SAVE OUR SEAS FOUNDATION

ANNUAL REPORT 2014

save our seas
foundation

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“AS LONG AS THERE ARE PEOPLE WHO CARE, WE CAN AND WILL MAKE A DIFFERENCE.”

THE FOUNDER | SAVE OUR SEAS FOUNDATION

CEO'S NOTE

In 2014, we at the Save Our Seas Foundation consolidated further our team and our centres around the world. We welcomed on board key staff members to lead the education centre and the communication team in South Africa, and we introduced some innovations, offering new opportunities to early-career scientists through our Small Grants and to emerging photographers through the Marine Conservation Photography Grant.

For the first time, we supported 16 new Small Grant projects, which range from mobulid fisheries in Palestine and the use of drones to survey sharks in French Polynesia and identify whales in South Africa to better understanding the personality of lemon sharks in the Bahamas. Although the scope of these grants is limited in time and financial support, we received many applications. The range and original approaches of the submissions indicate to us that this new category of projects will enable us to maintain our innovative and leadership role in the targeted fields of research and conservation relating to charismatic marine megafauna.

Sifting through thousands of images to identify potential professional photographers who will inspire the world through their vision and lenses is a daunting task. We believe that in Mac Stone and Joris van Alphen, the two winners of the first Marine Conservation Photography Grant, we have identified this rare talent. We are confident that the inspiring results of their assignments in False Bay, South Africa, will enable us to showcase this unique and fragile environment, as well as the complex and intricate relationship it has with humans.

Although we are dedicated to maintaining the small structure of the foundation, our outreach component and our objective to help our project leaders to communicate their work and results, and share their incredible stories with the world beyond the scientific community, have led us to revisit our strategies. We launched a biannual magazine that we envisage will become a benchmark in marine conservation publications, merging modern design, stunning visuals and compelling content that is accessible to all audiences. With the present annual report and our new website, we continue to follow a people-centred approach, recognising that all our efforts and accomplishments culminate in the achievements of our project leaders: foremost scientists of the present and future, innovative conservationists and dynamic educators.

Passion and dedication remain at the core of the foundation's heart and spirit – with our founder having inspired all the team members since the organisation's inception and still leading the way. With the synergy of a passionate and multi-functional team, along with the flexible and responsive nature of a small structure, we continue our pioneering approach.

Michael Scholl | Chief Executive Officer

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The Save Our Seas Foundation (SOSF) 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 2013 the Foundation proudly celebrated its 10th anniversary.
In that time, SOSF sponsored 150 projects in more than 40 countries, 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 find out more about our funded projects visit:
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SAVING OUR SEAS

GUY STEVENS

Being a part of the Save Our Seas Foundation's (SOSF) advisory panel for the past few years has been a real pleasure. It has been rewarding both personally and professionally to work with such a great team of people who are motivated by similar conservation goals to my own. At events like the Sharks International conference in Durban, I have been lucky enough to meet some of the top marine scientists in the world, learning about their work and discussing with them ideas for future collaborative initiatives. For me this is one of the most fulfilling aspects of being a part of the SOSF team; there is a world of passionate and dedicated marine scientists out there, yet we often get caught up in our own bubble, focused on 'our' species, region or niche subject. Being part of a wider team with a holistic conservation mission that propagates effective communication and a genuine cohesive desire to further our common goals – whether through the Manta Trust team or through the SOSF – is for me the most rewarding aspect of this job.

Competition is important; it drives us to succeed. But competition, egos and selfish desires, if not kept in check, can also be a hindrance to conservation and greater scientific achievements. A good example of effective collaboration that facilitated a real conservation gain in 2014 was the collaborative spirit between the coalition of NGOs at the Convention on Migratory Species of Wild Animals (CMS) meeting of parties in Ecuador in November. The CMS secretariat even drew special attention to this coalition, stating its importance in helping to facilitate and support the CMS party states in their decision to list 21 shark species, the reef manta ray *Manta alfredi* and all nine devil ray species *Mobula* spp. on the convention's appendices. CMS is the only global convention specialising in the conservation of migratory species, their habitats and migration routes. It is an environmental treaty supported by the United Nations Environment Programme and provides a global platform for the conservation and sustainable use of migratory animals and their habitats.

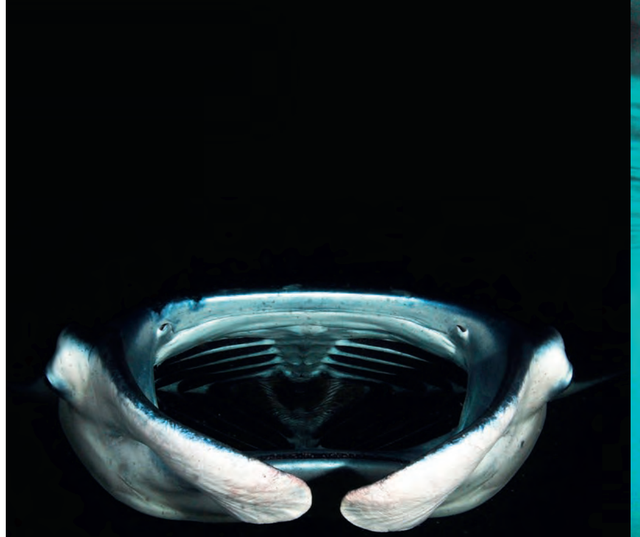
It is hoped the listing of many of these vulnerable species on the CMS appendices will drive greater national protection and strengthen any future proposals for protection under the Convention on International Trade in Endangered Species (CITES). Certainly the listing of manta rays on CITES Appendix II in 2013 has influenced several signatory nations to implement national protective measures for these species. Early in 2014 Indonesia announced complete protection for both manta ray species throughout its waters, and there has been a real commitment from its government to clamp down on illegal fishing and trade in the gill plates of these animals since the protective legislation came into effect. The UAE and the Maldives also announced protection for these species in 2014 and we hope that continued pressure from international organisations and growing concerns expressed by the general public will persuade more nations to follow suit soon.

Good science is fundamental to underpinning the foundations of conservation policy, but science alone cannot effect change. There must also be the political will, which is often heavily influenced by public opinion. Unfortunately, until recently most nations and individuals viewed our oceans and their inhabitants as nothing more than a common resource; a dark reservoir of infinite depth from which to exploit and plunder, each selfishly taking more than their fair share, raping the natural world of more than it can provide in a bid to extract national and personal profits from the ever-diminishing reserves of our global bank. Humans love land; for most of us the oceans are alien and uninviting places. What goes on under the seas is disconnected from our everyday lives, easily forgotten or brushed aside, out of sight and out of mind. It has been this general lack of awareness and care for the pressing conservation issues pertaining to our oceans that has hindered a political desire to effect change.

Thankfully there are signs that collectively our perceptions are beginning to shift. People are becoming connected to our oceans and this is happening thanks to the efforts of organisations like the SOSF, which reaches out to the general public through its media platforms and disseminates the science it has helped to fund not only in language that is digestible to the general public, but also by means of stunning and emotive photography. The more we delve into the marine world and begin to unravel the mysteries of the animals that live in it, the more we realise just how misinformed our preconceptions of these animals were. Manta rays, whale sharks and the vast majority of all other elasmobranchs are

harmless to humans. As this realisation spreads, the tide of ignorance is slowly starting to turn towards that of awareness, leading to a wider call for the global protection and conservation of our planet's oceans and the creatures that live in them.

I am proud to be part of a team of people who are driven by a desire to leave our planet and its oceans in a better state than the one we inherited. However, while there have been many positive conservation achievements in 2014 that the SOSF should be proud to have supported and been involved in, there is still much work to be done. Each time I dive into the underwater world I am enveloped by the natural beauty of our oceans and their inhabitants. I am also reminded of what is at stake if we choose not to safeguard our oceans and their inhabitants for the future.



SOSF ISLAND SCHOOL SEYCHELLES AND SOSF D'ARROS EXPERIENCE

ABI MARCH

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save our seas
island school seychelles

From a population of 92,000 people in the Seychelles, we estimate that the SOSF Island School Seychelles reached about 1,500 students in 2014, and out of that number we're confident that we have some excellent marine ambassadors in the making!

The SOSF Island School Seychelles got off to a great start in early 2014 with the launch of the D'Arros Experience. It began with a competition that any Seychellois secondary school student could enter, the prize being a week-long adventure on the Outer Island of D'Arros and nearby St Joseph Atoll. Students were required to write an essay, first explaining why they wanted to join the programme and then either discussing what the ocean means to them or addressing a marine environmental problem and planning a solution that could be met by a group of young students. We had 34 entries, which were judged by representatives from SOSF Island School Seychelles, the Save Our Seas Foundation, the Ministry of Education and the Ministry of Environment and Energy. The 16 students selected went on to attend a team-building session at the Global Vision International (GVI) base at Cap Ternay on Mahé. Here they were assessed for their team work and enthusiasm and all 16 were deemed excellent candidates to participate in the D'Arros Experience.

The day of departure soon came round and on Sunday, 27 April the first group of eight students met at the airport. Accompanying them were SOSF Island School Seychelles project advisor Abbie Hine, art teacher Neil Leon from English River Secondary School and myself. Excitement was high as we boarded the plane and flew to the start of our adventure. Flying low over the beautiful turquoise waters of St Joseph's lagoon was breathtaking. We soon landed and were greeted by the Save Our Seas Foundation and Danah Divers teams that would be helping with the week's activities.

Over the next week we swam over the beautiful coral reefs, marvelling at the number and variety of fishes. We encountered turtles, rays and sharks, both on our snorkels on the reef and on boat trips around St Joseph Atoll. We accompanied Chris Boyes, the lab manager at the SOSF D'Arros Research Centre, on trips to the lagoon to tag and release juvenile hawksbill and green turtles. And we joined the rangers on their turtle-monitoring patrols and found a hawksbill turtle just as she finished laying her eggs. On one afternoon out on the boat we were ecstatic to see a pod of rare Risso dolphins.

Back on land, our exploring continued and we observed the different bird species found on D'Arros Island. We visited the forest and helped clear young coconut trees to make way for the indigenous trees we planted to rehabilitate the area. We were astounded at the amount of rubbish collected during a beach clean-up. When not out exploring, the students participated in activities to increase their knowledge about the different animals, habitats and threats they had seen with their own eyes. They attended talks given by the educators and scientists about turtles, sharks, rays, coral, birds and other exciting topics. By the end of that week the eight young explorers were very tired but extremely happy.

On the following Sunday our plane landed at D'Arros and the second group of eight students arrived with teacher Andy Alvis from the English River Secondary School. As we welcomed the new group to begin their adventure, we waved goodbye to the first group, sending them back home to share their stories of the week with family and friends. The second week was as exciting as the first and we continued to discover all the incredible animals and habitats that D'Arros Island and St Joseph Atoll have to offer. During the second week the students were lucky to encounter several manta rays on a boat survey around the island and were amazed to see these majestic creatures swimming through the water. All 16 students who participated in the D'Arros Experience thoroughly enjoyed this once-in-a-lifetime opportunity and took so much away from it.

Back on Mahé, we continued to meet new students. We run monthly marine activity mornings at the Natural History Museum. Although they target primary school pupils, the sessions are open to everyone and at each one we welcome between 20 and 50 children. Each month we focus on a different marine animal or habitat, for example learning about the importance of corals and making our own colourful coral reefs. We have discovered how big and brilliant whale sharks are and turned a yogurt pot into the spotty animal that has a big mouth for eating lots of plankton. We have marvelled at manta rays and made our own, each with a unique spot pattern. We have learnt facts about each of the world's whales and dolphins.

It's not just the children attending the sessions who enjoy the activities; tourists passing through often come over and see what we are doing. During the session about manta rays, a group of Swedish tourists were delighted with a game of 'pin the tail on the manta ray'! A comment in the museum's visitor book from that morning read 'Visiting schoolchildren were wonderful!' It is brilliant to see so many youngsters every month who all leave the museum with some marine knowledge that they take home to pass on to their families.

In early August our Natural History Museum session focused on sea turtles to tie in with the Seychelles Sea Turtle Festival that was taking place the following weekend. The D'Arros Experience students came along and helped the younger children make turtle kites that would be flown at the festival's Family Fun Day. The students also gave a presentation to the children about their adventures with turtles during their D'Arros Experience. The younger children loved listening to the older students talk, and it was an excellent opportunity for the students to practise their presentation in preparation for the festival's opening ceremony the following Friday.

The Island School students played a big part in the Seychelles Sea Turtle Festival. One of them, Frances, was an MC for the opening ceremony. Then 10 of the students gave their presentation to a theatre full of guests about their time with turtles and what they had learnt on D'Arros. We were delighted that two of our students, Hamish and Maryssa, also won prizes in the school artwork and public speaking competitions. The Save Our Seas Foundation was one of the sponsors of the artwork competition and, together with GVI and Seychelles Islands Foundation, produced calendars of the stunning winning images of Seychelles sea turtles. In the week leading up to the festival, two Island School students, Tessa and Noah, were interviewed by the radio station Pure FM. They talked about their turtle encounters and about what being part of the D'Arros Experience meant to them. On the festival's Family Fun Day, the Island School manned a Save Our Seas Foundation stand and hundreds of people came to make turtle headbands and decorate turtles made from recycled plastic bottles.

