSF), is located in Fort Lauderdale, Florida, USA. The SOSSRC is housed in a new, architecturally award-winning building at Nova Southeastern University's Oceanographic Center, and includes state-of-the-art research laboratories and fieldwork facilities for conducting cutting-edge, interdisciplinary studies. The association between the SOSF and Nova Southeastern University was initiated in 2008 by directive of the Founder of the SOSF, with the formal naming of the association as the Save Our Seas Shark Center in 2009 (note the slight difference in the original and current names). With each of the three SOSF centres starting to focus on their strengths and targeting specific needs, an administrative decision was made in 2013 to highlight the remit and expertise of the SOSSRC by including the word 'research' in the centre name.

The SOSSRC primarily focuses on conducting scientific research aimed at expanding knowledge to aid the conservation, management and understanding of sharks and rays on a worldwide basis. The SOSSRC specialises in taking integrative, multidisciplinary approaches to research, which includes combining high-tech genetics research and fieldwork to holistically illuminate aspects of shark and ray biology that would be difficult to decipher using single discipline approaches alone. Another hallmark of the SOSSRC is its international, and in most instances global, scope of work on sharks. A key aspect of the SOSSRC also is that it serves as an academic unit within Nova Southeastern University, and as such also functions in an educational capacity. Indeed, most of the past and current scientists at the SOSSRC have been or are graduate students performing research as part of earning their Masters and PhD degrees.

Since its inception, the SOSSRC has worked in close partnership with the Guy Harvey Research Institute, another academic unit of Nova Southeastern University and the research arm of the Guy Harvey Ocean Foundation, to accomplish larger goals. This partnership works extremely well for two reasons. First, the SOSSRC and Guy Harvey Research Institute share broadly similar goals – scientific research to facilitate conservation, improve basic knowledge and guide sustainable use of our ocean's fishes. Second, by combining expertise the two entities have been able to tackle crucial research issues that are global in scope, and would be challenging for each entity to address alone.

Some examples of research by the SOSSRC and its partners that have had a global impact on shark conservation include the development of novel, rapid DNA forensic methods to identify the origins of shark body parts found in trade. This groundbreaking research found immediate application

OPPOSITE An artwork by Sunnye Collins representing a snapshot of a partial DNA sequence of a white shark. A science educator by training, Collins's artwork comes from a desire to encourage people to think about science in a different way. Four colours are chosen, one for each nucleobase that ultimately makes up nucleotides. She is fascinated by this micro-shuffling DNA, which ultimately creates every living thing on the planet. The resource for this code comes from the GenBank at the National Center for Biotechnology Information.
www.sunnyecollins.com

The staggering number of sharks (26 to 73 million) revealed by this study to be contributing to the fin markets brought international attention to the issue of shark overfishing.

in shark conservation and management practice internationally, including enabling law enforcement agencies to successfully identify and prosecute many operators conducting illegal shark fishing and trade. This work was also a key element in a high profile, collaborative study with Dr S Clarke from Imperial College (UK) that made the first quantitative determination of sharks traded by individual species, and the total number of sharks traded per year in the global fin markets. The staggering number of sharks (26 to 73 million) revealed by this study to be contributing to the fin markets brought international attention to the issue of shark overfishing. Equally importantly, this revelation has spurred policy changes by many governments to reduce this previously unrecognised and unsustainable level of destruction of our ocean's apex predators.

Research conducted by the SOSSRC has also led to the discovery of new species of large sharks and rays, including a hammerhead species that looks very similar to the scalloped hammerhead but is actually distinct evolutionary lineage. This surprising discovery of another large hammerhead shark increases the total number of known hammerhead species from eight to nine, highlighting how much we still have to learn about shark diversity.

Very recently, the SOSSRC and colleagues from Cornell University have dived into a new frontier in genetics research, studying shark species at their fundamental biological core – their entire genetic blueprint or 'genomes'. This ongoing work has produced the first, large-scale view of the genetic repertoire of one of the world's most charismatic animals, the great white shark. True to its fascinating form and biology, an in-depth look at the white shark's genes has revealed remarkable findings, including, and quite unexpectedly, more similarity in some of its protein categories to humans than the zebrafish, the quintessential bony fish research model. These findings further underscore that even more surprises are likely in store as we dig deeper into understanding how sharks work at the level of their genes.

Current research projects at the SOSSRC fall into three broad categories involving mainly large shark species, captured in world fisheries, that in many cases are overexploited and in urgent need of improved, science-based conservation and management:

I. Projects using DNA approaches to uncover hidden populations of sharks and monitor the sources of fins in international trade

The high demand for shark fins and other products continues to drive overfishing of shark species and populations worldwide.

Even though the DNA forensic tools pioneered by the SOSSRC and Guy Harvey Research Institute can rapidly determine the species of shark from market-derived body parts, the geographic population divisions of most sharks at a global level are so poorly known that it is nearly impossible to determine even the general geographic area that the traded shark or shark body part originated from. This means that some shark species and/or populations may unknowingly be subjected to disproportionate and unsustainable levels

Fort Lauderdale
USA

PHOTO BY THOMAS P. PESCHAK

Professor Mahmood Shivji looks back at the shadow of a confiscated shark fin. Research pioneered at the SOSSRC uses genetics to track the species and source of fins in the international shark product trade.

of fishing, risking the eradication of some shark populations before we realise it is happening.

The SOSSRC is addressing this issue head-on. Our ongoing research is showing that many shark species, despite their ability to travel thousands of kilometres, are typically made up of smaller genetic divisions (stocks) than assumed. Each of these stocks must receive targeted management, and in some cases even urgent protection by national and regional laws, to prevent their further depletion and attendant loss of important genetic diversity. The discovery of discrete shark genetic stocks is also providing an opportunity for tracking the geographic origin of shark products already in international markets distant from fishing sites. The information being provided is essential for developing tougher national legislation and international treaties to help the recovery of sharks on a global scale.

II. Projects investigating how sharks work at the level of their DNA

As far as vertebrates go, sharks are veritable antiques. Fossils of shark teeth show that sharks, in one form or another, have been around for at least 400 million years, predating even the dinosaurs. At least 500 species of living sharks are currently known, and more are undoubtedly going to be discovered. The antiquity of sharks, their species and habitat diversity, and their amazing form and function all point to sharks possessing unique genetic properties underlying their evolutionary success.

Recent evidence that shark immune systems produce novel molecules of potential human therapeutic value has highlighted the fact that, as the earliest-evolved jawed vertebrates, sharks can serve as important, comparative biomedical research model

PHOTO BY NOVA SOUTHEASTERN UNIVERSITY

for understanding the evolution and function of human biology and disease, including immune systems, neurobiology, stem cells, ageing and cancer biology.

Using sharks as research models may also lead to other direct benefits to human health. For example, the remarkable ability of elasmobranchs (sharks and rays) to heal rapidly from significant dermal wounding, although not well studied, is anecdotally well known by field researchers. How these wound-healing properties are achieved by elasmobranchs is unknown, but is likely a function of their genetic makeup. As such, sharks could very well provide a useful model system for studying genes and genetic mechanisms that underlie wound healing, a topic of major interest to human health. Furthermore, exploring such linkages between shark and human biology has the potential to provide additional public awareness tools to further the cause of shark and marine conservation generally.

The SOSSRC is taking a leadership role in understanding sharks at the level of their entire genetic blueprint – their genomes. The first large-scale look at the great white shark's genes has opened the intriguing possibility that some aspects of white shark overall biochemistry might be more similar to that of a mammal than a bony fish – a completely unexpected finding. These tantalising results further beg the question: what other distinctive genetic properties do sharks possess? The SOSSRC is moving full speed ahead to explore the world of shark genomes by investigating the full genetic repertoire of other threatened and endangered species such as mako, tiger and hammerhead sharks, as well as rays. There will undoubtedly be novel findings in store, helping illuminate the underlying genetics of what makes sharks such unique creatures.

III. Projects using satellites to determine the where, when and why of shark travels

Most of the world's overfished sharks are large species that can, and often do, move extensively in space and time. Researching these movements is key to not only providing information on the basic biology of sharks and how they use the ocean, but also where and when sharks might be most susceptible to fishing pressure. Understanding shark movements, including their migratory patterns, is also important for predicting how they might respond to physical environmental shifts, including climate change. The recent development of increasingly sophisticated animal tracking instruments is allowing an exceptional look into the long-distance and long-term movements of sharks in both horizontal and vertical dimensions.

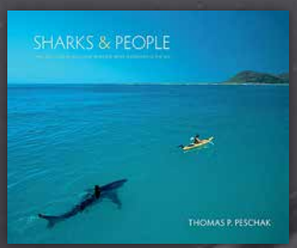
The SOSSRC is working closely with the Guy Harvey Research Institute (GHRI) to uncover the secret lives of sharks as they wander the oceans. Our researchers are attaching different types of electronic tracking tags to large pelagic sharks, and following the shark's movements, in many cases in near real-time, via information received from the tags as they report to orbiting satellites.

Sharks of current research focus are shortfin mako, tiger and oceanic whitetip, all species of conservation and management concern. The data being collected are revealing unprecedented information on the migration patterns of these large, highly mobile species, including demonstrating that these animals have a very finely tuned sense of space and time as they swim thousands of kilometres in the ocean.

Tracking work on tiger sharks in the Atlantic has been ongoing the longest, with several tiger shark individuals having been successfully followed for two to three years. Achieving these long-term tracks has been key to the discovery of clear, seasonal movement patterns by tiger sharks. In the western north Atlantic, tiger sharks are revealing an amazing ability to be quite happy exploring shallow habitats close to land for extended periods, but also feeling equally comfortable far offshore in very deep water nearly in the middle of the Atlantic, and moving seamlessly and quickly in between these very different and distant ecosystems. One tiger shark followed for three years travelled more than 44,000 kilometres in that time. The makos, tigers and oceanic whitetips are all showing distinct, seasonal migrations. Additional tracking work by the SOSSRC and GHRI in 2014 will add to these fascinating revelations, allowing general migratory patterns to be described and enhancing conservation planning for these remarkable and threatened species.

The tracks of all these sharks can be followed on an educational, interactive website at: ***www.nova.edu/ocean/ghri/tracking/***

Professor Mahmood Shivji and other researchers working at the SOSSRC laboratory break down the genetic blueprint that makes a shark a shark.



SHARKS & PEOPLE
Thomas P. Peschak
Published by The University
of Chicago Press

PORTFOLIO

THOMAS P. PESCHAK

JAWS & ME

SHARKS & PEOPLE explores the complicated dynamic between humans and the most feared fish in the sea. The book is a culmination of more than a decade of Thomas Peschak's expeditions with the Save Our Seas Foundation and photographic assignments for *National Geographic Magazine*. As a marine biologist turned photographer, Peschak created a unique and arresting collection of images; taking you on a journey to more than two-dozen locations on four continents. Highlights include rarely seen shark behaviours, interactions between surfers and sharks, a look at some of the planet's last pristine shark sanctuaries, and an unprecedented glimpse into the shark fin trade. The images are coupled with authoritative yet engaging text grounded in current scientific research as well as the author's personal experiences with these grand predators.

Q & A

THOMAS P. PESCHAK

Photographer Thomas P. Peschak shares his views on the creation of his new book and what it means for conservation.

How did you come up with the idea to write *Sharks & People*?

The idea for pho me more than a decade ago. While sitting in a seedy bar along the South African coast night after night, I chipped away at a book I was writing about white sharks. As word spread of what I was up to, I found myself spending most of my evenings talking to people about sharks. There is a hunger for knowledge about these animals and how they relate to our lives. From burley bikers to grandmothers, I conversed with all types until the wee hours of the morning. After several nights of this, I had my 'a-ha' moment.

I realized that many people want to talk about sharks, but there is an abundance of misinformation, which feeds into the culture of fear surrounding these popular predators. So I vowed to create a book that investigates and reports on the complex and contentious relationship between 'Jaws' and us. *Sharks & People* is the culmination of my 10-year journey as a photographer, journalist and marine biologist investigating, experiencing and exploring the shark/human interface.

What message are you trying to communicate through the book?

The subject of sharks is often polarising. Sharks are different things to different people. I have spent as much time with shark fishermen as I have with conservationists. I have spent time with surfers who are afraid of sharks and with divers who seek them out. I have tried to surround myself with as many different perspectives as possible. I am hoping the book will widen perspectives and create conversations. It is not pro shark or pro people. I am not under any illusions that this book is a panacea, but I hope at the very least it will contribute to more constructive dialogues about how people and sharks and people can co-exist.

In your book you describe witnessing the aftermath of a shark bite. How do you feel these incidents need to be approached?

Communities that have experienced shark bites are traumatised. As conservationists we are all guilty of rattling off statistics about death by toaster, lightning or falling coconuts without considering the small percentage of people directly affected. Don't get me wrong, shark attacks are exceedingly rare, but they do happen. We have to take each occurrence seriously and treat those affected with sensitivity and compassion.

In one of your earlier books you were outspoken against all shark fishing. Is this still true?

It is incredibly difficult to create and measure the environmental sustainability of shark fisheries, albeit a few well-managed fisheries do exist. I think my biggest change of heart has come from interacting with fishermen in developing countries. In the past, I saw them as faceless negatives, responsible for the destruction of a species and environment that I treasure. Today I recognise that fishing is a critical livelihood for

OPPOSITE, TOP
I free dive beneath a young whale shark off Djibouti, along the Horn of Africa.

OPPOSITE, BOTTOM
Surrounded by blacktip reef sharks in the shallows off Aldabra Atoll, I steal a few shots.

PHOTO BY CHERYL-SAMANTHA OWEN (2)

PHOTO BY GUY STEVENS

Books have a permanent and tangible depth, often remaining relevant for decades.

millions of people, many of whom are living far below the poverty line. Sharks are often a way of increasing the value of their catch. Putting shark fins on someone else's table ultimately means putting food on their own table. Shark meat is an economical source of protein for the poorest of the poor. In these communities, shark finning (cutting off the fins at sea and discarding the body) is not widespread because the meat is a staple. If shark fishing is banned all together, many communities could become even more desperate. Ultimately, a living shark has much more value than a dead one. But the process of transforming a fishing community into an ecotourism community is complex. In the end, this change has to come from inside the community in a way that is contextual and self-sustaining.

What role does *Sharks & People* play in furthering conservation?

Magazines and digital media are powerful communication tools, but they are ephemeral. Books have more of a permanent and tangible depth, often remaining relevant for decades. Ordinarily, a book like *Sharks & People* would only reach a niche audience; readers who seek out and purchase because they are interested in sharks. But how do we reach those who have a negative view or fear of sharks? In an effort to reach beyond the niche audience, the Save Our Seas Foundation is issuing 3,000 copies of a special edition of *Sharks & People*. These copies will go to people who, for either economic or geographical reasons, would not otherwise be exposed to this book. One of our core distribution areas will be the southern African coast. It's a place with a high frequency of shark/human encounters and is a hub for shark tourism. My hope is that people in this region will engage with this book and it will cause them to reflect on their own relationship with sharks. Whether it's school libraries or entire villages, it's all about expanding the reach of this book and making it more accessible.

What kinds of behavioural changes are you hoping to inspire with this book?

To those who are already enchanted with sharks, I hope this book strengthens the bond and builds on your understanding. For the uninitiated, I hope your view of sharks transforms from that of dark menacing creatures into animals worthy of respect and protection. As a photojournalist, it is my job to reflect accurately the reality of our time. Thus, I included many images in it that explore the darker side of our relationship with sharks – shark carcasses, piles of shark fins and barren, lifeless seascapes. These photographs are hard to digest but a book that consists of only beautiful images of sharks would not be a truthful representation of our current relationship with these important predators. Many people may

PHOTO BY ANNA SEAMAN

OPPOSITE AND ABOVE
As a marine conservation photographer, recording the butchering of sharks and other species is as important as recording them in the ocean, swimming free.

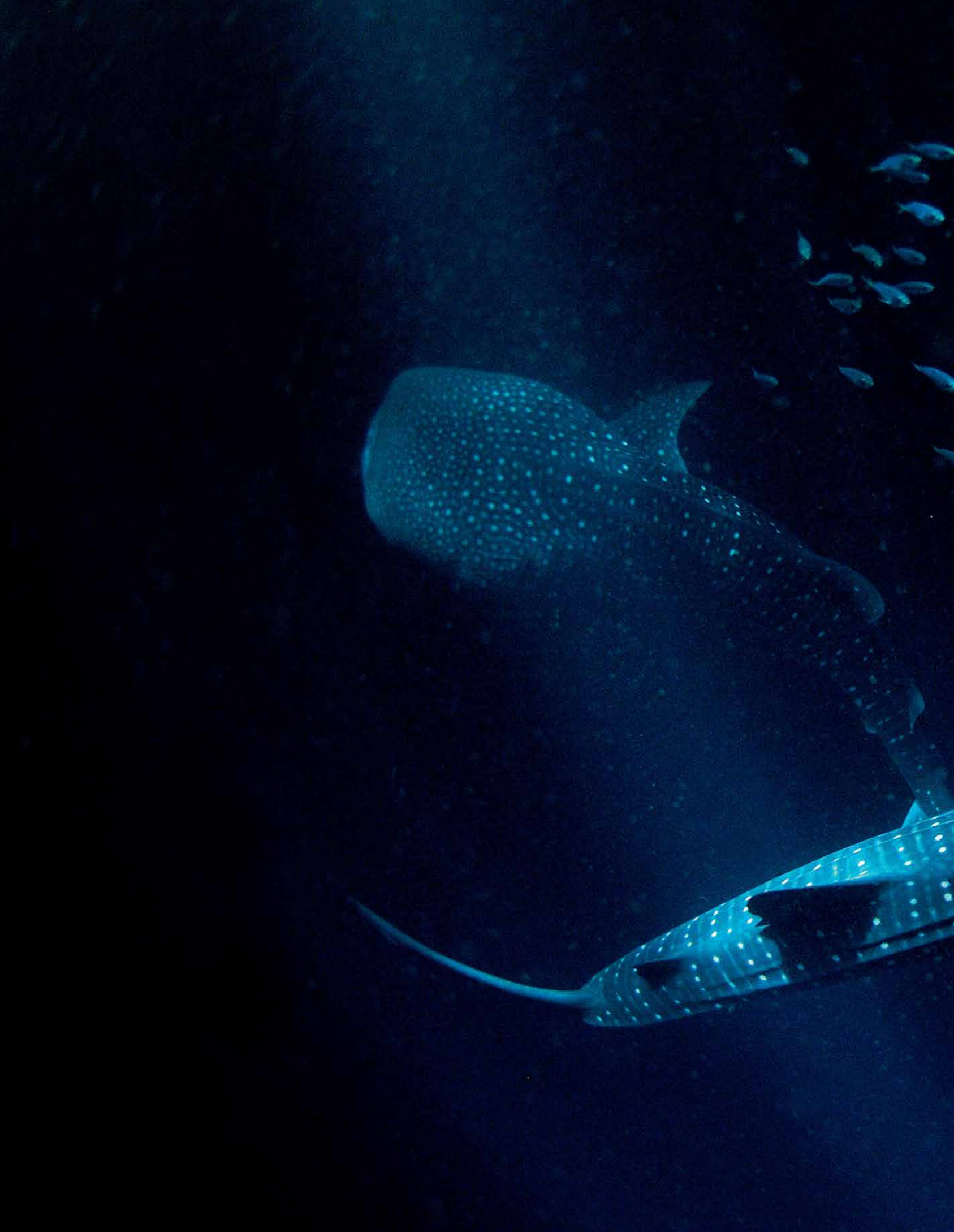
feel that they don't have the power or influence to make a difference in shark or marine conservation. Nothing could be further from the truth.

It isn't just about curtailing the consumption of shark fin soup. Many of the fish we regularly eat, like some species of tuna or swordfish can come from fisheries that catch and kill sharks as bycatch. You can educate yourself and become more intentional about the kind of fish you order at a restaurant or put on your dinner table. Ask questions, think, and be selective. It's difficult to turn down certain seafood dishes, especially if it is a habit. But as a consumer you have massive power to change the way markets and restaurants do business and make it ripple all the way up the supply chain and straight back to the fishermen. However, so many of these behaviours change as a result of one-on-one conversations. You can pass on your new understanding and appreciation for sharks to friends and family.

What have you learned while photographing and writing this book?
One thing that I have learned during my decade with sharks is that they resonate in a different way with each person. To the fin dealer in Hong Kong or fishermen on a longliner, sharks are a means of feeding their families or paying for their children's education. To the surfer whose best friend was tragically killed or to the mother whose child died in an attack, sharks are deadly beasts and symbols of loss. For the researcher, sharks are wells of biological and physiological data that have only begun to be tapped. For a child visiting an aquarium, sharks represent a window to the wild. For many divers, sharks are the reason they don their gear each day. Very few people are indifferent to sharks as they have an uncanny way of inciting our attention, often in a profound way. Sharks have held my attention for as long as I can remember.

A reef flat boils with sharks as a late-afternoon storm rages offshore.

Silvertip sharks move into shallow water at dusk and patrol the edges of coral reefs, where they often prey on reef fish and eagle rays.



For centuries Djibouti's Afar people have told stories of a large creature living in the 'Pit of Demons'. True marine monsters are unlikely to roam the seawater loch, but whale sharks occasionally venture up this fjord-like passage.

A Galapagos shark speeds across a coral reef looking for a meal in the Mozambique Channel. Juveniles prefer reef fish and graduate to a diet of rays and other sharks as adults.

A Sri Lankan fisherman lifts a dead thresher shark, a species that reaches maturity at between seven and 14 years of age and whose resilience is vulnerable to fishing pressure.

Awaiting auction, a single boat's catch of silky sharks is laid out in an orderly grid.

ABOVE A butcher in a Sri Lankan fish market deftly severs the dorsal fin of a bull shark.

ABOVE Shark fins are laid out to dry in the sun before being packed and shipped to buyers.

Plastic is becoming a common ingredient in the diet of most marine organisms. As filter feeders, whale sharks are prone to ingest plastic during their daily feeding sweeps through the water column.

A juvenile puffadder shyshark, which is endemic to South Africa's kelp forests, hovers above a diver's hand.

A white shark follows a researcher in a sea kayak off South Africa's south-

D'ARROS & ST JOSEPH

05° 24' 58.0" S, 53° 17' 56.1" E

Scientific director of SOSF D'Arros Research Centre **Rainer von Brandis** relays some of the knowledge gleaned on the local marine and terrestrial environments of these remote islands in the Seychelles' Amirantes Group.

Words by Dr Rainer von Brandis

Indian Ocean
Seychelles

D'ARROS ISLAND and St Joseph Atoll are situated in the remote outer islands of the Seychelles. They form part of a small chain of islands that comprise the Amirantes Group, named for the bank on which they are situated. Mahé and the other inner islands of Seychelles lie 250 kilometres northeast of the Amirantes while Zanzibar is 1,400 kilometres due west. Because of their inaccessibility, lack of fresh water and infertile soils, the outer islands have long been regarded unsuitable for permanent habitation. Nevertheless, over the past two centuries small communities have existed transiently on some of the islands to grow coconuts, collect guano and catch fish. Today, conservation and tourism are the main activities on the outer islands.

Although D'Arros Island and St Joseph Atoll are separated by a one-kilometre wide and 70-metre deep channel, they are considered a single ecological unit as their ecosystems are inextricably linked. D'Arros Island and the 16 islands that comprise the St Joseph Atoll are relatively young (circa 5,000 years) sand cays.

D'Arros Island is oval shaped and about two kilometres at its widest axis, which means you can walk around its uninterrupted sandy beach in less than two hours. St Joseph Atoll consists of a circle of 16 islands that have a combined landmass just less than D'Arros. These islands are situated on a shallow reef flat that encircles a central lagoon of 3.5 kilometres in length and 3 metres in average depth. During the low tide, marine organisms are trapped in the lagoon because the reef flat becomes entirely exposed. As the tide rises again, water spills back over the reef flat to eventually lap against the beach crests of the islands. Most of the rain falls during the northwest monsoon, between December and March. For the remainder of the year the island is subjected to moderate southeasterly winds and relatively dry weather. Air temperature varies between 25 and 35°C while the sea cools to 24°C in winter and warms to 31°C in summer.