For the schools' competition at both the Seychelles Sea Turtle Festival and SUBIOS (underwater festival), I was a judge for the artwork categories. The standard of entries was very high and for both competitions the Save Our Seas Foundation donated prizes of books, wrist bands and T-shirts. The foundation has been supporting SUBIOS for the past five years and the Seychelles Sea Turtle Festival since it began in 2013.

In June we launched the application process for the Marine Explorers Programme. Over six days we visited nine secondary schools on Mahé, Praslin and La Digue and spoke to more than 1,000 students about this exciting holiday programme. We received over 100 applications, which were judged by representatives from the Save Our Seas Foundation, the Ministry of Education, the Ministry of Environment and Energy and GVI Seychelles. Our 24 enthusiastic explorers were selected and we ran the first part of the programme in the August–September school holiday, followed by the second part in the December holiday.

The programme was held at the GVI Seychelles base at Cap Ternay, enabling us to visit the Baie Ternay and Port Launay national marine parks. It introduced students to the different coastal habitats found in the Seychelles, looking at their importance, the animals that live in them and the threats that they face. This is done in indoor lessons and by exploring the outdoor environment with a snorkel every day.

The snorkelling was the highlight for all the students. Although more than half of them had never snorkelled before, their enthusiasm outweighed any apprehension they might have had. Exploring the sea-grass beds, they announced with great excitement every sea cucumber they found. By the time they reached the coral reefs, they were in their element, discovering many different families of fish that they had just been taught in the classroom. A newcomer to snorkelling, 14-year-old Guyan was able to identify each fish family pointed out to him, explaining his excellent memory with 'Usually I don't have a good memory, but I remember stuff I'm really interested in' – an excellent attitude for a young marine ambassador! The requests for identification kept coming and as the programme

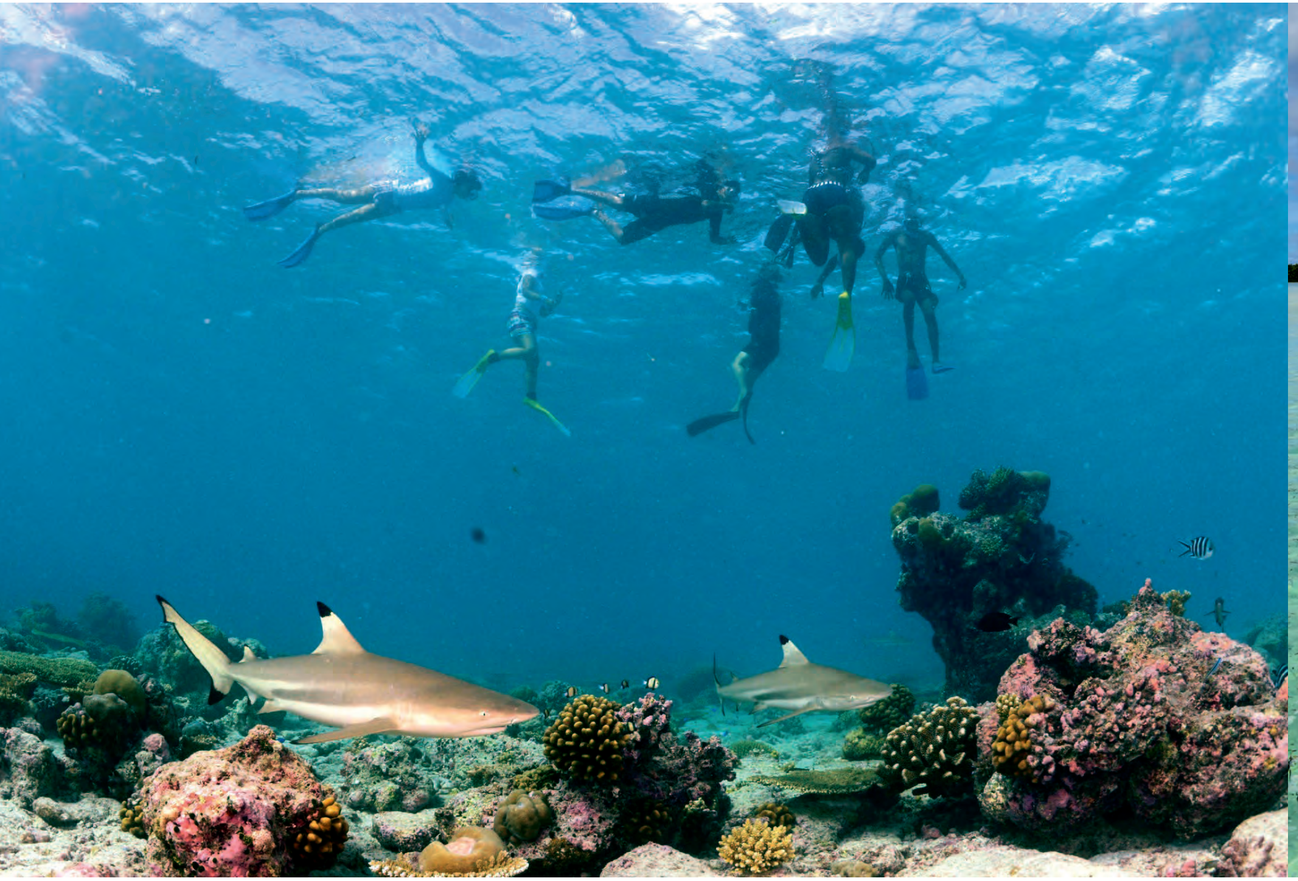
progressed the descriptions improved from 'I saw a red fish, what was it?' to 'I saw a fish, I think it was a butterflyfish and it had the face of a raccoon.' Thirteen-year-old Alvania's description of a raccoon butterflyfish was spot on!

As well as the fish, we discovered moray eels hiding in crevices, stingrays camouflaged against the sandy sea floor and turtles foraging on the reef. In every habitat we explored we found new and exciting creatures, from tiny hermit crabs on the sandy beaches to mudskippers on the rocky shores, from stingrays in the mangroves to turtles on the coral reefs. Why were all of these different habitats and animals so important? We learned that each animal has a vital role to play in maintaining a healthy ecosystem and that all the different habitats provide different things for their inhabitants: a home, a hiding place, somewhere to find food, a safe place to give birth.

Then it was the turn of sharks and we looked at how important and awesome they are. At first most of the students had a very negative view of these predators, regarding them as scary and dangerous. When asked if they had ever seen a shark before, they all answered yes. When asked where they had seen one, the answers *Jaws* and *Sharknado* revealed that few of the students had ever encountered a real shark in the water. We explored the reasons for sharks having a bad reputation and the students were surprised to learn that it was not justified.

It wasn't just the students who were keen. Primary school teacher Fred Hypolite joined us for the entire programme and was an enthusiastic learner. Fred loves the natural environment but hadn't had much to do with its marine side until now. He took every opportunity to ask questions and take notes and during the following term he shared with his younger students all he had learnt. A previous SOSF Island School Seychelles student, Irma Dubois, also assisted during the December programme. It was great to see Irma share her enthusiasm for the marine environment with the students. We're delighted that both Fred and Irma are continuing to work with us at SOSF Island School Seychelles.

The D'Arros Experience and the Marine Explorers Programme certainly ignited a passion for the marine world and since participating in the programmes



the students have regularly attended weekend snorkel sessions. When the session is announced, the students are quick to e-mail, text or call to secure one of the 24 places each trip. They're always eager to take part in other activities too, like the 'One F'in Mile', which the Island School organised for a Sunday afternoon at the end of August. The event was to raise awareness about shark finning and raise money for the 'Hacked Off' campaign arranged by Bite-Back Shark and Marine Conservation. In the UK, Bite-Back had organised one-mile walks that participants completed wearing their fins. We brought the idea to the Seychelles and, despite the heat, 22 students turned up to complete the mile walk along the busy Beau Vallon beach. To make it more of a shark fest, we wore cardboard fins on our backs as well as the fins on our feet, and the students had decorated them with anti-shark finning slogans and images. We received a lot of interest and supportive comments from beach-goers and raised SCR2,000 for the 'Hacked Off' campaign.

In November we were back at the Natural History Museum with a special event: the first screening of the SOSF D'Arros Experience series of videos. This year's D'Arros explorers attended with their families and friends and some of the previous year's students were also there. We were honoured to be joined by Michael Scholl, the CEO of the Save Our Seas Foundation, who had just flown in to the Seychelles that morning. In between watching the videos, the students read blogs about their experiences. Past student Irma Dubois narrated a moving piece she had written, called 'How Save Our Seas saved me'. Michael then presented each student with a certificate of participation in the D'Arros Experience. It was a fantastic way to bring back the memories of our trip and share the adventure with the students' families and friends.

At the end of 2014, the Save Our Seas Foundation generously donated four air conditioning units to the museum. The units will be fitted upstairs and will make our regular marine activity sessions and other events held there a more comfortable and enjoyable experience.

We thank all the partners and supporters of SOSF Island School Seychelles for helping to make our first year a successful one. Particular thanks go to the Environmental Education Unit at the Ministry of Education, the Ministry of Environment and Energy, GVI Seychelles and Seychelles National Parks Authority, Seychelles Natural History Museum, SOSF D'Arros Research Centre, SOSF Conservation Media Unit, Chelonia Company Ltd, Danah Divers and Air Seychelles.

SOSF SHARK EDUCATION CENTRE

ELEANOR YELD HUTCHINGS

save our seas
shark education centre

The past 12 months have been full of change for the Shark Education Centre, with new decisions, new direction and new leadership – all of which have made it a very exciting year!

Over the past few years the Shark Centre at Kalk Bay in South Africa found itself in a unique situation, able to contribute to conservation education both physically, by immersing children in experience-focused activities, and financially, by accommodating schools that could otherwise not afford to offer their students such opportunities. With the emergence of this advantage, the decision was made to re-invent the centre as the Save Our Seas Foundation's Shark Education Centre, which would focus specifically on school-level education – although adults would also be welcome! In order to do this, educational staff would have to be appointed and new and exciting programming would have to be implemented. The position of education centre manager was created and I took it up on 1 April 2014. The next step was to confirm the appointment of Ntombizanele Mayiya as the assistant educator and she, along with the educator Paul Millar and the facilities administrator Heidi Thormählen, comprised the Shark Education Centre team for 2014.

With education now being not only the centre's primary focus but also the name of the game, the time had come to strategically develop its programming, exhibits, capacity and direction. Our goals are to ensure that the SOSF Shark Education Centre becomes a place of interest in Cape Town not to be missed, and that our marine education and conservation messages are spread far and wide.

As part of the vision for the SOSF Shark Education Centre, the building now also houses the Save Our Seas Foundation's Conservation Media Unit (CMU), a small, dynamic team that is dedicated to showcasing the foundation's marine conservation activities. Working in the same building gives the education staff and the CMU wonderful opportunities for collaboration, particularly by sharing knowledge and exchanging ideas. Moreover, the presence of people with these diverse backgrounds and interests, along with our researcher-in-residence (currently Lauren De Vos, who is doing PhD research funded by the Save Our Seas Foundation), enables visiting children to see examples of the different career opportunities that are available in marine science and conservation, and the various avenues there are for getting involved in the field.

Looking back at 2014, the achievements and developments have been many and varied. We have reached more than 3,570 learners, even though there was so much else going on, such as building alterations, staff changes and the centre being closed to the public. This is a huge achievement and very promising for what lies ahead in 2015 and beyond.

Under the leadership of Paul Millar, the educational programming over the past year has comprised group visits to the centre, outreach, educational events and the very popular Marine Awareness Camps and Marine Explorers programme.

More than 1,500 schoolchildren in over 40 groups visited the centre and took part in a variety of programmes, most of which were tailored to the requirements of each group. The students ranged from Grade R to Grade 7 and they learned about sharks, rocky shores, False Bay's marine ecosystem, choosing sustainable seafood, and scientific method and hypothesis, among other subjects. Each programme has an in-classroom lesson component, which includes the use of multimedia and film, and an in-field expedition, during which learners are given the opportunity to experience the marine world by exploring, carrying out specific tasks, ask questions and generally get as 'hands-on' as possible.

As well as welcoming learners into the centre, our staff travelled regularly to different venues to give talks and present educational programming, either as part of an event or when groups were not able to visit us. The team did more than 10 of these outreach projects, which ranged from workshops with teenagers to discussion sessions with primary school learners. The topics of talks included careers in marine science and conservation; sharks; whales and dolphins; False Bay's marine ecosystem; rocky shores; choosing sustainable seafood the WWF-SASSI way; and marine conservation in general.

Among the educational events the centre organised, its holiday clubs proved very popular and catered for between 15 and 21 participants every day. The clubs provided 'edutainment' during the school holidays for children aged between five and 12 years who want to have fun and learn about the marine environment at the same time. We ran two clubs in 2014: a two-day club in the July school holidays and a three-day club during the summer break in December. Holiday club activities included rock-pooling, beach walks, harbour tours, baking, craft making, films and swimming. We have had wonderful feedback from children and parents alike.

As part of National Marine Week in October 2014, and in collaboration with BirdLife South Africa and its Celebrate Our Seas Festival, we ran an event called the 'Amazing Beach Race' on Fish Hoek beach. We had 19 participants, which was encouraging for an inaugural event of this nature, and the feedback was very positive. We plan to make this an annual event and expect that it will become a real highlight on the calendar.

Another feature of 2014 were the two Marine Awareness Camps that took place at the beautiful Soetwater Environmental Education Centre in front of Slangkop Lighthouse. Situated on the coast near Kommetjie, this site forms part of the Table Mountain National Park and is an excellent setting for our three-day residential camps. The camps are run free of charge for economically disadvantaged and coastal schools, with which we have already established a relationship in order to offer other programming, such as Marine Explorers. One was attended by 30 Grade 5 learners from Capricorn Primary School (which is located in an informal settlement close to Muizenberg beach), and the other by 22 Grade 5 pupils from Simon's Town Primary School.

Both camps provided team building, birding, hiking, recycling and litter collection, swimming, drama and cooking activities, as well as presentations by researchers and lessons about sharks and rocky shores. These pursuits were interspersed with many hours of field-based exploration and discovery. The camps are a real opportunity to introduce the marine environment to children who are

inherently unconnected to nature, even though they live so close to the sea. Once again, we have had wonderful feedback from the learners, educators and schools involved.

The final component of the 2014 educational programming was Marine Explorers, a 14-week in-water course that enables Grades 5 and 6 learners not only to experience the wonders of the ocean environment, but also to learn just how important the oceans are in maintaining the health of the planet – and just how much fun the sea can be! During the past year two groups from Capricorn Primary School took part, each consisting of 12 learners. One group participated from 2013 into early 2014 and the second from October 2014 into the first quarter of 2015.

The Shark Education Centre has partnered with the University of Cape Town Underwater Club, Pisce Divers PADI instructors and Xpression on the Beach Surf Shop to offer the learners a range of activities, equipment and instruction, as well as plenty of adult supervision! The centre provides wetsuits, masks, snorkels, fins and weight belts for the children, as well as transport. The course currently focuses on seven weeks of surfing and seven weeks of snorkelling, with the children being instructed and ultimately awarded a PADI Skin-Diver certificate. Additional marine education sessions are held at the Shark Education Centre and at the Two Oceans Aquarium.

All the programmes have been stand-out successes and have proven the Shark Education Centre's achievements in experiential environmental education.

The Shark Education Centre participated in many collaborative events in 2014, including Mandela Day, in which the centre and the CMU provided food, entertainment, activities and education to a crèche in Masiphumelele informal settlement; International Coastal Clean-up Day (administered through Plastics SA in partnership with the Ocean Conservancy), when we cleaned up the beach at Kalk Bay harbour and documented all the rubbish collected; and BirdLife South Africa's Celebrate Our Seas Festival during National Marine Week, in which we ran a beach event and participated in the Quest online competition. The centre

also sponsored a double-page spread (and provided a two-page article, with pictures) for the Wildlife and Environmental Society of South Africa's *EnviroKids* magazine.

The Wavescape Surf Film Festival, in December 2014, was a highlight. Although the CMU was the major SOSF participant in the main film festival, the Shark Education Centre featured in the Wavescape Fish Fry by providing children's edutainment, and produced marketing and other material to promote awareness of its activities. As the manager of the centre, I was also able to offer input into the planning and strategic direction of the festival. Our researcher-in-residence, Lauren De Vos, was the MC for the festival's Slide Night (of which the SOSF was a title sponsor) and she and I, as one of the invited speakers, created much exposure for the foundation and the centre.

Internally, the centre played host to four high-school work-shadow students as part of their Life Orientation curriculum. We also ran a very successful Documentaries and Debate series with the CMU.

With the Shark Education Centre's new approach in 2014, the interior of its home needed an upgrade to match. In May the renovation of the centre's exhibits got under way and after a number of workshops and brainstorming sessions we had a clearer idea of what was required of the exhibits and how best they could fit in with our mission. At this stage we needed the help of experts and Sunfish Consulting, spearheaded by Heidi De Maine, was contracted to lead the redesign process.

Although much of 2014 was taken up with planning, designing, and sourcing contractors and suppliers, a great deal has still been achieved and it feels that we have taken a huge step forward. The garage on the property, previously used for storage, was cleared out and is in the process of being turned into a ship-themed classroom space. As well as having a separate entrance for schoolchildren and secure storage for school bags and possessions, it will be furnished with seats, a table, a teaching screen and an area suitable for wet-work and arts and crafts. It has been exciting to watch the garage being transformed into the interior of

a ship, complete with curved wooden walls, portholes looking out onto the sea, a mast and ship's tables. The bulk of this work was completed in 2014.

The large fish tank on the premises will be upgraded and will have a touch-pool attached to it so that learning about rock pools will not be limited by tides, weather and capricious rock-pool creatures! The touch pool was commissioned in 2014 and will soon be ready. A new stand has been made for the tank and was put in place in December in readiness for the tank to be plumbed in with the touch pool.

Other plans approved in 2014 are gradually becoming reality. Two large murals for the centre have been commissioned, one depicting a pelagic shark and the other a kelp forest, complete with realistic 3D, touchable kelp and other living organisms found in the kelp ecosystem. All the visitor needs to know about the Save Our Seas Foundation and the Shark Education Centre will be found in the entrance lobby, along with context for Kalk Bay and False Bay, a digital poll and a visitor feedback section. The front room is being made over into 'Shark World' and will contain a large interactive table, a shark senses game and a wheel-of-fortune tooth match-up. A microscope, a camera and a large viewing screen will be set up next to the tank and touch-pool exhibit. There will also be an on-the-beach 'scratch patch', an interactive phone booth with information about marine creatures, touch panels representing the different skin textures of various sea animals, and a peep-through cartoon wall depicting the threats to the marine ecosystem and sharks. All in all, it's a huge body of work that has made every member of the team very excited about the future of the Shark Education Centre.

While all this goes on, the basic fabric of our building has needed attention too and a great deal of work has been done – and is continuing – under the supervision of Heidi Thormählen. The Shark Education Centre and CMU are housed in a beautiful old heritage building whose location in the seaside village of Kalk Bay makes it ideal for the purpose of marine education. However, it comes with the challenges associated with old buildings and heritage restrictions. In 2014 most of the house was rewired, 10 air conditioning units were installed, the tank was upgraded and re-plumbed and the entire building was repainted. We have also started to install solar panels on the roof to generate enough electricity for our requirements, a process that is ongoing. Other work to facilitate our operations has included the installation of a switchboard and separate telephone lines as well as a new intercom system for security, and the custom manufacture of office furniture. All the while, general maintenance is carried out by our gardener and housekeeper.

Finally, in November and December 2014 the Shark Education Centre was thrilled to play host to the two winners of the Save Our Seas Foundation's Photo Grant competition, Joris van Alphen and Mac Stone. They were working on different projects in the False Bay area and, despite some challenging conditions for marine work (this is the peak season for the south-easterly wind, with very rough seas and poor visibility), they managed to achieve some wonderful results. It was a pleasure to collaborate where we could.

SOSF SHARK RESEARCH CENTER

MAHMOOD SHIVJI

save our seas
shark research center

The scientific team of the SOSSRC comprises mainly graduate students working on their MSc or PhD degrees and postdoctoral research scientists. Each team member works independently on a research project, but also makes key contributions to the communal work of the centre.

In 2014 the Save Our Seas Foundation Shark Research Center (SOSSRC) focused its efforts on four thematic areas:

- Global-scale genetics research on shark population dynamics and diversity.
- Investigation into elasmobranch biology at its most fundamental level – genomes.
- The movement ecology of sharks.
- Student training and schools educational outreach.

GENETICS RESEARCH TO DISCOVER AND CHARACTERISE THE DYNAMICS AND DIVERSITY OF GLOBAL SHARK POPULATIONS

Shark fishing, indeed often overfishing, is conducted by nearly every coastal nation in the world. Some countries even have commercial fisheries that cover entire ocean basins in their search for fish and they often catch large numbers of sharks that come to an ignominious end as fins in the global fin markets. As in any large-volume fishery, the assessment and monitoring of sharks on a population-specific basis is the bedrock of proper fisheries management. The problem is that there is still little information about the population structure of most of the shark species captured worldwide. The SOSSRC has made major strides in addressing this problem for several key shark species captured in global fisheries, including smooth and great hammerheads and tiger, dusky, silky, porbeagle and bull sharks.

Four students completed their graduate degrees in shark genetics research in the past year, two earning their MSc and two earning their PhD degrees. Two new students, Cassandra Ruck and Cristin Fitzpatrick, joined the team and are also focusing on genetics research.

MSc student Kimberley Atwater-Finnegan did a ground-breaking study on the global population structure and biodiversity of basking sharks by sequencing whole mitochondrial genomes from this species. After she had analysed huge amounts of mitochondrial sequence data, the results were surprising on several fronts. They indicate that basking sharks form two very distinct maternal genetic groups. Unexpectedly, however – and unlike other shark species – the groups are not geographically separated; in fact, they co-occur.

Teagen Gray finished her MSc thesis on the global population structure of dusky sharks. Her results demonstrate that despite the ability of dusky sharks to travel long distances, the species comprises several genetically different populations scattered around the world. In fact, the genetic differences among some populations are large enough that market-obtained dusky fins can be assigned to their population of origin! Teagen won the best poster presentation prize for this work at the American Elasmobranch Society conference in 2013.

Doctoral students Christine Testerman and Andrea Bernard finished their PhD dissertations on the global genetic population structure of six shark species: smooth and great hammerheads and porbeagle, bull, tiger and Caribbean reef sharks, the first three of which have recently been CITES listed. Christine and Andrea are now working on postdoctoral research, some of which they describe on pages 46 and 48 respectively.

The SOSSRC also collaborated with Dr Rima Jabado of the United Arab Emirates (UAE) University to investigate the species diversity of sharks in fishery landings in the Arabian Gulf, and in trade in the UAE. Using in part genetic barcoding, these studies demonstrated the occurrence of four species in fishery landings that were not previously known in this region. Furthermore, more than 45% of the species traded in UAE markets were at high risk of extinction based on IUCN Red List assessments. These studies underscore the need for better characterisation of elasmobranch diversity and improved conservation efforts in this region.

RESEARCH ON ELASMOBRANCH GENOMES

For the past year, SOSSRC scientists and collaborators from Cornell University in New York have been working intensively on the question, what makes a shark – a shark? In other words, what makes sharks unique? Our scientists are addressing this issue by investigating these evolutionary marvels at the most fundamental level possible: their entire genetic blueprint, or genomes, including detailed examination of all their genes.

RECENT SOSSRC PAPERS PUBLISHED IN SCIENTIFIC JOURNALS

Bernard AM, Feldheim KA, Shivji MS. 2015. Isolation and characterization of polymorphic microsatellite markers from a globally distributed marine apex predator, the tiger shark (*Galeocerdo cuvier*). *Conservation Genetics Resources*. In press.

Hester J, Atwater K, Bernard A, Francis M, Shivji M. 2013. The complete mitochondrial genome of the basking shark *Cetorhinus maximus* (Chondrichthyes, Cetorhinidae). *Mitochondrial DNA*. DOI: 10.3109/19401736.2013.845762.

Jabado R, Al Ghais SM, Hamza W, Shivji MS, Henderson AC. 2015. Shark diversity in the Arabian Gulf higher than previously thought: insights based on landings composition of sharks from the United Arab Emirates. *Marine Biodiversity*. In press.

Jabado R, Al Ghais SM, Hamza W, Henderson AC, Spaet JL, Shivji MS, Hanner RH. 2015. Characterizing the trade in sharks and their products in the United Arab Emirates through market surveys and DNA barcoding. *Biological Conservation* 181: 190–198.

Richards VP, Suzuki H, Stanhope MJ, Shivji MS. 2013. Characterization of the heart transcriptome of the white shark (*Carcharodon carcharias*). *BMC Genomics* 14: 697. http://www.biomedcentral.com/content/pdf/1471-2164-14-697.pdf (Highly Accessed Paper category).

Teter SM, Wetherbee BM, Fox DA, Lam CH, Kiefer DA, Shivji M. 2015. Migratory patterns and habitat use of the sand tiger shark (*Carcharias taurus*) in the Western North Atlantic. *Marine & Freshwater Research* 66: 158–169.

What is a genome and why are we looking at this issue? A genome is the collection of all the DNA, including all the genes, in an organism's chromosomes. The make-up of the genome and the expression of its genes hold the secrets to what makes an organism function, including how it behaves physiologically and physically. The bottom line is, if you want to *really* understand what makes an organism tick, you have to examine its genome, which holds the key to a treasure trove of biological information. Our first look at all the genes expressed in the heart of the white shark has shown that some aspects of its genetic make-up are more similar to mammals than to a teleost fish. That's a very unexpected finding, considering that sharks are, after all, fish. (For more details see: *http://www.news.cornell.edu/stories/2013/12/shark-human-proteins-are-surprisingly-similar*). Clearly, there's a lot more novelty to shark functioning than meets the eye. Our exploration in this area continues and includes the sequencing of the white shark genome and the large-scale discovery of immune system genes expressed in several elasmobranch species. You can read more about this ongoing work in *Save Our Seas* magazine, issue 3.