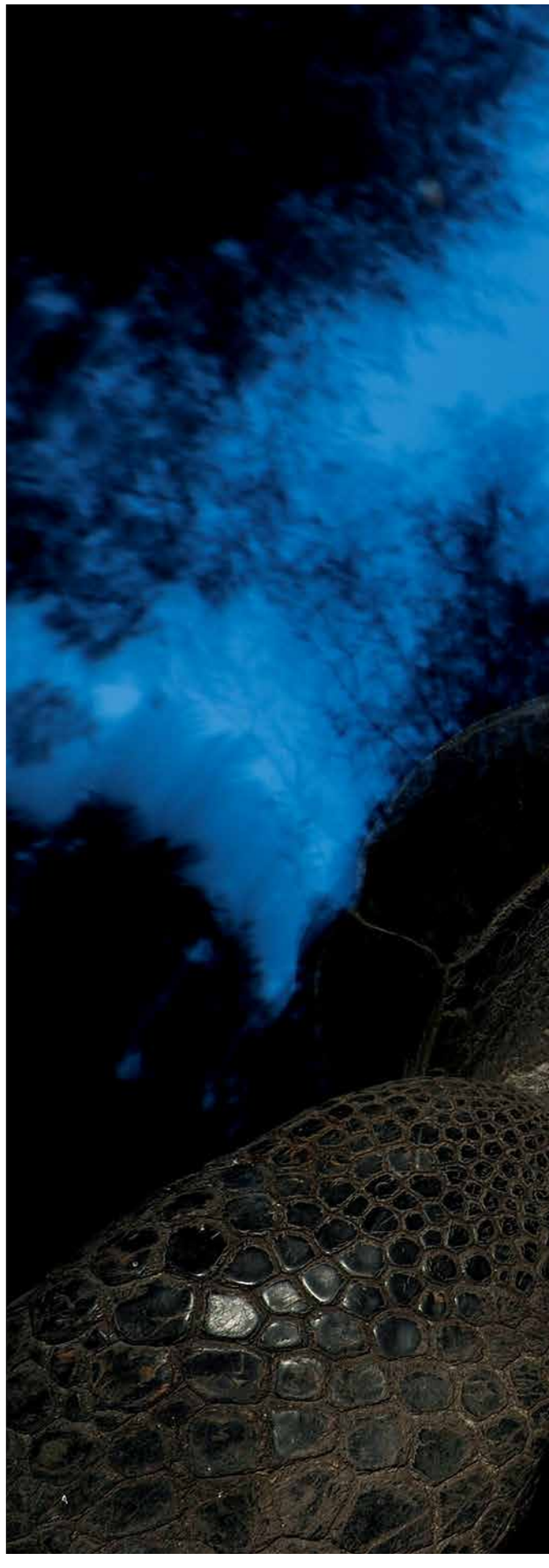


PHOTO BY THOMAS P. PESCHAK

OPPOSITE
One of the largest known Aldabra giant tortoises (*Aldabrachelys gigantea*) lives on D'Arros island.

PREVIOUS SPREAD
D'Arros Island (left) and St Joseph Atoll (right) provide a hotspot of biodiversity in the remote outer islands of the Seychelles.

While a jungle of coconuts might seem aesthetically pleasing, it is extremely low in biodiversity.

PHOTO BY THOMAS P. PESCHAK (3)

ABOVE
Bohar snappers (*Lutjanus bohar*) are one of the most common predatory fish on the coral reefs surrounding D'Arros and St Joseph.

OPPOSITE
Blacktip reef sharks (*Carcharinus melanopterus*) hunt along the reef crest and shallow reef flat at dusk.

The terrestrial environment

D'Arros and the islands of the St Joseph Atoll are flat and sandy. Scattered throughout the interior of the larger islands, a rocky layer of fossilised guano lies beneath the surface of the sand, giving testament to bygone seabird colonies. The beaches consist of uninterrupted soft white sand and are fringed by gentle lapping waves on one side and coconut palms on the other. Although coconuts are indigenous to the region, they are normally restricted to the beach crests of islands as they are unable to penetrate existing tropical forests. However, when the interior is denuded of native vegetation, coconut palms quickly occupy the open space to form a dense jungle devoid of other plant species. Unfortunately, by the late 1900s this fate had overcome most of the outer Seychelles islands. D'Arros and the seven largest islands of the St Joseph Atoll were no exception and today 90 percent of the vegetation on these islands is dominated by coconut. The remaining 10 percent comprises casuarina trees and small patches of indigenous broadleaf forest interspersed along the beach crest and among the coconuts.

While a jungle of coconuts might seem aesthetically pleasing, it is extremely low in biodiversity. This quickly becomes evident when you attempt to slash your way into the dense jungle on D'Arros. Apart from a few skinks, spiders and several million mosquitoes, there is very little life. If the natural forest had been left undisturbed, you would likely have encountered several species of land bird feeding on a diversity of insects and fruits; giant tortoises lumbering around on the open forest floor; crabs and skinks scuttling about and seabirds nesting in the leafy canopy overhead. Fortunately there is a very strong conservation ethic in Seychelles and several vegetation rehabilitation projects are currently underway. D'Arros Island has taken a lead role in this initiative as it facilitates the most extensive forest rehabilitation programme in the region using an innovative, low cost and effective technique that was devised on the island. Encouragingly, large numbers of seabirds have already begun nesting and roosting in the rehabilitated areas, raining down the nutrient rich guano that is required to kick-start natural ecosystem processes.

In the southeast of the atoll along the inner shore of St Joseph Island, there are a series of muddy channels flowing between rocky shelves of fossilised corals. Small stands of mangrove grow in these channels and along the inner rim of most of the other islands in the atoll. In the past, mangroves were heavily exploited for their bark and thus it is believed that they were once far more common in the atoll than they are today. Although these remnant mangrove stands are expanding again, the D'Arros Research Centre is accelerating this process by planting propagated mangrove seedlings in strategic areas. Mangroves are a vital component of lagoon ecosystems as they provide food and shelter for a diversity of marine creatures; act as a nursery for fish, sharks and rays; provide nesting habitat for seabirds; act as a nutrient trap; offer a valuable food source for many species and reduce coastal erosion.

The marine environment

The marine environment surrounding D'Arros Island and St Joseph Atoll boasts a diversity of habitats

A BRIEF HISTORY

The islands were uninhabited when they were officially discovered in 1771 during a French exploratory mission from Mauritius and named after Baron d'Arros, the French Naval Commander at the time. A small community of less than 20 Seychellois settled on the islands in the mid 1800s to establish a coconut plantation. By the early 1900s the community had grown to more than 100 and more than 90 percent of the natural vegetation had been converted to coconut plantation. The community was also extracting guano, logging mangroves and curing fish and turtle meat for the local market. By the 1970s Asia was dominating the coconut oil market and most of the outer island plantations were abandoned. In 1974 D'Arros and St Joseph came under private ownership and soon coconut production ceased and discreet conservation policies were implemented. Today, the population on D'Arros numbers between 30 and 40 while the Islands of the St Joseph Atoll are once again uninhabited.

ABOVE A juvenile fairy tern (*Gygis alba*) waits patiently for its parents to return with a meal of fish.

Potato cod (*Epinephelus tukula*) are known for being friendly and inquisitive.

PHOTO BY THOMAS P. PESCHAK

PHOTO BY THOMAS P. PESCHAK (2)

ABOVE
A Hawksbill turtle (*Eretmochelys imbricata*) prepares its nesting site on the beach crest of D'Arros Island.

OPPOSITE
A juvenile hawksbill turtle feeds on sponges.

and species. Compared to the other islands in the Amirantes, marine ecosystems are significantly healthier because, over the past four decades, the private owners have done much to preserve habitats, reduce fishing pressure and limit poaching.

The lagoon, which has a maximum depth of 6.5 metres, is divided into a series of basins by parallel flat-topped reef ridges or so-called 'ribbon reef'. These ridges, of which the tops emerge during low tide, support thick growths of seagrass frequently visited by foraging turtles. The bottom is sandy and interspersed with patches of temperature-resistant corals that provide shelter for a host of fishes, crustaceans, turtles and rays. Because sediment is transported over the reef flat on the incoming tide, the water in the lagoon is generally warmer and turbid.

The surrounding reef flats are periodically exposed during low tide but in some places, shallow pools and lower lying areas are permanently inundated with water. In the southeast of the atoll, where the inner reef

Of the five land bird species existing on D'Arros and St Joseph today, the turtle dove and the Seychelles fody are believed to be native while the house sparrow, Madagascar fody and the zebra dove were probably introduced by humans. However, once a significant portion of the vegetation has been rehabilitated, certain land bird species that are endemic to the Seychelles will be reintroduced.

PHOTO BY RAINER VON BRANDIS

Three heron species occur of which the grey heron and green-backed heron are breeding residents. No less than 15 migrant wader species have been recorded with the ruddy turnstone and crab plover being the most common.

More than 1,000 greater and lesser frigatebirds and 1,500 lesser noddies roost on the islands at any one time. These birds breed at other locations and

flat is protected from wave action and tidal currents, millions of fiddler crabs emerge from their holes at low tide to feed on fresh silt deposits. Using their claws and mouthparts the crabs work over the entire surface of the reef flat, leaving behind small balls of filtered sand. As soon as the flats are submerged again, stingrays arrive to dig out these crabs and other burrowing creatures. Shark pups and bonefish flood over the flats with the rising tides to hunt for sprats and shrimps. On the high tide, larger sharks arrive in search of rays, bonefish and shark pups.

Where it meets the open ocean, the reef flat is replaced by a coral reef that descends down a slope to about 25 metres, where it abruptly meets a sandy plateau. Along the northern shores, the reef slope is steep and, in many places, completely covered by corals. In the south, the reef slope is more gradual and corals more sparse. Apart from corals, other prominent benthic life forms on the reef slope include soft corals, gorgonians, sponges, algae and zoanthids.

The coral reefs have recovered well since the devastating coral bleaching event in 1998, when approximately 70 percent of the corals in the Seychelles died due to global warming. Every year large areas that were previously devastated are inundated with thousands of juvenile corals. Corals are the building blocks of tropical marine ecosystems and we have noticed a steady increase in macroinvertebrates, fishes, stingrays and even the larger charismatic species including sharks, manta rays, dolphins and turtles.

Blacktip reef sharks and sicklefin lemon sharks thrive in the shallow lagoon and reef flat habitats of the atoll. Both species use the lagoon for breeding purposes and shark pups can be seen patrolling the shallows all year round. Other sharks regularly encountered around the islands are whitetip reef, tawny nurse and grey reef sharks. Bull sharks and hammerheads are less common but have been encountered on several occasions. Further out to sea where the Amirantes bank drops off into the deep, silvertip, silky and oceanic whitetip sharks have been seen.

Hundreds of endangered hawksbill and green turtles nest on the beaches of D'Arros and St Joseph every year. While green turtles emerge to nest at night, hawksbills nest in the daytime, a phenomenon that is unique to the Seychelles.

Hundreds of endangered hawksbill and green turtles nest on the beaches of D'Arros and St Joseph every year.

use D'Arros and St Joseph as a convenient stopover or as a routine perch from which to go on daily fishing forays.

At least seven seabird species breed on the islands including approximately 23,000 pairs of wedge-tailed shearwaters, 2,000 pairs of fairy terns, 500 pairs of roseate terns, 300 pairs of lesser noddies, 50 pairs of common noddies, 15 pairs of blacknaped terns and 10 pairs of white-tailed tropic birds. The roseate tern and shearwater colonies are of particular importance as they are the second largest in the Seychelles. The roseate terns usually arrive in June and settle in a single noisy colony somewhere along a remote beach crest in the atoll. A breeding pair usually produces one or two chicks but breeding success is strongly dependent on predation rates from grey herons and hermit crabs. More than 90 percent of the wedge-tailed shearwaters breed on Fouquet Island in the atoll.

Three gecko and one skink species are ubiquitous around the islands and a small reproductive population of Aldabra giant tortoises exists in the open grasslands adjacent to the village and gardens.

Massive land crabs are common along the beaches of the atoll, and hermit crabs hide in the shady forest by day but at night, millions migrate to the beach to feed on anything that the tide has washed up. Ghost crabs are also abundant, and giant robber crabs are slowly making a reappearance despite going extinct in the Amirantes several decades ago.