MOVEMENT ECOLOGY OF SHARKS

Most of the world's overfished sharks are large species that often travel extensively. Understanding their movements is key to providing information about not only how sharks use the ocean, but also where and when they are likely to be most susceptible to fishing pressure. Understanding shark movements, including their migratory patterns, is also important for predicting how they may respond to physical environmental shifts, including climate change.

The SOSSRC is working closely with its research partner 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 each individual's movements – in many cases in near real-time – via information received from the tags as they report to orbiting satellites. A good example is provided by four shortfin mako sharks named SOSF 1–4, which were tagged in May last year off the east coast of the USA. One shark was unfortunately captured by commercial fisheries nearly four months after being tagged (we recovered the satellite tag), but the other three are still showing brilliant long-distance travels. These and other shark tracks are featured on a publicly available interactive website constructed and maintained by the GHRI (*www.ghritracking.org*). This site has received more than 315,000 page loads to date, providing extensive exposure to the Save Our Seas Foundation, which is linked to several individual shark-tracking projects on the website.

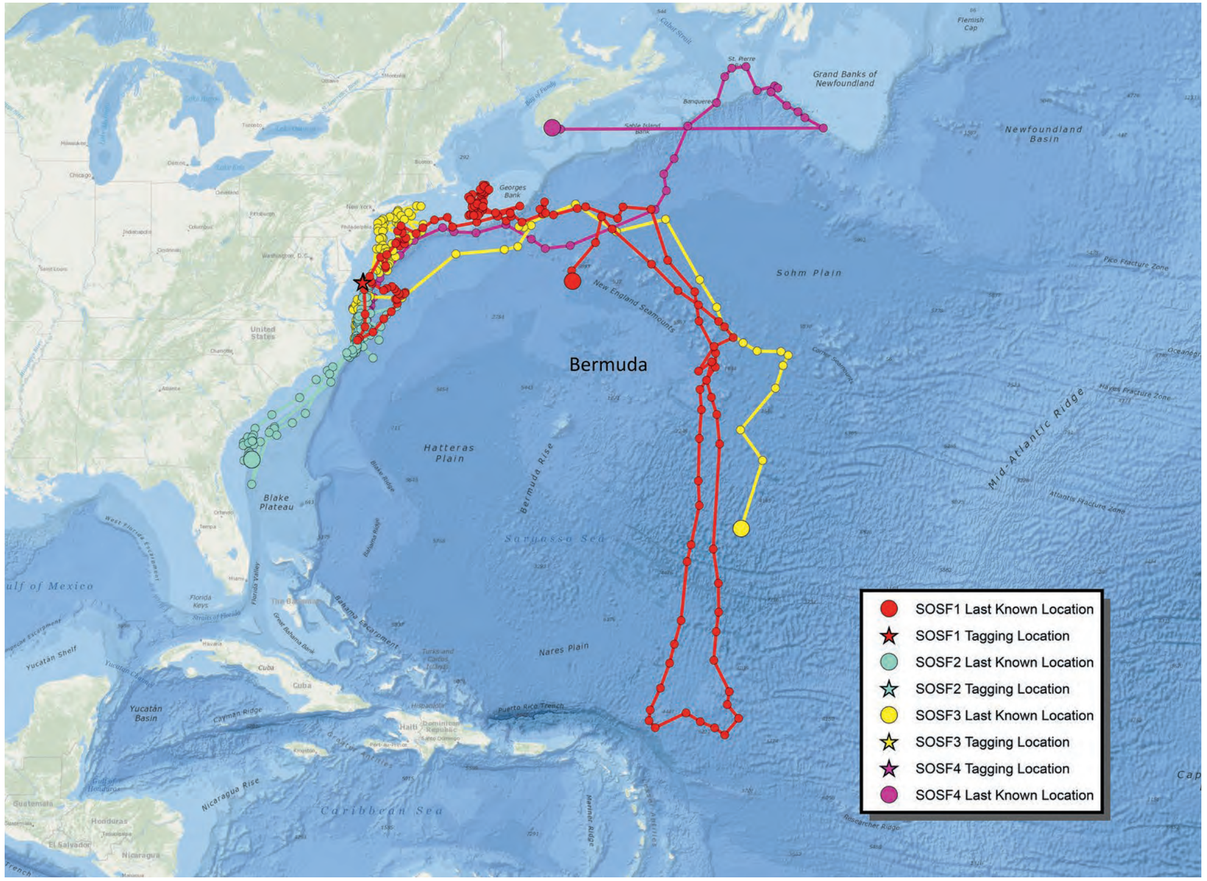
STUDENT EDUCATION AND OUTREACH

In addition to its primary research mission, and in partnership with the GHRI, the SOSSRC provided research training opportunities to students and conducted some school educational outreach activities. Research training was provided to:

- Seven US graduate students (five MSc, two PhD).
- One visiting Brazilian PhD student (from the State University of Sao Paulo, UNESP).
- One UK and two US high school students.

Our school's educational programme consisted of two components, led by GHRI and SOSSRC scientist Dr Derek Burkholder:

- 'Skype in the Classroom' presentations on shark conservation that reached more than 2,400 students in 46 schools around the world (six countries: Malaysia, Kingdom of Bahrain, Pakistan, Australia, USA (25 states) and Canada (three provinces).
- In-person, classroom presentations made to 28 schools in the USA (Florida) and Canada (Ontario), with more than 7,000 students in attendance.


Bermuda
Grand Banks of Newfoundland
Newfoundland Basin
Sohm Plain
Hatteras Plain
Blake Plateau
Bermuda Rise
Nares Plain
Mid-Atlantic Ridge
Caribbean Sea
Gulf of Mexico
Yucatán Basin
Nicaragua Rise
Cayman Ridge
Puerto Rico Trench
Georges Bank
St. Pierre
Banquereau
Fleming Cap
United States
Cuba
Haiti
Dominican Republic
Jamaica
Honduras
Nicaragua
Guatemala
El Salvador
SOSF1 Last Known Location
SOSF1 Tagging Location
SOSF2 Last Known Location
SOSF2 Tagging Location
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CASSANDRA RUCK
MASTERS DEGREE STUDENT

This past year, 2014, was a particularly exciting one for me. It marked the beginning of my graduate school career and the start of my work with the Save Our Seas Shark Research Center. I began the year with an introductory lab project identifying the species composition of almost 300 shark fins collected from artisanal fisheries in the Central Pacific. After getting my lab feet wet with this project, I began to shift gear towards the main task at hand: my MSc thesis. My thesis project examines the population genetics of the oceanic whitetip shark *Carcharhinus longimanus* and aims to determine the global connectivity and diversity of the species using genetic techniques. My results will contribute to baseline knowledge of this enigmatic shark and efforts to protect it.

Built for cruising, the oceanic whitetip glides through the tropical and warm-temperate waters of the open ocean, often following schools of tuna. Although it was once one of the most abundant pelagic shark species, it has declined dramatically due to its high susceptibility to being taken as by-catch by long-line fisheries and being caught intentionally for the international shark-fin trade. According to the IUCN Red List of Threatened Species™, the oceanic whitetip is now Critically Endangered in the Western North Atlantic and Vulnerable to extinction globally. Without sound, scientifically based conservation efforts, it may face a grim future.

Excitingly, a victory for oceanic whitetip conservation was achieved in 2014 when the species was added to Appendix II of CITES, which restricts international trade in the listed species by imposing strict reporting requirements. Although this listing is a major step towards saving these magnificent sharks from extinction, too little is still known about their population structure and dynamics for conservation practices to be effective. What, you may ask, can I do about this from inside a laboratory? Well, that is the wonder of genetic tools. To date there have been no published studies on the genetic population structure of the oceanic whitetip shark. However, I plan to change this and have been working towards this goal for the past year.

Through many years of international collaboration, our lab has been able to collect oceanic whitetip tissue samples from around the globe. I extracted DNA from these samples and sequenced two regions of the mitochondrial genome. Preliminary analyses of these sequences have revealed significant genetic differentiation between Atlantic and Indo-Pacific oceanic whitetip sharks. In other words, the sharks in the Atlantic Ocean basin are not migrating and breeding with the sharks in the Indo-Pacific Ocean basin. As a distinct population, therefore, sharks in the Atlantic will respond to exploitation independently of sharks in the Indo-Pacific and must be managed accordingly. I am continuing this project by applying microsatellite genotyping techniques to obtain a holistic view of the oceanic whitetip's global population structure.

In the end, my research will help us to estimate the number of genetically distinct populations of oceanic whitetip sharks in our oceans. By inferring the number of populations and their overall global connectivity, I will contribute essential information to guide scientifically based management strategies for the species around the world.

CHRISTINE TESTERMAN, PHD
POSTDOCTORAL RESEARCHER

My research at the SOSSRC over the past year has focused on finishing my global-scale genetics study on the porbeagle shark *Lamna nasus*.

Porbeagle sharks are found in cool-temperate waters in the North Atlantic and throughout the southern hemisphere, but are curiously absent from the North Pacific. Due to documented declines resulting from overfishing, the species is assessed by the IUCN Red List of Threatened Species™ as Critically Endangered in the eastern North Atlantic and Mediterranean and Endangered in the western North Atlantic. In addition, it was approved for listing on CITES Appendix II effective from September 2014. Despite its endangered status and CITES listing, little is known about the porbeagle's population structure globally. In our laboratory we have already developed forensic tools for species identification, but these need to be taken to a higher level so that they can be used to identify the population from which internationally traded porbeagle body parts originated.

The key questions that I worked on were:

- Are there fixed genetic differences between porbeagle sharks in the northern hemisphere and those in the southern hemisphere, or even within each hemisphere? If so, could we develop forensic tests of geographic origin based on these genetic differences?
- Have enough genetic differences accumulated between porbeagle sharks in the northern and southern hemispheres for them to be considered separate species?

The results show high genetic differentiation between porbeagle sharks of the northern and southern hemispheres. These findings highlight the urgent need to implement strong conservation measures for the endangered North Atlantic porbeagle population because connectivity between southern and northern hemisphere porbeagles is extremely low. In other words, extirpation of northern hemisphere porbeagles will not be rectified by migration of animals from the southern hemisphere. Based on the strong genetic differences, I have been able to develop a rapid combination forensic test to identify market-derived porbeagle fins not only to species, but also to hemisphere of origin. However, despite the strong genetic and morphological differences between northern and southern hemisphere porbeagles, the comparative genetics data do not support delineating them as two different species.

ANDREA M BERNARD, PHD
POSTDOCTORAL RESEARCHER

For the past year, I have worked as a research scientist (postdoctoral fellow) at the Save Our Seas Shark Research Center (SOSSRC) examining the genetic population dynamics of two of the largest and most fascinating shark species: the tiger shark *Galeocerdo cuvier* and the white shark *Carcharodon carcharias*.

Tiger sharks are globally distributed, occupying warm-temperate and tropical waters. As generalist predators, they consume a huge variety of prey, from seabirds and sea snakes to dugongs and smaller shark species. Their cosmopolitan diet makes them extremely important members of the marine ecosystem. My work on the population dynamics and genetic connectivity of tiger sharks began during my PhD. Using a set of molecular tools developed at the SOSSRC, I examined the broad-scale connectivity and gene flow of these predators across a large portion of their global distribution. This work revealed high connectivity and overall lots of mixing within ocean basins by these predators, but at the same time there was some evidence of potentially fine-scale differences or restricted movements by some individuals.

To explore this further and achieve a better understanding of the dynamics of tiger shark connectivity – and ultimately gain insight into how best to manage the species – part of my postdoctoral work has centred on attempting to tease out some of these potentially fine-scale differences. To do this, we have adopted a relatively new, high-throughput, cutting-edge approach called 'genotyping by sequencing' to screen *thousands* of markers, known as 'single nucleotide polymorphisms', that are scattered throughout the tiger shark genome. Because this genome-scale approach uses a huge number of genetic markers, it provides an extremely high-resolution view of genetic differences that can identify small, but potentially very meaningful disparities among populations. Only a few years ago the examination of a few dozen markers was a difficult task; today technological advancements enable us to delve much more deeply into the tiger shark genome, which may help us to understand some of the behaviour and movements of these very complex animals.

My second research focus during the past year (and continuing) has been developing increased genetic marker sets to examine the diversity and connectivity of white sharks in the Pacific Ocean. Despite the notoriety of these predators, there are still large gaps in our knowledge of their movements, stock structure and population history. In fact, few genetic tools currently exist to examine these issues in detail over regional and global scales. To this end, I am working towards generating a much larger set of molecular markers specific to the white shark in order to better understand the population dynamics of the species. Specifically, I am isolating genetic markers called 'microsatellites', which are small repetitive regions dispersed throughout the genome. These markers often show high inter-individual variation with respect to the number or lengths of the repeats, which makes them ideal for DNA forensic work. Using massive amounts of white shark DNA sequences generated from other genome projects at the SOSSRC, I have been scouring the genome for these repeats. Having found dozens of new molecular markers and optimised their performance, I am now looking for fine-scale differences between populations of white sharks inhabiting the Pacific Ocean.

CONSERVATION MEDIA UNIT

LISA BOONZAIER

2014 was the year the Save Our Seas Foundation's Conservation Media Unit (CMU) truly took flight. From a fledgling unit at the end of 2013, the group expanded to its full potential in 2014, when a social media manager and a science editor joined the team. And for the foundation as a whole, the year was a success, with our presence extending to print, online, video, photographic and social media, as well as several outreach events.