PHOTO BY THOMAS P. PESCHAK

The shallow marine environment at D'Arros and St Joseph provide crucial developmental habitats for juvenile green and hawksbill turtles, the numbers of which probably range in the thousands. Green turtles graze seagrass on the reef flats during the high tide and when the reef flats become exposed on the dropping tide the turtles retreat to the deeper lagoon or the adjoining coral reefs to rest. A leisurely dive along the reef crest during the low tide can yield more than 30 turtle sightings. Hawksbills forage in a variety of habitats seeking out sponges and zoanthids. The most preferred habitat is the shallow silty region in the southeast of the atoll as it is rich with their food. It is a long way to deeper water from there so turtles are forced to sit out the low tide in small stagnant pools on the reef flats, often tolerating water temperatures in excess of 37 degrees. These turtles are clearly distinguishable from others as their lack of contact with the open ocean ensures that they are covered from head to flipper in green algae!

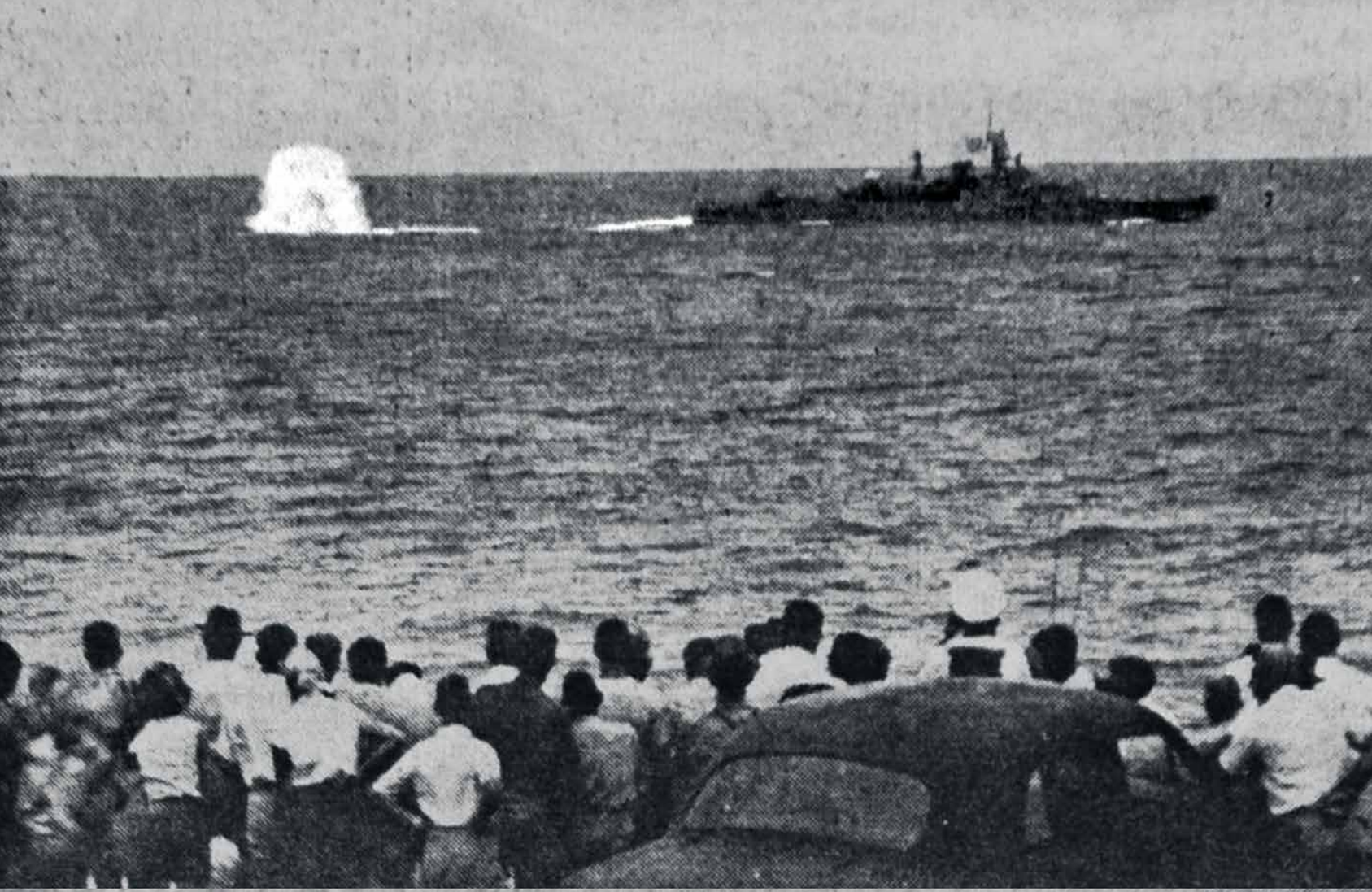
Three gecko and one skink species are ubiquitous around the islands and a small reproductive population of Aldabra giant tortoises exists in the open grasslands adjacent to the village and gardens.

The fish species assemblage numbers more than 300 and includes the entire trophic spectrum of herbivores, corallivores, invertivores and piscivores. Large shoals of beautifully coloured fish of a variety of shapes and sizes swarm over the outer coral reef, occasionally darting about in unison to avoid attacks from predatory fish such as tuna, trevallies, snapper and barracuda. In the atoll, bonefish, permit, trevallies and barracuda chase sprats into the shallows, gulping down mouthfuls of them at a time.

Manta rays circle D'Arros Island and St Joseph Atoll year round feeding on plankton aggregations as close as 20 metres from the beach. Groups of eagle rays are often encountered patrolling the reef edge and inquisitive stingrays spanning up to two metres in disc-width rise up from the ocean floor to confront divers before darting off.

Bottlenose, spinner and Risso's dolphins are regularly spotted around the islands while melon-headed whales, short-fin pilot whales and humpbacks are less common. D'Arros Research Centre was built in 1994 and tasked with conducting scientific research to better understand and manage local marine and terrestrial environments.

Fairy terns (*Gygis alba*) are excellent fishermen and thus can afford to spend a great deal of time socialising or resting.



THE POLITICS OF SHARK 'ATTACKS'

Christopher Neff discusses the politics of sharks and shark 'attacks', and how this frames our understanding of these events.

Words by Christopher Neff
Photography by Thomas P. Peschak

THE FIRST QUESTION I am often asked is: is there politics to shark attacks?

After four years of research and finishing the first PhD of this kind, I can report soundly that 'yes there is'. And moreover, the politics of shark 'attacks' is complicated. Not simply because there are tensions between public safety and shark conservation, nor because of the emotion-laden, media-attracting events, but because at a fundamental level these are ungovernable events in nature.

Shark bites are tragic and traumatic. They are also the result of an interaction in a wild marine ecosystem between one land animal and one aquatic animal. Simply put, these are events in the natural world where there is no blame, no intent, and no policy solution. There is no government decision that can shark-proof swimming at all times. The best we can hope for are half-measures on a small scale. Yet, shark bites are made governable by policies, politics, and rhetoric. Thus, the 'politics of shark attacks' relies heavily on moving these events out of the natural world and into the social world, where accidents are intentional, bites are 'attacks', and animal behaviour is criminal behaviour. There are four messages to four different audiences that emerge from my PhD, four things I take away as lessons and which I would like to tell these different audiences if I could:

To governments: shark bites are not governable events and governments are not always blamed;

To scientists: please highlight that 'we are in the way, not on the menu';

To the public: the beach is the wild and you are sophisticated; and

To conservationists: shark bite prevention is shark conservation.

Speaking to government

This first point is perhaps the most important and bears repeating. Shark bites on humans are not a governable event. However, there are two leading factors that influence its movement out of nature and into politics. Firstly, these events present political problems for politicians and it is to this that governments respond. The problem arises from four elements: the objective harm of the event, emotional response from the public, the frequency of the events and media attention.

Secondly, even if the events are not governable they are blamable. As a result, short-term responses are seen

OPPOSITE The events of 'Black December' along the KwaZulu-Natal coastline in South Africa in 1957 led to mass public fear and extreme reprisals against sharks.

The message to scientists is simple, the public wants to know if they are on the sharks' menu?

as a politically valuable idea. Here, the context and features of shark bites are unique and politically inviting because sharks are often maligned and unpopular and because the events are random. Political responses to shark bites can look like a successful response to a deviant 'rogue' animal because the events are so infrequent that the time frame between events makes a policy look like it is working. As a result, the message to governments is to reconsider these events and reengage with the public.

Speaking to scientists

Scientists do a lot of things very well. Shark science and shark conservation both rely on their research and innovation. They are also my friends, colleagues and most appreciated critics. However, talking to the public about the uncertainties of shark bites remains a challenge. The message to scientists is simple, the public wants to know if they are on the sharks' menu?

This is particularly important because politicians use reasoned, measured, scientific uncertainty to gain leverage with the public and to undermine shark conservation and kill sharks. In short, science is taking a secondary role in shark bite response policy. The ideas of the 'rogue' shark, the *Jaws* shark and the man-eating shark have not gone away. Indeed, killing sharks is seen as a successful policy response for maintaining public confidence in beach-going. Government responses directed at shark hunts to kill sharks believed to pose a particular threat to the public occurred in 2013, 2012, 2011 and 2010.

The idea that people may be on the menu has been dispelled since the 1980s, more than 30 years ago. Yet, the lingering narrative that sharks know what we are and seek us out is damaging to global shark conservation education. Indeed, the phrase 'attack' connotes an intent that has not been scientifically validated. In this case, we see sensationalised media reports, movie scripts and scientists using a shared discourse to reflect different meanings and realities.

In addition, the evidence to support most 'shark control' methods has been disproven since the early 1990s, some 20 years ago. As an example, the data show that the shark culling in New South Wales (NSW) has not reduced the rate of shark bites. In addition, the data show that there does not appear to be a relationship between shark culling and shark bite prevention. While the negative impacts highlight that over the past three years, 57 percent of the wrong target species has been caught and killed, 54 white sharks have been culled on the east coast since 2008; and most of the white sharks culled happened during times when there has never been a fatality.

I was pleased to see the American Elasmobranch Society recently voted in favour of a resolution to address this rhetoric based on new proposed categories from Dr Robert Hueter and myself. These included shark sightings (where there is no contact between sharks and people), shark encounters (where there is contact but no injury), shark bites (where there is a non-fatal injury) and fatal shark bites (where the injury is fatal). This change in the discourse is a first step in a long-term approach to giving the public the best evidence-based information. Hueter and I argued that this research matters because current constructions criminalise shark bites; this discourse lowers policy thresholds (that lead to easy overreactions); and it misleads the public. A full application of the proposed classifications offers a new narrative to scientists, policymakers and the media. It provides new options for considering human-shark interactions without intent and focuses on multiple outcomes – particularly non-dangerous ones. It also may promote less overreactive public policies and encourage changes to media reporting by news outlets, such as the Associated Press.

Moving forward, a consensus among scientists on causal stories about shark behaviour that 'stick' with the public will assist conservation stakeholders in education efforts and also equip governments with more choice in how they talk to the public following shark bite incidents.

Speaking to the public

There is a difficult message to convey to the public about shark bites; however, it is not about sharks. It is about the ocean and marine environments. Simply put, the beach has been domesticated as a tourist location for bathers in ways that do not conform to the reality of what the ocean is: the wild. In many ways, going to the beach is

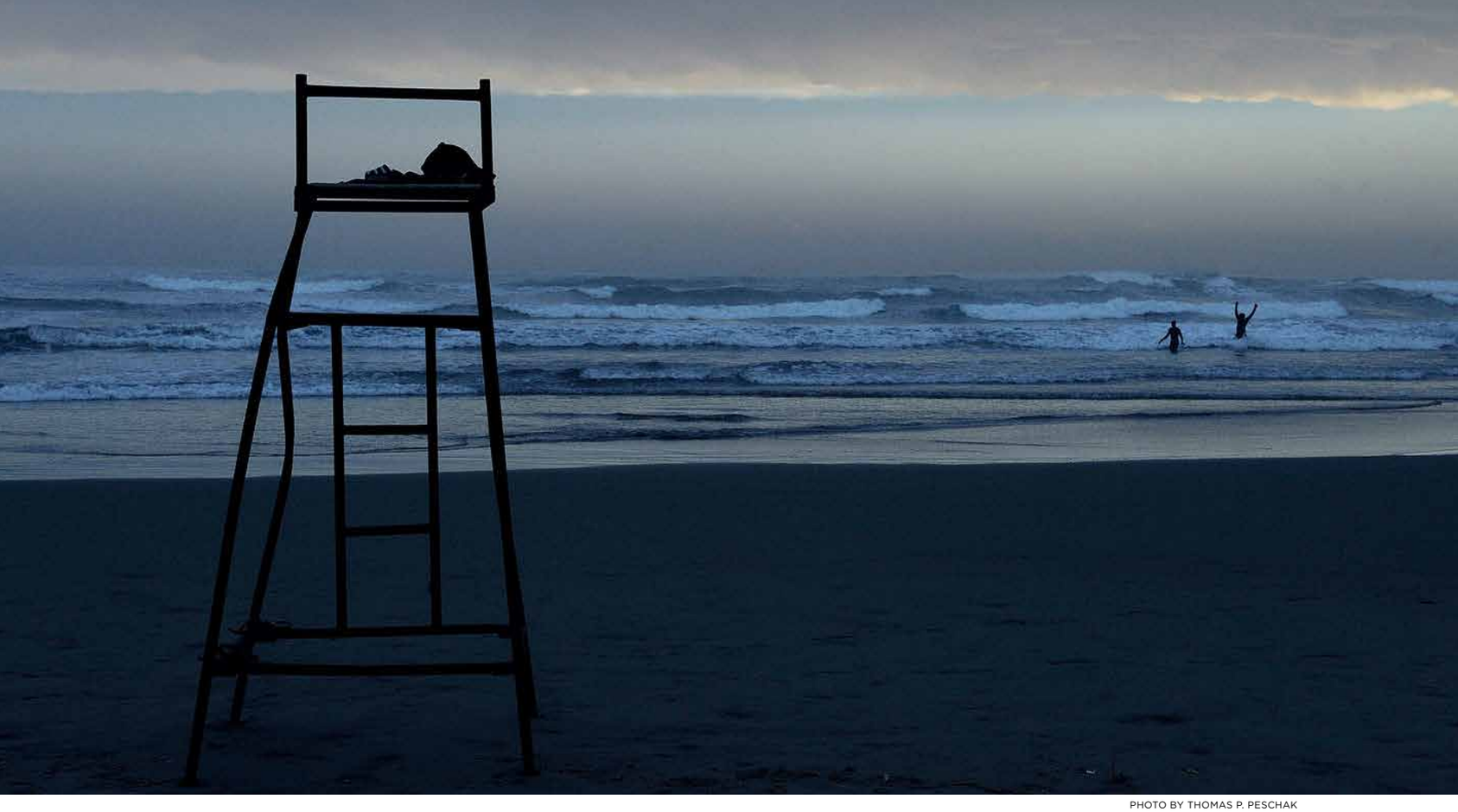


PHOTO BY THOMAS P. PESCHAK

The beautiful Second Beach of the picturesque resort town of Port St Johns has become the deadliest stretch of coastline on earth when it comes to fatal shark attacks.

like putting a picnic table in the Serengeti and pretending it is not the wilderness. Yet, entering the ocean is to submit to a foreign world that is dynamic and unsafe.

These are difficult points because most of us love the ocean and the beach. It is reasonable to want to have a safe, recreational experience at the beach. Indeed, many people do, most days of the year. But rip currents, jellyfish, stonefish and sharks represent just a fraction of the ecological totality that is the 'swimming' experience. Essentially, we are talking about a plan for 'informed choice' that considers personal risk based on personal behaviour. The focal decision is the one to stay on the beach or enter the dynamic marine ecosystem.

The good days provide a false sense of security to what the ocean is and commercial interests are invested in promoting the idealised and false narrative. The result is not to approach the beach as an enemy but to respect the mystery of what is going on beneath the surface, before we enter the water. The wild is not governable and sharks do not abide by regulation.

Speaking to conservationists

The message to conservationists is simple: 'shark bite prevention is shark conservation'. The first piece of this argument is to note that there is currently a disconnect in most locations between shark bite prevention work and shark conservation science. This is changing, but it begins by avoiding discussions of the endangered status of sharks following a shark bite. Following these tragic events, the endangered nature of sharks looks like the solution to the problem, not a problem. In addition, articulating the value of sharks following a loss of human life is insensitive.

The change that is needed is for shark conservationists to be champions of shark bite prevention because when conservationists engage they include themselves in meaningful ways that show the need to protect both people and sharks. This reconciles many of the tensions between the two issues and offers them a seat at the table as stakeholders in solving the issue. The result is the promotion of better public education by adding voices of science and conservation to those of risk management. This encourages balanced solutions that reflect higher social values in animals and shifts away from the 'precautionary principle' where the burden of proof is on animals to prove 'innocence' to human behaviour. This approach also prioritises scientific evidence of ani-mal behaviour as a way to protect people, reduce human risk and offer the public useful tips.

Recap and final thoughts

There are a number of final points. Firstly, a thank you to the Save Our Seas Foundation. This research would not have been possible without the support of the

PHOTO BY THOMAS P. PESCHAK (2)

ABOVE Scientist Sheldon Dudley measures the size of a shark's teeth.

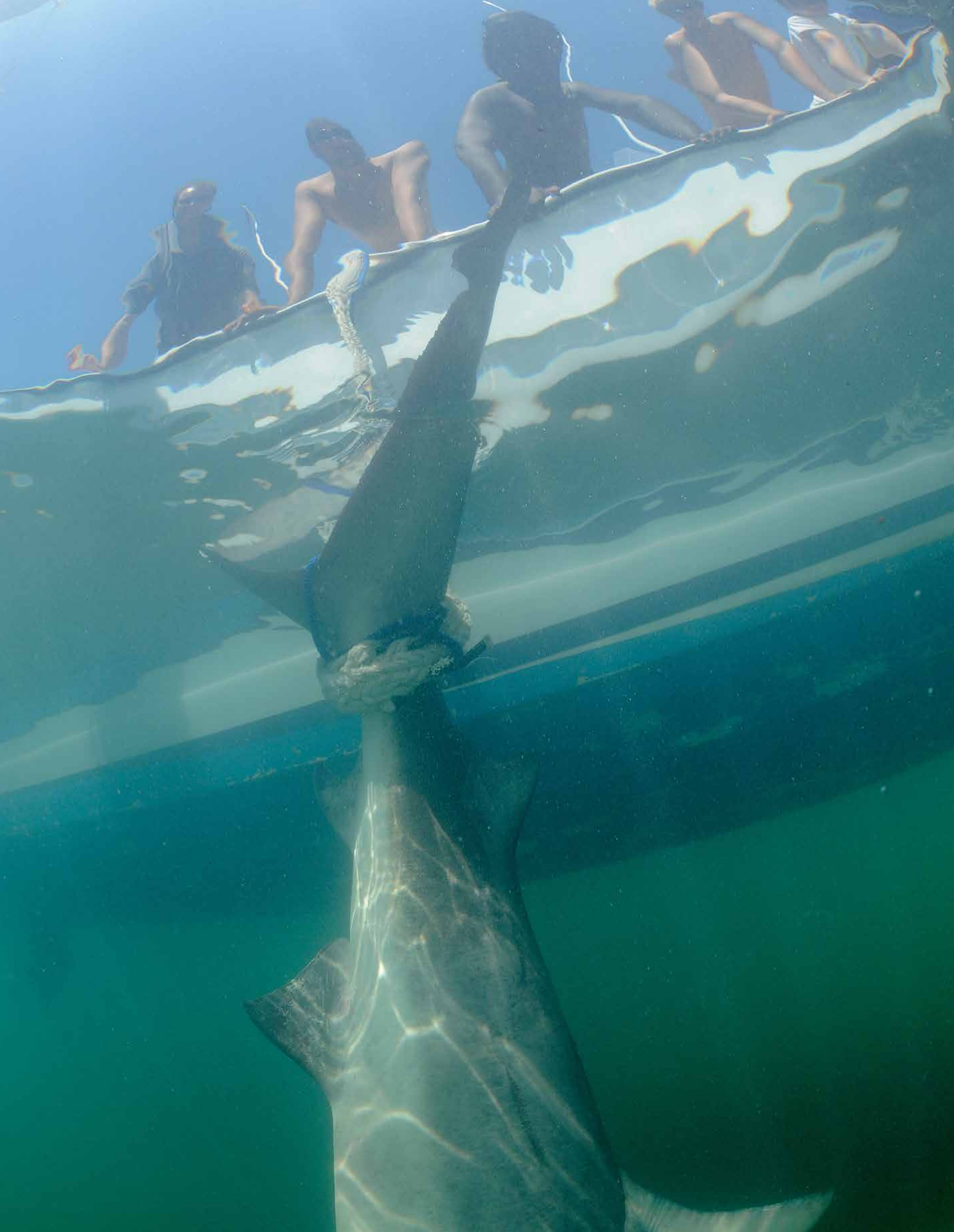
OPPOSITE A dead shark dangles from the side of a boat.

SOSF, or put a different way, I would not have been able to complete this PhD without the friendships, professional support and financial assistance of the foundation. It simply could not have happened and I am grateful to all of the scientists who assisted me and to the Save Our Seas Shark Centre for hosting me during my fieldwork in Cape Town.

Secondly, how would I recap these points? It is critically important to locate shark bites in the natural world. However, this will happen only when policies, politics, the public and rhetoric change. Governments can play a leading role by prioritising science in their efforts to reduce shark bites. Scientists can help do this by highlighting the many different features of the human-shark relationship. Conservationists can engage by connecting their efforts to support local sharks with new assistance in shark bite prevention. Lastly, the public can do more to promote calculating beach risk by rethinking the beach and marine environments. A key starting point is in identifying the ocean as the wild and developing an 'informed choice' model of shark bite prevention. This focuses on the personal behaviour in which we put ourselves in marine ecosystems.

Thirdly, where does this research go from here? While I have completed my dissertation, further study is needed. Policy responses that reinforce fears of sharks limit public support and undermine shark conservation for all species. In addition, the disparate policy directions and the role of science in anti-finning and fishery campaigns, compared with shark-control beach policies, point to a problem in the different social values placed on shark conservation.

In closing, meaning-making matters. When beaches are closed because of whale migrations inshore the public is happy, and when they are closed because of white sharks they can get angry. If we were to replace the word 'shark' with the word 'dolphin' throughout this article it would fundamentally alter the conception of this story and public attitudes. In short, there is an existing shark bite profile in the minds of the public based on predicted perceived outcomes and emotions, images and causal stories in human-shark narrative. It is therefore the task of social scientists and natural scientists alike to challenge the power dynamics and stereotypes that value one meaning over another and one perception over another, not simply because conceptions of shark bites as governable events and ocean beaches as hospitable places to recreate are false, but because it is at this core argument that the future of shark conservation will sink or swim.




名世界燕窩莊

LOSING THE TASTE FOR SHARK FIN SOUP?

SOSF principal scientist **Sarah Fowler** reviews what the SOSF has been doing to address the global threat to sharks and the extent to which its efforts are making a difference.

Words by Sarah Fowler
Photos by Thomas P. Peschak and artwork by Alessandro Bonora

DEMAND FOR SHARK FIN, to supply the huge market demand for an East Asian luxury soup, has driven most unsustainable shark fisheries since the early 1990s. Of the shark species identified in Hong Kong's shark fin markets, 70 percent were pelagic sharks. Worryingly, more than 80 percent of the pelagic sharks that are commonly caught in high seas fisheries and harvested for their fins or meat are so seriously depleted by fishing pressure that they have been assessed as Threatened or Near Threatened in the IUCN Red List of Threatened Species. Many other coastal and deep-sea sharks that enter international trade are also assessed as having a higher risk of extinction.

The Save Our Seas Foundation has, almost since its inception, supported projects aimed at reducing the impact of the international shark fin trade. These have addressed several key aspects of this threat, including:

- improving legislation and shark fisheries management to prevent shark finning and over-fishing, and enforcing finning prohibitions effectively,
- raising scientific knowledge and public awareness and providing technical advice in support of the designation of one of the world's largest shark sanctuaries,
- developing novel techniques for monitoring trade by identifying fins in landings and markets, and reducing demand in the major consumer markets through education and awareness campaigns.

Other organisations have focused upon air and sea freight transport networks, seeking to hinder the trade by persuading carriers to stop moving shark fins to major processing centres and end markets. Several airlines, for example, no longer carry shark fin as freight or serve it to passengers, and the Evergreen Line (which operates the world's fourth largest container fleet) has stopped shipping shark fin.