One of the early, and major, accomplishments of the year was the launch of the inaugural issue of the foundation's magazine, *Save Our Seas*: a brand-new, biannual publication that showcases exceptional marine science projects around the world and celebrates the successes of the Save Our Seas Foundation. Published in April 2014, the first issue featured scientists from places as diverse as South Africa, Seychelles and the USA, as well as topics ranging from nature conservation photography to politics and covering the areas of research, conservation and education. The flagship feature for that issue was a feast for the eyes comprising an extensive photographic portfolio on manta rays by Thomas Peschak, the Save Our Seas Foundation's director of conservation, and an article written by Guy Stevens, founder of the Manta Trust.

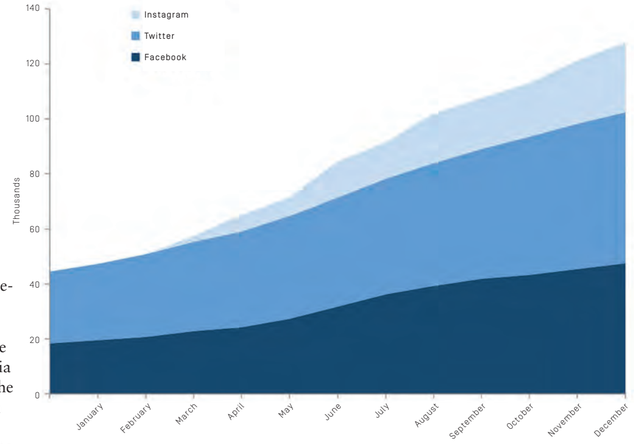
The achievements of the first issue motivated the editorial team to go further and exceed our previous work with its successor, and about six months later we published the Autumn 2014 issue. This introduced 'Inside stories', which come from our main centres and partners around the world. A photographic portfolio and article about Arabia's seas from Thomas Peschak paved the way for stories about turtles, sharks and rays elsewhere in the issue. Distributed in print via a few thousand copies and available online free-of-charge through Issuu, Zinio and iTunes, the magazine has been well received and was a resounding success.

In addition to unveiling our magazine, the Save Our Seas Foundation pulled off another first in 2014 with the launch of its Marine Conservation Photography Grant, the only one of its kind in the world. The foundation firmly believes that photography can be a tool for conservation, and the aim of this grant is to support young photographers who are using their talents in such a way. The response we received to the call for entries was impressive, with more than 100 applications coming in.

After much consideration, the two winners were chosen by our judging panel: Kathy Moran, senior editor (natural history) at *National Geographic Magazine*, David Griffin, visuals editor for the *Washington Post*, Thomas Peschak and Michael Scholl, our CEO. Mac Stone and Joris van Alphen submitted superb portfolios and were deemed exceptional and worthy recipients of the award. Each received a cash prize and was reimbursed for a three-week assignment to document SOSF-supported marine research in False Bay, South Africa.

Looking back on 2014, in my mind the year fell into two parts: before the Sharks International Conference, held during the first week of June, and after it. This is not only because it marked my first week – daunting and memorable in equal measure – as part of the foundation and a high point in my career so far, but also because the hosting of this prominent conference (which takes place once every four years) on South African soil meant a golden opportunity to present the foundation to the world of shark scientists. And this was what the Save Our Seas Foundation did in full force. In addition to running video interviews with leading scientists, hosting a social media workshop and furnishing travel grants to numerous attendees, the Save Our Seas Foundation in conjunction with Thomas Peschak showcased the book *Sharks and People* with an exhibition of selected photographs from it. Our presence at Sharks International 2014 was strong, and the conference as a whole succeeded in bringing together the international community of shark scientists to share their latest research. We were proud to be involved.

Although the photography exhibition in Durban was the first showing of the *Sharks and People* images, it was not the only one of the year, and the photos were subsequently displayed at two other events: the Volvo Two Oceans Race and the Wavescape Surf Film Festival, both held in Cape Town. The images, which tell the story about the relationship between humans and the most feared fish of the oceans, were seen by more than 10,000 people who were estimated to have been at these two showings combined.



During and around these highlights on the Save Our Seas Foundation's calendar, we continued to run our regular media activities, including the management of our social media channels and website. Through all these avenues we aim to share inspirational and topical content – both originating from the Save Our Seas Foundation and curated from other sources – that relates to the science and conservation of the marine world. This year we, as a foundation and a media unit, adopted more resolutely the principle of sharing good-news stories about the ocean and its conservation to balance the prevalence of bad news that, although relevant, is sometimes overwhelming. This stance is not new, but has taken on new significance among the marine science and conservation community with the launch of the #OceanOptimism hashtag on World Oceans Day in June.

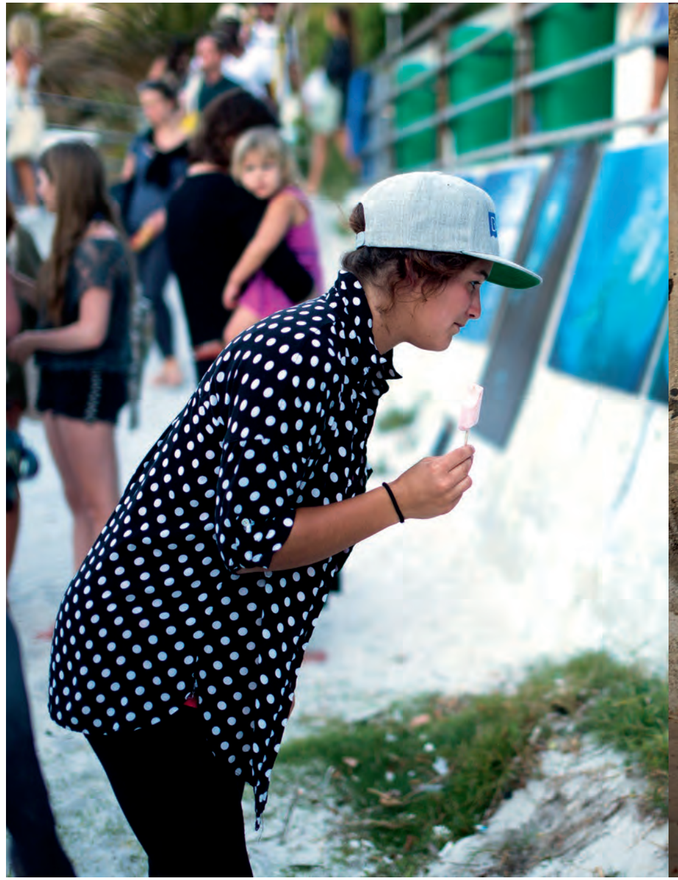
The growth of the Save Our Seas Foundation's audience on Twitter and Facebook has been phenomenal and in 2014, under the guidance of Jade Schultz, our content marketer and social media manager, we celebrated two significant milestones on Facebook: we reached 30,000 likes in June and 40,000 in September. Overall we've seen our audiences on Facebook and Twitter each grow by more than 29,000 during the past year. In 2014, too, we initiated the Save Our Seas Foundation's Instagram feed and have acquired 27,000 followers. Collectively, the size of our online audience has more than tripled.

Of the content that we share and distribute, none is closer to the foundation than the blogs that come directly out of Save Our Seas-funded project leaders. These blog posts tell stories from the field, share personal insights, and explain and disseminate scientific findings and conservation successes. Collaborating with project leaders to encourage more interactive and approachable blogs and effective science communication has been a positive experience for the CMU team, and we feel it is one of the most important things we do. Our goal is to see these blog posts reach as wide a readership as possible to create lasting support for the important work of our project leaders.

Among the most exciting content to come from the CMU itself was our immersive feature about the Western Indian Ocean. This online, multimedia story looked at the wonders of two tiny and remote groups of islands: Bassas da India and Europa Atoll. With images from Thomas Peschak and writing and other multimedia from our conservation journalist Philippa Ehrlich, this online feature transports the viewer on a virtual journey to these island paradises. Stories like this are fun to make and we hope they are an inspiration to engage with. We plan to create more immersive features like this in future.

As a unit, and in conjunction with the Save Our Seas Shark Education Centre, the CMU was involved in outreach activities in and around Cape Town during the year. For Mandela Day, an annual celebration of the birth of South Africa's former president and icon, Nelson Mandela, the team delivered marine-related education and activities to a class of previously disadvantaged children. Interacting with these young future leaders and citizens and seeing the joy on their faces was a highlight of the year. And in recognition of International Coastal Cleanup, we all trooped down to a local beach laden with garbage bags, protective clothing and clipboards, and cleared it of many bags of rubbish – even a car tyre! As media practitioners, we sometimes feel removed from the more practical elements of conservation and so it is wonderful to get involved with hands-on activities.

As part of our outreach activities for the year, the CMU's Philippa Ehrlich journeyed to the island of D'Arros, Seychelles, and the Save Our Seas Foundation's research centre there, to share her knowledge of storytelling and effective communication with some of the country's bright young minds. The Seychellois teenagers



were on the island as part of the D'Arros Experience, an educational camp organised by the Save Our Seas Foundation's Island School Seychelles in collaboration with the D'Arros Research Centre. To celebrate the camp, which was run for the second time in 2014, the foundation commissioned a series of videos documenting its success. (These can be viewed online through our Vimeo channel.)

The year ended on a high note when Mac Stone and Joris van Alphen, the two winners of the 2014 Save Our Seas Marine Conservation Photography Grant, joined the team in Kalk Bay to document stories from False Bay that will appear in the Summer 2015 issue of the magazine. Each one was tasked with telling a story from the bay, and they tackled their assignments in their own style. The experience of working with these two young and talented photographers was priceless and we are very excited to share their images. Until then, there is a record of their trip and their activities online on the Save Our Seas Foundation's website, with blog posts written by the grantees and Philippa Ehrlich.

From the end of November to early December, the Save Our Seas Foundation sponsored the Wavescape Surf Film Festival, an annual event in Cape Town that draws locals together to share and enjoy ocean culture and conservation. Among the notable events was Slide Night, an evening of 10 10-minute presentations by inspirational people intimately connected to the ocean, including Eleanor Yeld Hutchings, the manager of the SOSF–Shark Education Centre. Lauren De Vos, the SOSF–Shark Education Centre's researcher-in-residence, acted as our host for the evening and eloquently led the audience through the sequence of presentations.

The festival's finale was a beach film screening held outdoors on what is arguably one of the most beautiful stretches of coast in the world, Cape Town's Atlantic seaboard. Here the Save Our Seas Foundation went about spreading some #GoodSharkKarma to help change perceptions about these marine creatures. Playing on the idea of creating good karma for sharks and, in return, earning some for oneself, the campaign used an on-site activation and social media campaign to share knowledge and foster understanding of sharks. Through direct interaction and the compelling images of *Sharks and People*, the effect was felt across the beach. 'Beautiful!', 'It's awesome!', 'I honestly think they're amazing', were some of the comments from the beach-goers. Thousands of people were on site that day and exposed to the campaign, whose reach also extended beyond the festival and into the online channels of social media.

Sitting in my office, overlooking the tumultuous sea of False Bay with its bobbing kelp heads trailing downwards to unseen wonders, I'm constantly reminded of why we do the work we do, why the Save Our Seas Foundation and its people dedicate their time and passion to conducting relevant research, effective conservation and vital education work. It's the goal of the Save Our Seas Foundation and its CMU to bring this work to the eyes, ears and minds of the world.

I'm pleased to say that the plans we have lined up for the future are just as promising as the events and achievements of 2014. The third issue of the magazine is due out in summer 2015 – and we have other projects up our sleeve that will have to remain a surprise.

To view the *Save Our Seas* magazine for free, you can search for us on Zinio, Issuu and iTunes.

MARINE CONSERVATION PHOTOGRAPHY GRANT

PHILIPPA EHRLICH

Joris van Alphen

Mac Stone

In 2014, the Save Our Seas Foundation (SOSF) offered its first Marine Conservation Photography Grant, the brainchild of conservation photographer and Save Our Seas director of conservation, Thomas Peschak. Imagery plays a critical role in influencing our behaviour, believes Peschak. '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,' he explains.

The foundation invited young environmental photographers to submit portfolios and photo stories. The grant would be awarded to the top two entrants and comprised a cash prize, a paid assignment to cover an SOSF-funded project and a unique opportunity to be mentored by top industry professionals.

Almost 100 entries were received from emerging conservation photographers around the world and the SOSF team worked with Kathy Moran, senior editor (Natural History) for *National Geographic* Magazine, and David Griffin, visuals editor for the *Washington Post*, to choose the winners. The grantees were chosen for their ability to not only take beautiful, thought-provoking and original images, but also tell a cohesive conservation story with those pictures.

The successful applicants, Joris van Alphen and Mac Stone, were announced in June 2014 and their portfolios were published in the second issue of the *Save Our Seas* magazine. Van Alphen is a young photographer from the Netherlands who specialises in stories about nature and science. He is also a National Geographic Explorer and a Fellow of the International League of Conservation Photographers. With field biologists for parents, Van Alphen had a nomadic childhood very close to nature and lived in numerous countries around the globe. He has completed assignments to remote locations in South-East Asia and South America.