Recent media accounts of falling shark fin prices around the world, reportedly driven by a declining consumer market in China (the world's largest consumer of shark fin products), have been presented as evidence that campaigns to reduce the consumption of shark fin soup, and hence overall mortality due to shark finning, have succeeded. So too, have reports of decreased imports and consumption of shark fin soup in China. Can this be true: is the work of the SOSF, its partners and other conservation bodies having the desired effect? If so, which stages in the supply chain are being addressed most effectively? Can we now even afford to relax our efforts?

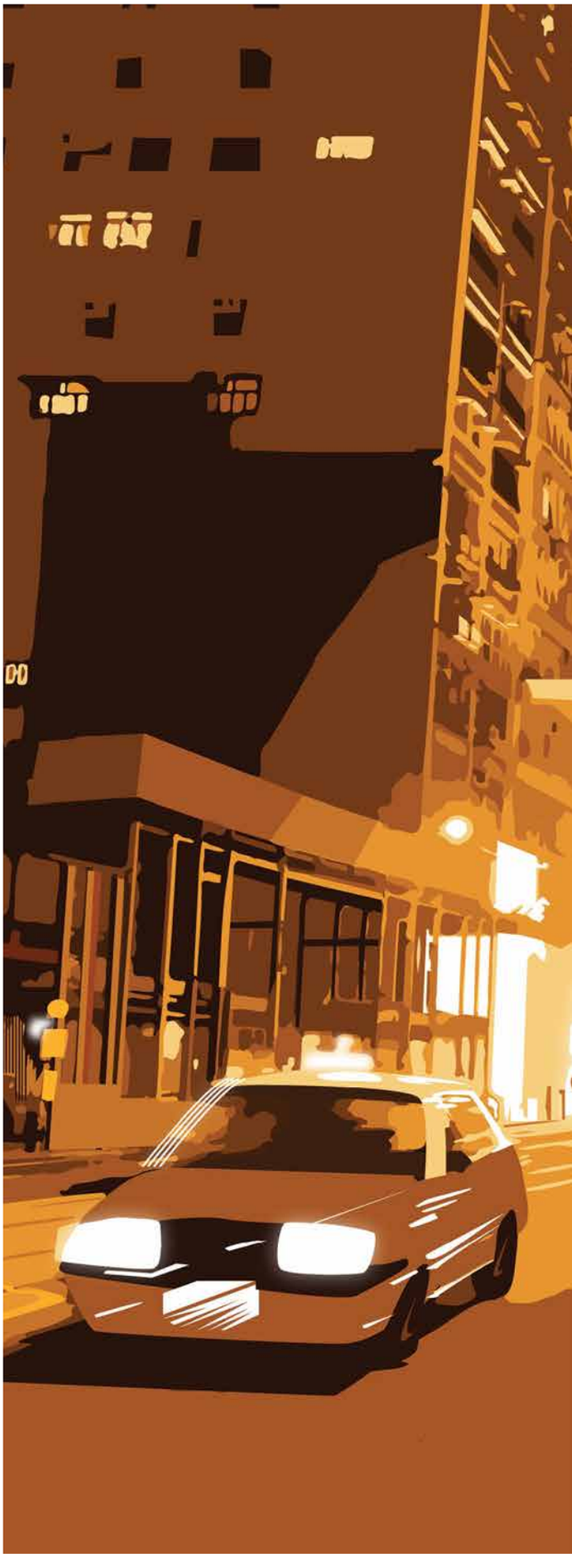
OPPOSITE Shoppers at a market in Hong Kong do not lack for available dried shark fin.

Some countries have recently declared huge shark sanctuaries and banned all shark fishing.

The supply of shark fins

During the past decade, the number of major fishing countries regulating shark fisheries and prohibiting shark finning (the removal and retention of shark fins while discarding the carcass back to the sea) has risen significantly. A significant drop in imports to Hong Kong was observed 10 years ago, from countries just starting to implement finning regulations. Many regional fisheries management organisations (RFMOs) have since adopted shark finning regulations and even prohibited the capture of a few shark species (albeit mostly those that were already seriously depleted). Some countries, including Palau (where SOSF started supporting the shark research, education and conservation efforts of the Micronesian Shark Foundation in 2008) have recently declared huge shark sanctuaries and banned all shark fishing. Furthermore, through the efforts of SOSF partners such as the Shark Alliance and Shark Advocates International, the implementation of shark finning prohibitions is steadily improving. For example, in June 2013 (after an almost seven-year Shark Alliance campaign), the European Union's Council of Ministers adopted a strengthened ban on shark finning that requires the world's largest shark fishing fleet to land all shark carcasses with their fins still naturally attached, reducing potential loopholes that might have allowed finning to continue undetected, while also setting the stage for similar future improvements in RFMOs.

These conservation measures have certainly reduced the capture and supply of shark fins, but it is important to recognise that unregulated overfishing of sharks and population depletion has also imposed a significant reduction upon global landings of sharks at this time. Indeed, Food and Agriculture Organization (FAO) data indicate that the total reported catch of sharks, skates and rays peaked in 2003 (at just under 900,000 tonnes) following the sequential depletion of one shark stock after another. This was well before most conservation campaigns or implementation of the FAO International Plan of Action for the Conservation and Management of Sharks (which improved shark catch monitoring and reporting) had begun to take effect. Regardless of the reasons for these declines, however, falling shark landings inevitably means fewer shark fins for the East Asian market. Indeed, FAO statistics on shark fin imports to China partly follow the catch



OPPOSITE There is little difficulty in sourcing shark fin in the Asian market.


魚翅城
SHARK'S FIN CITY
SHARK'S FIN CITY
永恒海味
WING HANG MARINE PRODUCTS LTD
永恒海味
PCCW

trend, although overlain by the economic factors that also influence consumption of luxury goods.

The economics of shark finning

Had the market for shark fin soup remained buoyant in the face of dwindling supply, basic economic theory suggests that fin prices would have risen as consumers compete in the face of scarcity. Instead, FAO data to 2009 indicate a reasonable stability for fin prices, particularly when compared to the rising values and relatively stable volumes of (uncharismatic) sea cucumber imported to China. The Asian financial crisis of 1998–1999 negatively affected the imports of high-value sea foods, as did the dip during the global economic downturn of 2001–2002.

Furthermore, there seems little doubt that the prices being paid for shark fins have now fallen significantly, in at least some parts of the world during the past few years. For example, SOSF principal investigator Igbal Elhassan, who has been collecting shark tissue samples from fish-landing sites on the shores of the Red Sea, was recently told by Yemeni shark fin traders that the price they receive has fallen by between 30 and 60 percent over the past two years. The fin traders stated that this is a global phenomenon, and all attribute it to a change in the main Chinese import market. None, however, know for sure why this has happened. Possible reasons suggested include competition from other sources of shark fin, a general economic downturn in China (following that in most other parts of the world), increased regulation of fin imports into China (traders are now more likely to be asked to provide invoices for their sales), and (occasionally) the impact of pressure from the wildlife organisations campaigning against the shark fin trade. Simple economic theory certainly supports the suggestion that a decline in unprocessed shark fin prices could be caused by a decline in market demand, but what is the cause? Economic downturns, shark conservation campaigns (apparently a popular scapegoat with industry), increased regulation of imports to China, or some other factor altogether? FAO commodity data are not yet available, post 2009, so other clues are needed.

The influence of policies & campaigns

Two recent initiatives by the Chinese government could have reduced demand: an anti-smuggling campaign over a six-month period in 2011–2012, and President Xi Jinping's recent frugality campaign, which is affecting the consumption by officials and other Chinese elites of luxury seafood.

The anti-smuggling campaign would not have focused upon trade in protected or prohibited shark species; there are virtually none of these (last year's CITES listings will not take effect until September 2014). However, smuggling of high-value goods is also used to avoid customs taxes. This clamp down could temporarily have shut down shark fin trade, with repercussions upon domestic consumption in China (which would also explain the reported new interest in receiving invoices from traders at fish landing sites).

The government's crack-down on corruption and extravagance by officials, including prohibiting shark fin soup at official functions, and preventing gifts of other luxury items, have reportedly caused huge declines of revenues at Beijing's most upmarket restaurants as well as a crash in sales of imported high-end consumer goods. However, China surely does not have a sufficiently large government service for this to significantly influence national utilisation of these luxuries. That leaves us to consider whether the world's current economic problems are throwing sharks a lifeline, or the campaigns to reduce shark fin consumption are really taking effect – or perhaps a combination of the two.

An early WildAid survey in China discovered that 76 percent of the population did not understand what shark fin soup contains and highlighted the importance of raising public awareness of its impacts. In 2006, SOSF's successful television special on marine conservation, co-produced with WildAid, reached an estimated audience of 200 million Chinese viewers, and China's most popular celebrity, the National Basketball Association superstar Yao Ming, pledged to stop eating shark fin soup. WildAid, with SOSF support, subsequently exhibited 20 giant billboards around Beijing featuring Yao with sharks and the message: 'When the buying stops the killing can too'. These 20 billboards were seen by 1.1 million commuters every day. A follow-up survey in 2008 found that 55 percent of those interviewed had seen and remembered the campaign. Of these, 94 percent said it had made them aware of the problems; 82 percent had reduced or stopped eating shark fin;

and 89 percent said shark fin should be banned or regulated. A second documentary featuring top musician, Liu Huan, broadcast on television in 2008 was also shown 60 times a day on 2,600 video billboards in Beijing, reaching an audience of about 33 million a year. By 2010, public service announcements on shark fin were being distributed widely throughout China, reaching up to one billion people every week on screens in airports, on trains and subways, in commercial buildings and on street corners.

Other conservation bodies have mounted similar exercises on a smaller scale (leading to cries of an anti-Chinese conspiracy by seafood traders, whose businesses are undeniably suffering). So, have the shark conservationists won the day?

Well, this does look like a (partial) success story, of which SOSF and its partners can justifiably be proud. However, I don't believe this is a clear 'win' yet. A Beijing restaurant survey in December 2013 found that more than half were still serving shark fin and largely unaware of the crack-down on shark fin at government functions. Most of the population of China outside Beijing and other major city centres still have no idea why shark fin soup is such a serious environmental and wildlife problem. We have seen shark fin markets dip before during an economic downturn, and then recover again when matters improve. With a few notable exceptions, management is still lacking in most target and bycatch shark fisheries (for meat and liver oil, as well as fins), and these continue to drive depletion of shark stocks. Most shark finning regulations have loopholes that can allow finning to continue, and many key shark fishing countries have not yet adopted any finning regulations or shark management plans. Many shark species are threatened with extinction and would need decades to recover, even if fishing pressure was lifted immediately. It is far too soon to relax and congratulate ourselves on having protected sharks because of a reduction in shark fin soup consumption, although this is a great way to end our first decade. Saving Sharks, and Saving Our Seas is a longer and more complicated task than this.

ABOVE China's most popular celebrity, the National Basketball Association superstar Yao Ming, pledged to stop eating shark fin soup.

MICHAEL SCHOLL

We spoke with the Save Our Seas Foundation CEO Michael Scholl about where his passion for sharks began and what drives it.

Here was a place with a massive population of great whites and no one was studying them!

How did sharks become an important part of your life?

I grew up in Switzerland, and although it's a landlocked country, I have always been drawn to the ocean. There was a natural history museum my mom would take us to a couple of times a year. Incidentally, the centrepiece of that museum is the largest stuffed great white shark in the world. It's a six-metre long animal that was caught in the 1950s just off the coast of France. I remember walking straight past the dinosaurs and stuffed animals and standing in front of this thing and just dreaming. That shark was so huge and for me, magical.

When did you first see a shark outside of an aquarium?

I was in the Florida Keys and I went on a snorkelling trip on one of those tourist boats with 30 other people. I was the first one in the water and as I jumped in, I looked down and there was a nurse shark swimming 10 metres below me. I'll never forget it.

How did you end up studying sharks in South Africa?

I started my studies in biology in Switzerland and then went to the University of Aberdeen to complete a marine component. I got my first field experience with sharks at the Sharklab in Bimini (the Bahamas) where I was a volunteer research assistant.