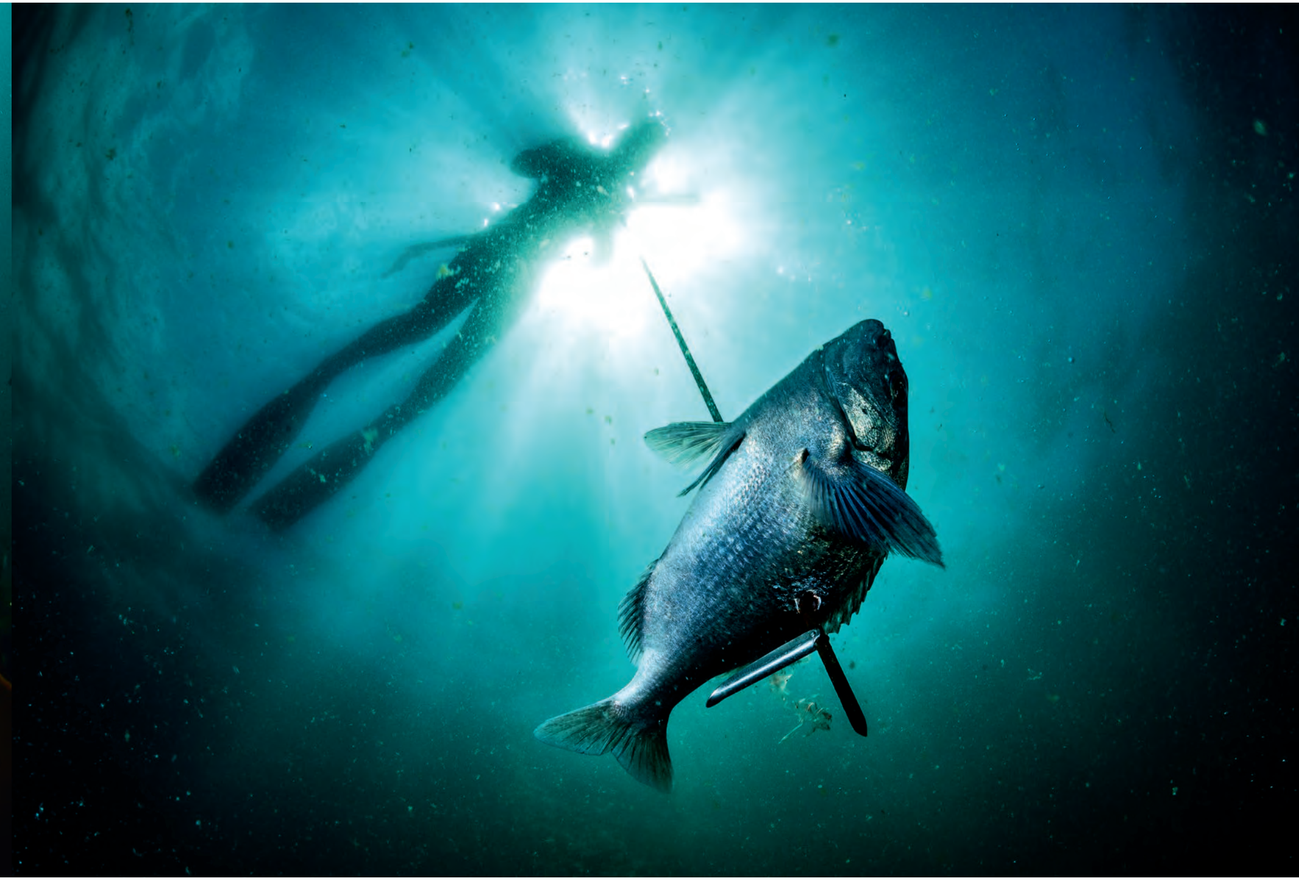
Stone is from Gainesville in the USA and grew up exploring the waterways of North Central Florida. As a passionate advocate for his backyard, he has recently released a book entitled *Everglades: America's Wetland* and hopes to change public opinion about the country's swamps. Stone's dedication to using his expertise for conservation is longstanding. In his early 20s he spent two years in a remote village in Honduras, teaching photography to underprivileged youths in an effort to inspire environmental awareness in the region. In addition to his ongoing photographic pursuits, Stone is the executive director of Naturaland Trust, which aims to protect wild spaces in North Carolina.

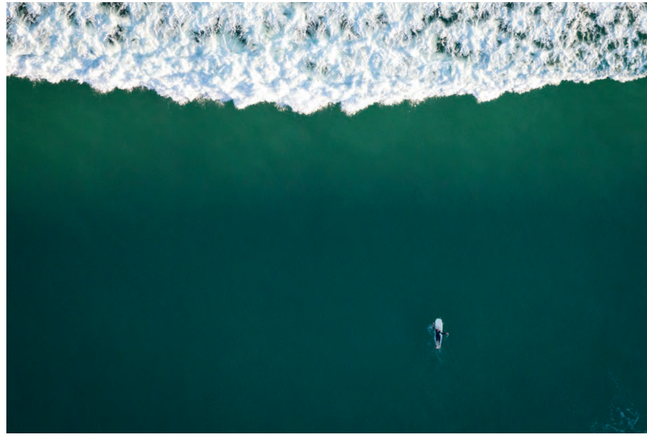
The idea behind the Marine Conservation Photography Grant is to facilitate collaboration between each young photographer and an SOSF-funded project leader who would benefit from a visual portrayal of their work. 'Many scientists need media support to translate their findings from the technical into the popular arena in order to reach a large, influential audience… Working with project scientists, these emerging photographers will create critical photographs and tell stories that drive conservation change all over the globe,' says Peschak.

After much deliberation, the SOSF's executive team decided that this year's grantees would be sent to False Bay, South Africa, to work with marine biologists Alison Kock and Lauren de Vos. This would give them the support of the SOSF Conservation Media Unit (CMU), based at the Shark Education Centre in Kalk Bay, and provide an important opportunity for them to meet Peschak and workshop their stories before beginning the assignment.

On 12 November 2014, Stone and Van Alphen landed at Cape Town airport, each laden with multiple pelican cases. It was the first trip to South Africa for both photographers. They were met by Jade Schultz, Lisa Boonzaier and Philippa Ehrlich of the CMU and travelled directly to Peschak's house in Greyton, a nearby village. For the next two days they got to know the *National Geographic* Magazine photographer and received some valuable feedback on their existing portfolios. They also discussed their SOSF assignment and workshopped shot lists.

Peschak aimed to give the grantees just enough information for them to construct their narratives but not so much that their creative freedom would be undermined. Assigned the story of the Shark Spotters, Stone described the process as starting a 'treasure hunt'. The Shark Spotters programme is managed by Alison Kock and Sarah Waries. In a bay that teems with shark life, from small endemic catsharks to enormous great whites, keeping Cape Town's growing population of water-users safe is a challenge. The Shark Spotters are stationed on mountains






K_SPOTTERS

SOSF Marine Conservation Photography Grant jury (from left to right): David Griffin, visuals editor of the *Washington Post*; Kathleen Moran, senior editor for natural history at the *National Geographic* Magazine; Thomas Peschak, assignment photographer for the *National Geographic* Magazine and director of conservation for the Save Our Seas Foundation; and Michael Scholl, CEO of the Save Our Seas Foundation.

along False Bay's coastline and warn surfers and bathers to leave the water when a great white is seen swimming close to the beach. Stone's challenge was to portray shark biodiversity in balance with people's relationships with the bay and the Shark Spotters efforts to keep both sharks and people safe.

Van Alphen was given the assignment 'Rocky reef fish – more endangered than the rhino?' Because of its unique position at the confluence of two opposing ocean currents, False Bay hosts an incredible array of bottom-dwelling fishes that live on rocky outcrops and in kelp forests. Before the unsustainable exploitation of the bay, anecdotal reports by fishermen described the waters as turning red when a school of red stumpnose swam by. Today these fish, along with many other long-lived, resident species, have all but disappeared. South Africans countrywide are passionately outspoken about the imminent extinction of rhinos, but are oblivious to the plight of reef fishes. Van Alphen's mission was to work with marine biologist Lauren de Vos and give his audience a glimpse into the fascinating lives of these fishes, as well as document the fishermen who hunt them and the increasing difficulty of making a living.

'Reef fishes are incredibly diverse in False Bay. It really is an unusual place to dive and an unusually beautiful place to see these fishes, yet most people think of them only in terms of food and very few know how beautiful and diverse they are. I think what I have had in my mind while I have been photographing these fishes is trying to be an ambassador for them so that people will connect with them and see them as more than just food,' explained Van Alphen during an interview at the end of his assignment.

After a few days with Peschak, Stone and Van Alphen were thrown in the deep end – literally. Early summer in Cape Town is followed by the relentless south-easterly wind that churns False Bay into frothy, green seafood soup with water temperatures as low as 11 °C (52 °F). For the next few weeks the grantees had to navigate these conditions while learning as much as they could about their subjects to get the shots they wanted. 'It was like a cruel joke. I needed crowded beaches, dramatic horizons and clear water. Instead I had ripping winds, textureless blue skies and False Bay's version of pea soup,' wrote Stone at the end of his assignment.

Although both photographers agreed that False Bay was one of the most beautiful places they had ever worked in, their assignments were challenging. For Van Alphen, getting an original shot of a roman seabream on the line was especially difficult and required a separate boat and the support of a team of three assistants. 'Everything would bob up and down independently in the chop – not just the boat and the fish, but also the camera and I. Just as the fish and the boat aligned, a wave would drop and obscure my viewfinder. Meanwhile I was swimming against the current. After many hundreds of misses, I finally managed to shoot one frame that worked,' he recalls.

In addition to covering the plight of the fish, Van Alphen set out to understand the human story, which meant early morning trips out into the bay on local fishing boats. 'The boat rolled enough to make even some of the crew throw up on occasion. Still, each time I went out with the fishermen I felt extremely privileged to be allowed into their world… It was a shock to me how little they caught on most days. Often they returned after 12 hours at sea with only a handful of small fish each,' he explains.

Both photographers spent a lot of time shooting in False Bay's Castle Rock Marine Reserve, which is home to a population of resident sevengill cowsharks. Stone spent numerous dives trying to capture images of these primitive animals.

'With every privileged encounter I became more tuned in to the habitat and the sharks' behaviour – and more focused on crafting the photograph that would honour this shark sanctuary that is False Bay,' he remembers.

Working closely with the CMU and the respective scientists, and despite the persistent south-easter, the grantees were tireless in their mission to collect the images they needed. 'More often than not, there were no sharks in the seine nets, no exclusion net to remove and I would come home empty-handed. It killed me to have a day go by without taking a publishable photo,' recalls Stone. 'What counted, though, was that I constantly showed up. The Shark Spotters all knew my name and the fishermen could recognise me walking down the beach a kilometre away.'

By the time the photo grantees reached the end of their time in False Bay they had each shot thousands of photographs – some capturing aspects of the bay that had never been photographed before. Throughout the expedition, they had regular contact with Peschak and Moran, who guided them through the storytelling process. This input was invaluable for their development as conservation photographers.

Working with Stone and Van Alphen was also very productive for the SOSF CMU team. It presented an important opportunity for the media unit to spend time with the relevant project leaders and craft positive narratives about their work. The motivation to do justice to these projects was shared by Stone. 'What the Save Our Seas Foundation is accomplishing in False Bay on behalf of marine conservation is truly remarkable. It has helped transform a feared predator into dozens of jobs, educating its citizens that marine wilderness and urban life can coexist,' he wrote.

The photo stories shot by Stone and Van Alphen will appear in the third issue of the *Save Our Seas* magazine and will be showcased on the new Save Our Seas Foundation website.

SOSF D'ARROS RESEARCH CENTRE

RAINER VON BRANDIS

save our seas
d'arros research centre

The natural environment of D'Arros Island and St Joseph Atoll is among the most ecologically healthy and spectacular in the world. More sea turtles come to nest on the beaches, more sharks, rays and fishes swarm over the coral reef and more seabirds nest and roost in the trees than at any other island in the Seychelles' Amirantes Group.

The Save Our Seas Foundation D'Arros Research Centre (SOSF–DRC) has been tasked with preserving and showcasing the ecological integrity of these islands and their surrounding marine environment through research, monitoring, restoration and education. Since its inception in 2004 the SOSF–DRC has initiated no fewer than 34 research projects in collaboration with more than 25 institutions, resulting in two PhD dissertations, one MSc dissertation, 11 scientific journal publications and 27 scientific reports.

The SOSF–DRC uses state-of-the-art equipment to monitor climate change (weather, sea temperature, sea level and currents), population numbers (nesting and foraging turtles, fishes, sharks, manta rays and seabirds) and ecosystem health (coral reefs and reef flats). These long-term monitoring programmes have been instrumental in guiding management decisions and the design of new targeted research projects. Recently the SOSF–DRC began some exciting targeted research projects that include the ecology of stingrays and neonate sharks in the atoll; the local movements of manta rays and juvenile hawksbill turtles (acoustic tracking); and the regional movements of adult green and hawksbill nesting turtles (satellite tracking).

In 2010 the centre started an ambitious forest restoration project with the aim of transforming parts of the abandoned coconut plantation back to natural broad-leaved forest. More than six hectares have been restored so far by means of a novel rehabilitation method designed on D'Arros.

In collaboration with other NGOs and local government, the SOSF–DRC has recently initiated a marine education programme for local schoolchildren. Children are awarded this opportunity on merit and come to St Joseph for a week to explore the atoll and learn about conservation. Among other things, they assist resident scientists in their work, conduct coral reef transects and bird counts, plant trees in the forest and snorkel with manta rays and turtles.

The SOSF–DRC building overlooks the ocean on the north-western side of D'Arros Island. Facilities consist of a dry and a wet laboratory that are separated by a series of eight flow-through sea-water tanks. The dry lab contains computer and electronic equipment and the wet lab is used for sample analysis and experimentation. The flow-through tanks house corals, algae and other benthic organisms for experimental research purposes.

The SOSF–DRC is directed by Dr Rainer von Brandis and managed by lab manager Chris Boyes and research assistant Kerryn Bullock. Throughout the year, the centre supports visiting scientists and research assistants working on their various projects.

A. LONG-TERM MONITORING PROGRAMMES

> Figure 3: An example of a bleached *Pocillopora* coral on the north-eastern reef crest of D'Arros Island (right) that made a full recovery within two months (left).

v Figure 1: SOSF–DRC lab manager Chris Boyes measures tagged corals.

1. CORAL REEFS

AUTHOR: DR RAINER VON BRANDIS
PRINCIPAL INVESTIGATORS: SOSF–DRC
FIELD PERSONNEL: SOSF–DRC STAFF, RESEARCH ASSISTANTS

In 2014, SOSF–DRC staff members conducted more than 250 scuba dives in order to fulfil the requirements of the annual coral reef monitoring programme. The fundamental aim of this programme is to assess trends in the structure and health of coral reef communities at D'Arros and St Joseph. The purpose of this is fourfold: to determine the causes of potential harmful trends and attempt to lessen them through management intervention; to add to the overall understanding of coral reef ecosystems; to identify new targeted research projects; and to add to the database of the status of coral reefs around the world.

Our coral reef monitoring programme employs standardised methods and sampling strategies and includes the monitoring of ambient environmental and oceanographic parameters; benthic cover and composition; coral recruitment; coral bleaching; growth and survival of coral recruits; and reef fishes and mobile invertebrates. Although only four years old, the programme is already revealing interesting trends. Encouragingly, a general improvement in the health of the coral reef ecosystem at D'Arros and St Joseph is evident in that there has been a gradual increase in the abundance of corals and fishes over the years.

In May 2014 the sea surface in the region became unusually warm and maintained the higher temperature for more than three weeks (Figure 2). Uncommon events such as this are linked to global warming and if severe they can be detrimental to coral reefs. Coral bleaching occurs when above-average sea temperatures result in the expulsion of the colourful microscopic algae that occur mutualistically in coral skeletons (Brown and Suharsona 1990). The loss of these photosynthetic algae turns corals white, diminishes their energy resources and eventually results in their death. In 1998, almost 70% of the hard corals in the Seychelles region perished due to an uncharacteristically extreme sea-surface warming event (Spencer et al. 2000). The SOSF–DRC has monitored the sea temperature at 21 coral reef sites around the islands since then and when bleaching occurs conducts surveys to determine its extent and which coral species die and which recover.

Results from the benthic photoquadrat survey this year reinforced the increasing trend in hard coral abundance (Figure 4). Encouragingly, the survey of *Acropora* and *Pocillopora* coral recruitment showed a marked increase in coral recruits over the past three years from an average of 2.6 recruits per square metre in 2012 to 6.2 in 2014, further strengthening the future outlook for corals. Fish numbers have also shown a steady increase, especially in species that rely on healthy coral reefs (such as damsels and butterflyfishes) or that are subject to fishing pressure (such as snappers and groupers).

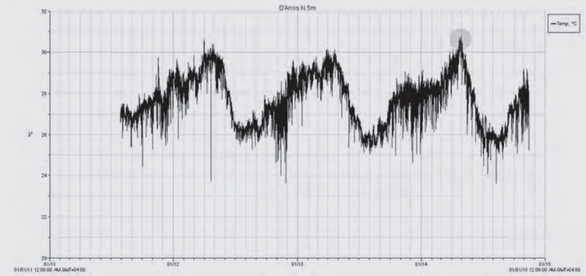


Figure 2: Sea temperature between July 2011 and November 2014 at 5m depth on the north-eastern side of D'Arros Island. Note the temperature spike in May that caused a minor bleaching event.

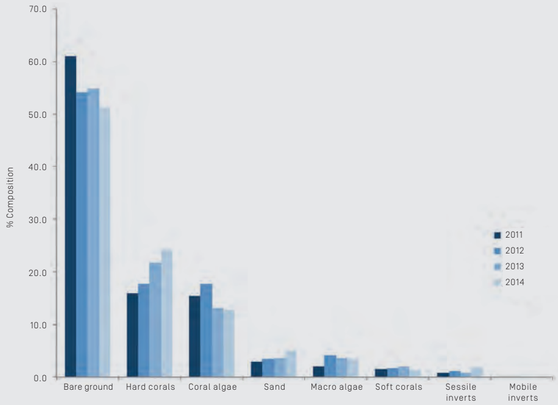


Figure 4: Benthic composition at D'Arros Island and St Joseph Atoll, 2011–2014.

2. COMMUNITY MONITORING OF NESTING SEA TURTLES AT D'ARROS ISLAND AND ST JOSEPH ATOLL

AUTHOR: DR JEANNE MORTIMER
PRINCIPAL INVESTIGATORS: SOSF–DRC
FIELD PERSONNEL: CHELONIA STAFF, DR JEANNE MORTIMER, SOSF–DRC STAFF

Sea turtles have long been of economic importance to the people of the Seychelles. Historically turtles were killed to extract products for export. Calipee from green turtles was used in Europe to make 'turtle soup' (an average 150-kilogram turtle yielded approximately 1.5 kilograms of the dried cartilage that goes into the soup) and the scales covering the shell of hawksbill turtles were removed to produce 'tortoiseshell', a semi-precious material originally exported to Europe and later (between 1960 and 1992) to Japan. In addition, turtle meat has always featured prominently in traditional Seychelles cuisine. In 1994 the Seychelles government passed a law that offered complete legal protection to all sea turtles and their eggs. The export trade ceased. But some human customs and habits die hard and many Seychellois retained a taste for turtle meat, especially among more traditional Seychellois people who live and work in the nation's Outer Islands.

Clearly there was a need to persuade people to see turtles in a different light. The best way to do that proved to be to encourage the coastal Seychellois to take ownership of conservation programmes involving sea turtles. The D'Arros Research Centre achieved this through its 'Community Monitoring of Nesting Sea Turtles' programme, which enlists Seychellois labourers who work on D'Arros Island to monitor the nesting beaches of D'Arros at the end of each day on a paid overtime basis. Once a week they go across to the more remote St Joseph Atoll and monitor nesting activity on the beaches there.

ACTIVITIES CONDUCTED IN 2014

During the year 2014, the 'Turtle Team' comprised the following Seychellois workers:

1. Michael Luc (conducted 317 track counts)
2. Nait-Flor Hettimer (conducted 184 track counts)
3. Ericson Rousseau (conducted 37 track counts)
4. George Jeremie (conducted 20 track counts)
5. Wills Labrosse (conducted four track counts)
6. Robin Rousseau (data compiler)

Figure 5 indicates the number of beach patrols (i.e. turtle track counts) conducted at each island in each month of 2014. An effort is made to monitor D'Arros Island daily and St Joseph, Banc Coco and Ressource islands weekly. In 2014, D'Arros was surveyed on 298 days and St Joseph Atoll was visited 32 times. The ideal schedule was occasionally disrupted by factors that included bad weather, problems with boats and engines, illness and groups of people visiting the island. Nevertheless, data collection was consistent enough throughout the year for missing data to be extrapolated to give reliable estimates of the numbers of turtle tracks made and egg clutches laid by each of the two turtle species.

An overview of the raw track count data (prior to extrapolation) for each species at each island is given in Table 1.

GENERAL OUTPUTS OF THE PROGRAMME SO FAR

In the process of monitoring, the part-time turtle workers developed a fondness for the living turtles and an appreciation of the need to protect them. Because they had developed a sense of ownership of the turtle conservation programme, they refused to tolerate any poaching of turtles by members of their own community and poaching ceased. None of the workers involved with the project were trained scientists, so the programme has reached members of the Seychellois community who might not otherwise have become involved in conservation.

In addition, most of the monitors came to love the work so much that some have worked on the programme for up to seven years. Two of them, after leaving D'Arros, became full-time conservation rangers on other islands in the Seychelles.

The turtle monitoring programme initiated in 2004 at D'Arros and St Joseph was the first such study to be implemented anywhere in the Amirantes Group. Over the years it has gathered valuable data that document many aspects of the status and biology of the turtle populations. These include:

1. What species of sea turtles occur? Two species nest at D'Arros and St Joseph: hawksbill turtle *Eretmochelys imbricata* and green turtle *Chelonia mydas*. We also know that juveniles of both species forage in near-shore waters.

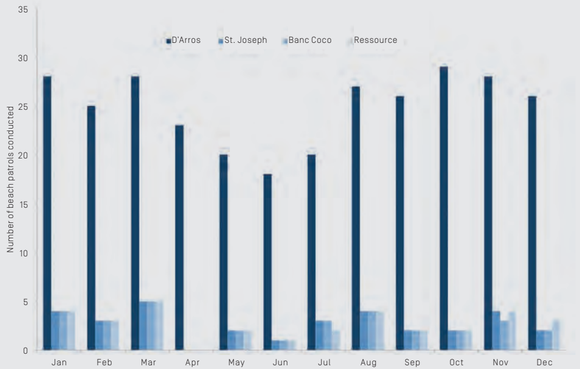


Figure 5: Number of turtle track counts conducted at D'Arros and St Joseph in 2014.

Table 1: Number of hawksbill and green turtle tracks and nests counted in 2014.

	HAWKSBILL TURTLES		GREEN TURTLES	
	Tracks	Nests	Tracks	Nests
D'Arros Island	668	310	255	141
St Joseph Atoll	174	105	484	341
Banc Coco	59	24	21	18
Ressource	85	39	1	0
TOTAL (Minimum)	**986**	**478**	**761**	**500**

Table 2: Estimated numbers of turtles nesting at D'Arros and St Joseph annually

	HAWKSBILL TURTLES	GREEN TURTLES
D'ARROS ISLAND	~ 100	~ 25
ST JOSEPH ATOLL	~ 175	~ 135
TOTAL	**~ 275**	**~ 160**

In addition, the turtle workers found a dead juvenile loggerhead turtle *Caretta caretta* washed ashore, which increased the list of known turtle species inhabiting the waters of D'Arros and St Joseph.

2. How many turtles nest each year? Based on the data collected, we estimate that about 100 hawksbill and 25 green turtles nest annually on D'Arros Island and about 176 and 135 respectively on St Joseph (table 2).

D'Arros Island and St Joseph Atoll, considered together as a single site, host the largest nesting population of hawksbill turtles anywhere in the Seychelles. This is important given that this species is listed as Critically Endangered by the IUCN (Mortimer and Donnelly 2008). The Seychelles as a whole hosts one of the four largest national populations of nesting hawksbills anywhere in the world.

3. Population trends The D'Arros and St Joseph turtle populations have been monitored since 2004 and for most of that time the number of turtles nesting from year to year has remained relatively constant. In recent years, however, the number has been growing, which is evidence that conservation efforts are producing increases in population size.

4. Nesting seasonality Hawksbill turtles throughout the Seychelles show a clear nesting season that peaks from mid-October to mid-January. The same seasonal pattern is evident at D'Arros and St Joseph. Green turtles are a different matter. The nesting seasonality of this species in the Western Indian Ocean has been documented as varying from one site to another with more northerly sites (near the equator) peaking in the austral winter and more southerly sites (away from the equator) peaking in the austral summer (Dalleau et al. 2012). One might expect all the green turtles nesting in the same island group (such as the Amirantes) to share the same pattern. To our great surprise, however, we found that green turtles nesting at D'Arros Island consistently show a different peak in activity (February to April; Mortimer et al. 2011) from those nesting at St Joseph Atoll (June to October; Mortimer et al. unpublished data) only two kilometres away. The reasons for this difference remain a mystery, but may be related to water temperatures.

> Figure 6:
Michael Luc and Nait-Flor Hettimer measuring a nesting hawksbill turtle at D'Arros Island.

> Figure 7:
A juvenile green turtle is released after capture.

5. Genetic characteristics Our monitoring programme has enabled us to collect genetic data from nesting hawksbill and green turtles. Although the genetic characteristics of hawksbill turtles appear to be relatively consistent at most nesting sites in the Seychelles (Phillips et al. 2014), we have found evidence that green turtles nesting in the Amirantes Group may be genetically distinct from those nesting in the Seychelles' southern islands (Bourjea et al. in review).

The D'Arros and St Joseph site has been recognised as one of the most important and unique for sea turtles in the Western Indian Ocean, given the relatively high numbers of both hawksbill and green turtles sharing the same nesting beaches. There is much more to learn.