After this I returned to Switzerland. At the time, there was very little interest in sharks in the country. That meant that even though my experience was limited I was kind of a shark specialist in Switzerland. One day, in 1996, somebody called me up and said they were organising a Shark expedition to South Africa for Swiss people. They asked if I'd be interested in coming along to act as a translator and shark guide.

The trips never materialised, but I did go down to South Africa for an exploratory trip. I quickly realised there was no one, to my knowledge, doing research on white sharks at the time. Here was a place with a massive population of great whites and no one was studying them! I returned to South Africa six months later and ended up staying for almost 10 years.

Do you feel biased towards white sharks?

In my wildest dreams, I don't think I ever imagined I'd be working with white sharks. They are a mythical, but also an iconic, species. When someone says the word 'shark', the image conjured is usually a white shark. There are so few places where you can study these animals. And the opportunity just happened for me. I think I'd have been happy working with another species, but I'm so grateful for my experience with white sharks.

What have been your most memorable moments during your time as a researcher?

I have a clear memory of being on the research boat's back platform when a curious white shark came up to the surface and popped its head out of the water. I remember seeing this big blue eye

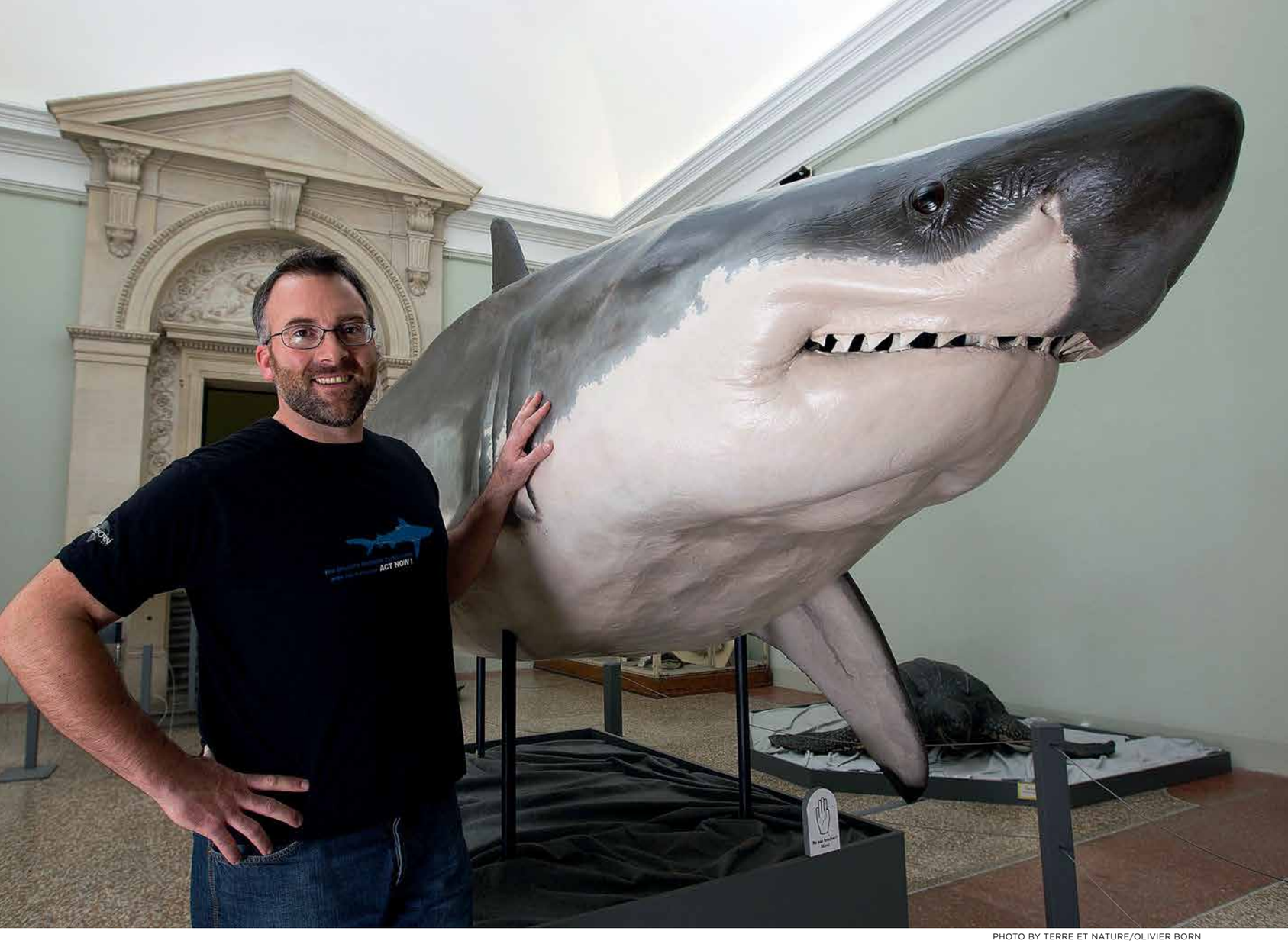


PHOTO BY TERRE ET NATURE/OLIVIER BORN

ABOVE The Natural History Museum of Lausanne in Switzerland is home to this six-metre-long white shark that triggered Michael's passion for sharks.

looking at me from a metre away – like I was looking into a person's eyes. It's a non-verbal connection that's just hard to explain. He's looking at me and I'm looking at him and we're both probably wondering, 'What's going on?'

Were there any animals you felt particularly connected to?

Yes, and I called her Nicole, although she wasn't named Nicole for most of the time I knew her. I gave up naming sharks fairly soon because once you have 200 to 300 animals you run out of names. I gave them numbers instead. This one was called WST 1308. I knew her for five years and she was very predictable. In the end, she did something amazing for shark conservation globally. What we were looking for was proof that white sharks move out of the protected waters of South Africa. Most scientists believed they did, but Nicole's round trip journey between South Africa and Australia gave us irrefutable evidence supporting our hypothesis, which ultimately led to this species being listed on CITES Appendix II, affording them the best available protection on an international level in regulating the traffic across boundaries.

What do you feel is unique about the Save Our Seas Foundation?

The Save Our Seas Foundation is unique through its multifaceted approach to protecting megafauna and ultimately the oceans. No other organisation has targeted the plight of sharks in the way that SOSF has. Given my respect for these animals, there's obviously a very close connection for me there. Most conservation groups will run a short-term campaign for a specific animal or species, but I believe that if we want to meet real conservation goals we need to be invested for the long-term.

PHOTO BY MICHAEL SCHOLL

Passion is at the heart of the foundation; a passion for the science, for the ocean and for charismatic threatened marine life…

The foundation is also unique in that it has invested a lot of funding and energy into young people. Some organisations may view this as a risk, but it's something that's very close to the founder's heart. Supporting conservationists and scientists that are just starting out has enabled many of these projects to grow beyond their initial scope and become significant features of the marine conservation and research landscape.

Shark research started about 60 years ago. It's younger than space exploration in many ways. There's still a hugely intimidating amount of work to be done and the Save Our Seas Foundation has played and will hopefully continue to play a very important role in this.

As you say, the Save Our Seas Foundation has a major focus on sharks. What about the other elasmobranchs?

We're working to conserve all sharks and their relatives. We often just say sharks as a catch-all term than includes chondrichthyans or elasmobranchs, but we mean sharks, rays and skates, and chimeras. Many skate and ray species are in just as much danger, if not more, than sharks. Sharks attract most of the attention, both in the media and among researchers, but they're all equally important to us.

You have been CEO of the Save Our Seas Foundation for 18 months. What have been some of your biggest challenges so far?

Even though I knew of the foundation for many years, I always had an outsider's perspective. It took some time for me to get a grasp of what the foundation had achieved so far. SOSF is celebrating its 10th anniversary this year, so it comes with a very strong legacy. We needed to take a hard look at the past and be honest about what mistakes have been made and what real successes we have had. Ten years is an important milestone and a good time for reflection. One of the things I have focused on is putting together a review of all of our work over the past decade. In that time, we've worked with 60 species and sponsored more than 160 projects in more than 40 countries, some of them for more than seven years. This database forms the core of the foundation. Without that knowledge, we couldn't really move forward.

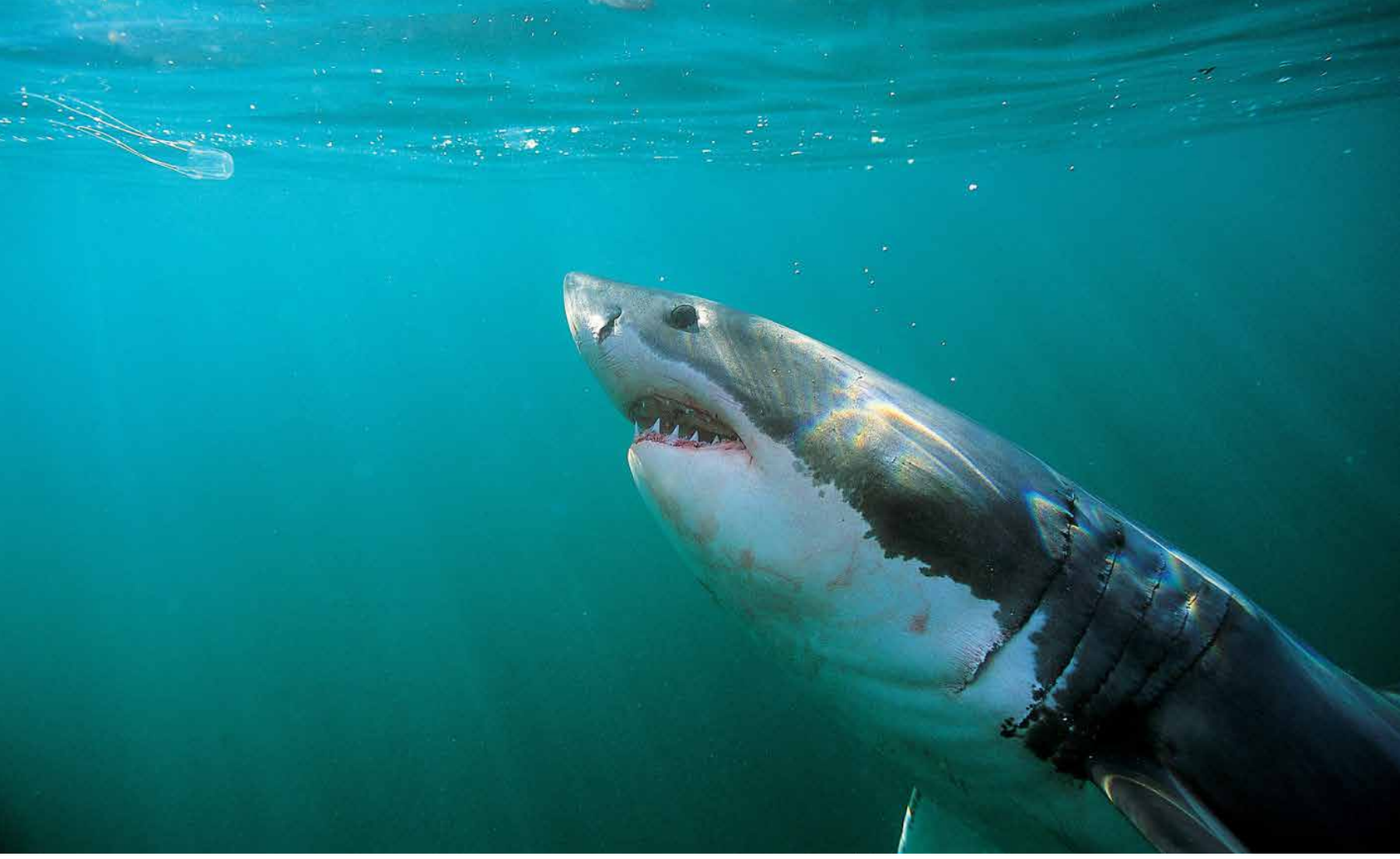


PHOTO BY THOMAS P. PESCHAK

What do you think has been the foundation's core strengths over the past 10 years?
The Save Our Seas Foundation is funded by a passionate founder and is run by passionate people. Passion is at the heart of the foundation; a passion for the science, for the ocean and for charismatic threatened marine life, particularly sharks, skates and rays.

What is your vision for SOSF?
I see the foundation as a huge, multinational family, which includes our project leaders. I believe that for the foundation to reach its full potential, we really have to nurture these relationships. They're the crucial bonds that hold everything together. We're so lucky to have a founder who provides the resources and backing we need to be leaders in the field, in communities, in classrooms. The people and projects we fund need to be closely connected to the ocean, and they have to be passionate. It doesn't have to be passion for sharks. It has to be passion for what they do, whatever the species, whether it's research, conservation, communication or education.

What keeps you up at night?
Other than my 16-month old son? In all seriousness, I feel extremely honoured to be in this position, but I'm also acutely aware of the responsibilities that come with it. I always have to keep the mission statement of the foundation at the forefront of my mind. The mission keeps me accountable and I have a huge responsibility to the founder and the SOSF family. Everyday we throw amazing ideas onto the table. It's my responsibility to decide which of these ideas will be brought to life and then to make sure it happens. Most people in the foundation are spread across the planet and I have to communicate and build relationships with all of them, but I also have to find the interconnections amongst the members' work to create a cohesive story for the foundation. I truly believe in the work we do and every single success, from sharing a story from one of our project leaders to protecting a new habitat, excites me. All that said I am living my dream. I have the best job on the planet. Each day, I have the opportunity to meet, discover, fund and collaborate with the most dedicated, passionate and certainly the best scientists, educators and conservationists in the world.

OPPOSITE AND ABOVE Michael's finprinting technique allowed his team at the White Shark Trust to identify more than 1,500 different white sharks from 1997 to 2007, including the legendary Nicole.

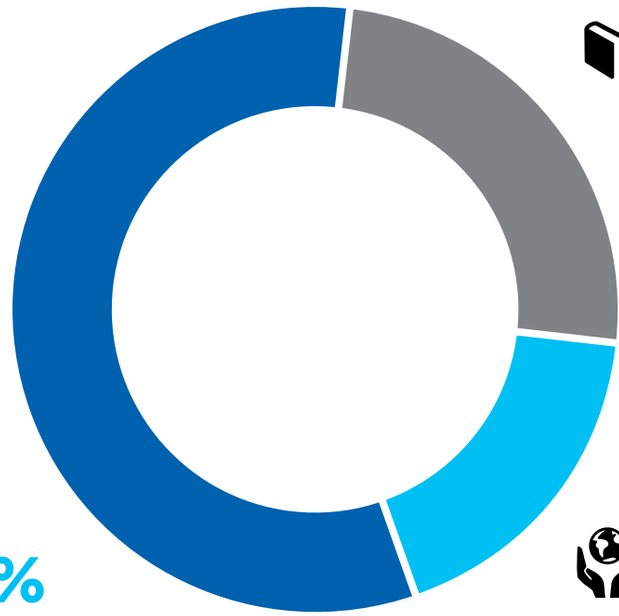
save our seas foundation

10 YEARS 2003 – 2013

IN 2013 the Save Our Seas Foundation celebrated its 10-year anniversary. From just three projects in 2003, the foundation grew to fund a total of 48 projects in 2013. We are proud to support scientists, educators and conservationists that are dedicated to the oceans, whether they are tracking sharks, rehabilitating habitats, working with communities, creating documentaries, processing genetic samples, or designing programmes for children, the future stewards of our planet.

Programme categories

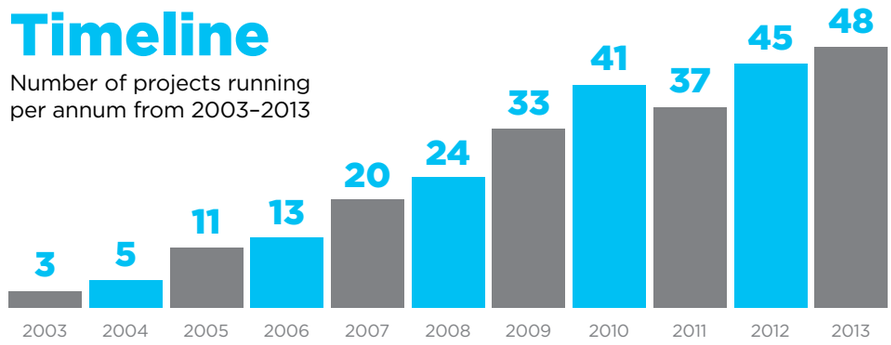
(includes projects at centres)



These figures exclude sponsorships (8), centres (3) and projects at centres (6)

Timeline

Number of projects running per annum from 2003–2013



150
PROJECTS FUNDED

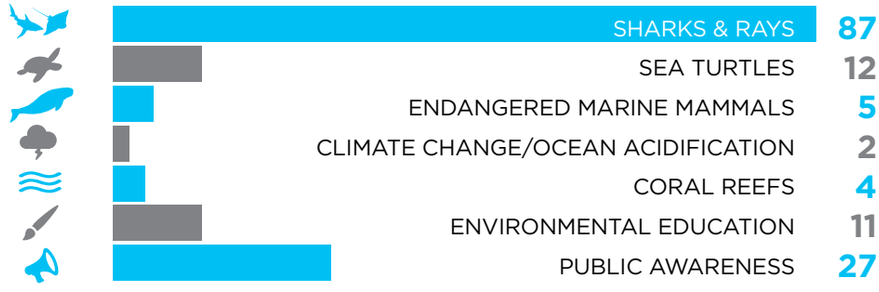
8
SPONSORSHIPS
(conferences, symposiums, events)

CENTRES
D'Arros, Seychelles
Florida, USA
Cape Town, South Africa

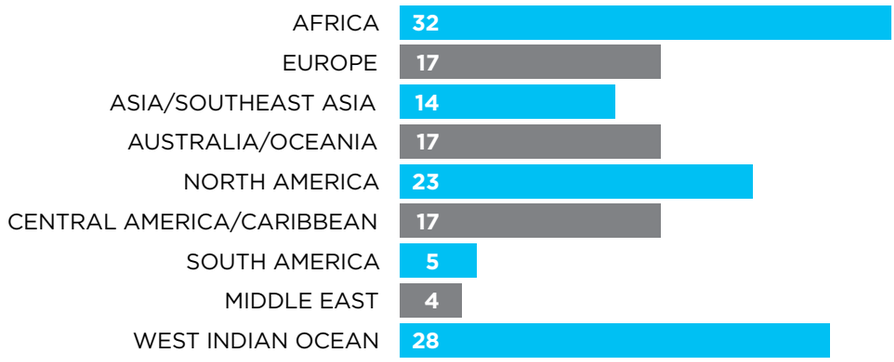
3

Programme areas

(includes projects at centres)



Projects by continent/region



44

TOTAL PROJECT COUNTRIES

Projects involving...

Sharks	Whale sharks *(Rhincodon typus)*	Rays and/or skates	Sea turtles
76	**10**	**20**	**12**
White sharks *(Carcharodon carcharias)*	Sharks, rays and skates	Marine mammals	Coral reefs
10	**9**	**8**	**4**

58

SPECIES

64 Projects focused on one species

49 Projects focused on multiple species

24 Projects with a media focus

47 Projects involving tagging/tracking

THE SAVE OUR SEAS FOUNDATION

MARINE CONSERVATION PHOTOGRAPHY GRANT

The Save Our Seas Foundation (SOSF) believes that photography is a powerful tool for marine conservation. We seek emerging conservation, wildlife and environmental photographers with a passion for marine subjects to apply for an unprecedented annual photography grant. The SOSF has set aside US$40,000 to invest directly in marine conservation photographers of the future.

save our seas
foundation

CALL FOR ENTRIES

PHOTO BY THOMAS P. PESCHAK (3)

CRITERIA

Applicants should be serious emerging photographers who may have become successful in their local region, but have not been widely published in major magazines and have not earned numerous high-profile international awards. We prefer applicants to be under the age of 30, but older applicants who fit the emerging criteria may also be considered. Photographers with underwater photography skills in their repertoires are especially encouraged to apply.

PRIZES

Each year two winners will be selected. Each winner will receive a US$2,000 cash prize and be given a paid three-week photographic assignment to document an SOSF-supported marine research or conservation project.

The SOSF has funded more than 160 projects in more than 40 countries and the winning photographers will be assigned to tell one of these stories. Thomas P. Peschak, *National Geographic Magazine* photographer and director of conservation for the Save Our Seas Foundation, and Kathy Moran, senior editor (natural history) of *National Geographic Magazine*, will mentor photographers throughout the process. This assignment period will be a learning and refining experience as well as an opportunity to earn income through photography.

Both winners will also receive an all-expenses-paid trip to an international photographic or conservation conference to present their photo story. Each winner's story will also be published as a photo essay in the Save Our Seas Foundation's magazine.

Important dates and deadlines

- **APPLICATION OPENS**
  15 February 2014
- **APPLICATION CLOSES**
  30 April 2014
- **WINNERS ANNOUNCED**
  31 May 2014
- **ASSIGNMENT**
  July – November 2014
- **PRESENTATION DEADLINE**
  End 2014/Early 2015

APPLICATIONS

1. A 'best of' portfolio of 20 photographs. The portfolio must showcase your strongest images and must include some marine, coastal or underwater photographs.

2. One photo story of 10 images. The story must be nature or environmentally themed. Marine themed subjects are welcome, but not essential.

3. Completed online questionnaire.

Visit *www.saveourseas.com/photograph* to find out more and complete the application.

SOSF PHOTOGRANT

In February 2014 the Save Our Seas Foundation launches its Marine Conservation Photography Grant. SOSF champions the use of powerful images to tell important conservation stories. We asked Save Our Seas Foundation director of conservation and National Geographic Magazine photographer ***Thomas P. Peschak*** *to give us his views on the significance of this unique opportunity for emerging photographers.*

What do you hope to achieve with the grant?
We fund some of the most creative and well-known marine scientists on the planet. Many of them are battling major conservation issues ranging from establishing marine protected areas to safeguarding endangered species. Many scientists need media support to translate their findings from the technical into the popular arena in order to reach a large influential audience. We want to use the foundation's specialty in conservation media to mentor, uplift and drive the next generation of conservation photographers. Working with project scientists, these emerging photographers will create critical photographs and tell stories that drive conservation change all over the globe.

What are some of the major challenges for emerging conservation photographers?
Budgets are continually shrinking, especially in the magazine world. It's becoming economically harder, especially for less established photographers, to tell stories with real conservation value. I think we're losing a lot of great young photographers to other, perhaps more financially reliable, careers. I hope this grant will be a small step to changing this, and give us the chance to mentor younger photographers to tell honest, balanced and engaging stories.

THE JUDGING PANEL

Thomas Peschak
Contributing Photographer
National Geographic Magazine
and Director of Conservation
Save our Seas Foundation

Kathy Moran
Senior Editor (Natural History)
National Geographic Magazine

David Griffin
Visuals Editor *Washington Post*

Michael Scholl
CEO Save Our Seas Foundation

save our seas
foundation

PHOTO BY THOMAS P. PESCHAK

What does 'conservation photography' mean?

If you Googled 'conservation photography' 10 years ago, you would have found pages about restoring old photographs. Back then, there were only a handful of photographers regularly using their images to raise awareness about environmental and conservation issues. Today the field of conservation photography is entering the mainstream. At its essence, it's a tool to break or rewire human habits that negatively impact our marine environment.

How do you believe conservation messages should be framed?

You can engage in conservation photography in two ways. One way is to show people the beauty and the biodiversity that remains. You can say, 'This is what is at stake and what we still have left to protect.' It's about nurturing a connection between the audience and the species. The risk with this approach is that you can create the impression that nature is thriving, which makes people complacent. The other approach focuses on the problem. The truth is that the wonderful 'Edens' of biodiversity that appear in magazine articles and wildlife documentaries make up just a minute fraction of our planet. The reality is that our exploitation of the planet is having an incredibly detrimental and destructive impact. We're at a point where our actions have shaped the planet as much as geological processes. This is not something people want to face and they often try to avoid images that portray this reality. It's a challenge, but just because the images are hard-edged and sad to look at doesn't mean these photographs are ugly. As a conservation photographer, I strive to create compelling and beautiful imagery that addresses disturbing subjects.

What are you looking for in photography grant recipients?

I expect all successful applicants to be exceptionally talented and creative photographers. However, it's also about drive. It's about commitment. You have to be obsessed with wanting to tell a story that matters to you and making it matter to your audience. You also have to be in love with the process: the research, the science, and the hardships of travel. You have to be hungry and maybe just a little bit crazy to succeed in this profession.

save our seas foundation