3. GROWTH RATES AND POPULATION SIZE OF RESIDENT JUVENILE HAWKSBILL AND GREEN TURTLES AT D'ARROS ISLAND AND ST JOSEPH ATOLL

AUTHOR: DR RAINER VON BRANDIS
PRINCIPAL INVESTIGATORS: SOSF–DRC
FIELD PERSONNEL: SOSF–DRC STAFF, RESEARCH ASSISTANTS

The objective of this study is to gain a better understanding of the population numbers, demographics, growth rates and movements of juvenile foraging turtles at D'Arros and St Joseph. Both hawksbill and green turtles recruit into the neritic environment when they attain approximately 35 centimetres in carapace length and will remain there for 10 or more years (Diez and Van Dam 2002). Efforts to conserve foraging hawksbill populations are hindered by a lack of basic demographic and ecological information. Although the number of foraging population studies in the Atlantic Ocean is increasing, for the Western Indian Ocean fundamental data such as population demographics, habitat requirements, home range and movements of foraging hawksbill turtles are largely lacking.

D'Arros and St Joseph support a high density of juvenile foraging hawksbill and green turtles and provide a unique opportunity to study and monitor the populations of these endangered species. So far the study has focused more on hawksbills, even though they are less common in the area. The reason for this is that the species has suffered a global decline of more than 90% and is classified as Critically Endangered, albeit data deficient.

In 2014, 51 hawksbill and four green turtles were caught using predominantly the rodeo method, which entails leaping off the front of the boat and grasping turtles with your hands. This brings the total score of captures to 244 hawksbills and 34 greens since 2006. Several individuals have been recaptured on multiple occasions (as many as 10 times) and the maximum period between first and last captures is 10 years. We have learnt that hawksbill turtles at D'Arros and St Joseph grow extremely slowly – about one centimetre per year, which is significantly less than at other locations (between two and five centimetres is the norm). Since the density of foraging hawksbill turtles at D'Arros and St Joseph is one of the highest in the world, we suspect that this slow growth is a consequence of competition for food resources.

4. POPULATION STRUCTURE, RESIDENCY AND BEHAVIOUR OF REEF MANTAS ENCOUNTERED AROUND D'ARROS ISLAND AND ST JOSEPH ATOLL

AUTHOR: DR RAINER VON BRANDIS
PRINCIPAL INVESTIGATORS: SOSF–DRC STAFF, MANTA TRUST
FIELD PERSONNEL: SOSF–DRC STAFF, GUY STEVENS, RESEARCH ASSISTANTS

The SOSF–DRC undertakes regular surveys to establish the identity of mantas present around D'Arros Island. This information enables us to determine the population size and structure of mantas in our area and, to some extent, their residency and behaviour. We also use a stereo-video camera to measure mantas at cleaning stations in the hope of determining growth rates. In 2014 we conducted 16 boat surveys and 19 scuba-dive surveys at well-used cleaning stations and filmed 35 hours of remote underwater video footage at the same cleaning stations. During surveys we document the underside of as many mantas as possible. The pattern of spots and stripes is unique to each manta, much like fingerprints in humans. The photographs are then entered into the identikit database to determine whether the individuals are new to the area.

To date, 100 individuals have been identified, which means that the Amirantes manta population is probably the biggest in the Seychelles. Of these, 57 are adults (29 females, 28 males), 40 are juveniles (13 females, 22 males, five unknown) and three are unknown. Although mating behaviour has been observed, mantas visit D'Arros and St Joseph predominantly to feed on near-shore plankton aggregations and to visit the cleaning stations. So far, 17 individuals have been measured with the stereo-video system, of which the largest was 3.61 metres across and the smallest 2.37 metres.

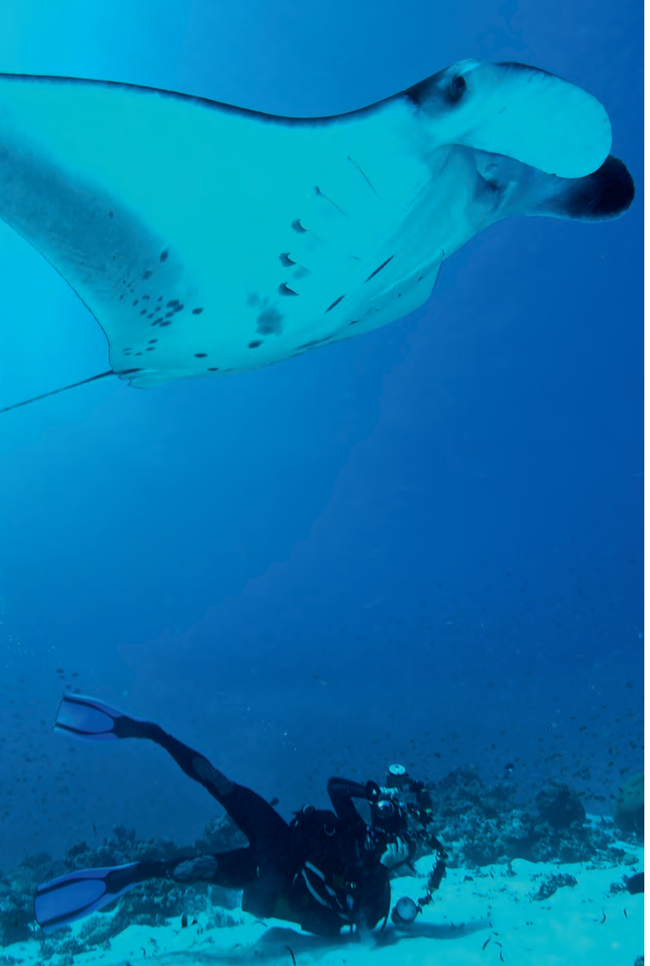


Figure 8: SOSF–DRC lab manager Chris Boyes swims under a manta to photograph its underside.

5. WEATHER

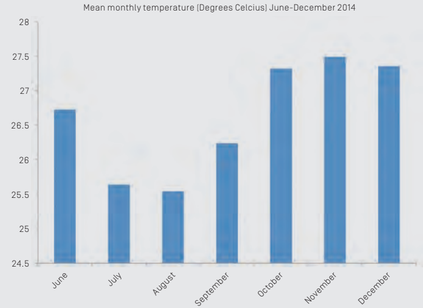
AUTHOR: DR RAINER VON BRANDIS
PRINCIPAL INVESTIGATORS: SOSF–DRC
FIELD PERSONNEL: SOSF–DRC STAFF

In May 2014, the SOSF–DRC installed a new weather station (Davis Vantage Pro2) on D'Arros that, in addition to the usual variables (temperature, rainfall, humidity, barometric pressure and wind speed and direction), records solar and UV radiation, both of which may play a significant role in coral bleaching. Because the station was installed in May, we only report monthly data collected from June to December 2014.

Mean monthly temperatures were in concordance with previous annual averages. The coldest and hottest temperature recorded on D'Arros were 22.2 °C (20 August) and 31.9 °C (26 December) respectively.

The summer rains arrived late this year, resulting in an uncharacteristically dry period from June to October (Figure 9). The highest amount of rainfall received in one day was on 14 November (72.2 millimetres), the day on which the drought finally broke.

Wind speed and direction were normal throughout the study period, with the fresh south-easterly dominating until November (Figure 10). Maximum wind speed was recorded in July at 51.5 kilometres per hour.



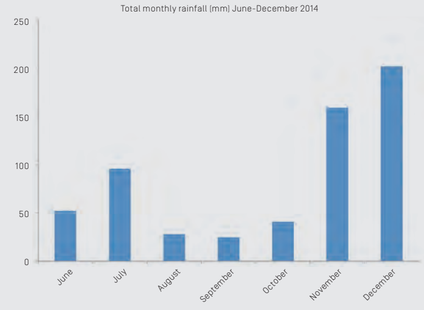


Figure 9: Mean monthly temperature and total monthly rainfall at D'Arros Island between June and December 2014.

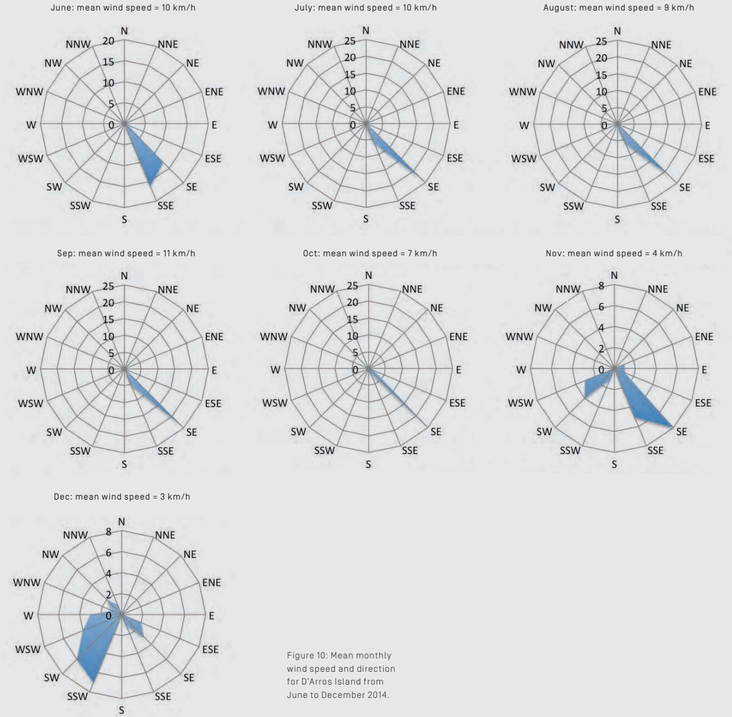


Figure 10: Mean monthly wind speed and direction for D'Arros Island from June to December 2014.

B. TARGETED RESEARCH PROJECTS

Figure 11: PhD candidate Chantel Elston's team catching a stingray in the St Joseph Atoll.

1. THE ECOLOGY OF STINGRAYS AT ST JOSEPH ATOLL, SEYCHELLES

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PRINCIPAL INVESTIGATORS: SOSF–DRC, SAIAB
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The amount of research into elasmobranch diversity, ecology and conservation has traditionally been low and many areas, such as the Indian Ocean, remain under-researched. There are three species of stingray that are ubiquitous and abundant at St Joseph Atoll: the cowtail ray *Pastinachus sephen*, the porcupine ray *Urogymnus asperrimus* and the mangrove whiptail *Himantura granulata*. Over the past two decades, stingray numbers in the atoll appear to have declined significantly for unknown reasons (Von Brandis *pers. comm*., Mortimer *pers. comm*.), mimicking global population declines. In order to manage these populations of rays effectively, information pertaining to their diets and their movement patterns is required.

Working out the feeding ecology of these three species is vital to conservation efforts and to understanding the ecosystem of St Joseph Atoll as a whole. Numerous references throughout scientific literature and in field guides state that mangrove, cowtail and porcupine rays eat bony fish and bottom-dwelling crustaceans (FishBase 2013), but detailed dietary analyses are lacking, with the exception of one study carried out in Australia on the porcupine ray (Vaudo and Heithaus 2011). Our objective is to determine key prey components in the diets of these rays and whether there is overlap between the species, indicating a high level of competition within the atoll.

In 2014 55 porcupine rays were caught by hand in the atoll and their stomach contents were collected by means of gastric lavage. Sediment samples were also collected to determine the composition of animals available as prey to these rays. We discovered that porcupine rays consume mostly annelid worms, but that small prawns and shrimps are also an important dietary item. From the sediment samples we determined that annelid worms are the most abundant prey source and as such are consumed with a moderate preference. Crustaceans were very rare in the sediment samples and we hypothesise that they are consumed with a very high preference. Further work will see the collection of stomach contents from mangrove and feathertail rays. We will also collect tissue samples for stable isotope analysis, which will provide insight into long-term shifts in the stingrays' diets.

An understanding of movement behaviour is also vital to developing a management strategy for stingray populations. Observations of the stingrays at St Joseph Atoll reveal that they are present on the shallow sand flats at high tide, but they retreat to the cooler lagoon or reef slope habitats at low tide, when parts of the sand flats are exposed and temperatures increase. Apart from these observations, their habitat use and movements have not been studied.

By using acoustic telemetry we hope to learn what the stingrays' main habitats are and whether the three species overlap spatially or occupy different habitats. We will also investigate whether their movements are affected by diet, tidal and seasonal influences, predation risks and competitive effects. Seventeen mangrove rays and 13 porcupine rays were surgically equipped with acoustic transmitter tags in March 2014. In partnership with Danah Divers, a group dedicated to diving for conservation, an extensive network of 90 acoustic receivers was already established within and around the atoll. The data from these receivers were downloaded at the end of 2014 and more than 200,000 pings were recorded from the two species. In-depth analysis of the data has yet to be performed.

Some of the acoustic tags that were placed in the larger individuals have a battery span that will run for the next two to five years, which will provide long-term data of their movement patterns. In 2015 we will tag three more mangrove rays, seven more porcupine rays and 20 feathertail rays (so that there are 20 of each species tagged). In addition, we will actively track smaller individuals to investigate movement patterns at a finer scale, as well as noting social interactions. We hypothesise that the atoll is an important nursery for these rays and we hope to provide evidence for this.

Trying to protect these species is vitally important as the porcupine ray is listed as Vulnerable, the mangrove ray is listed as Near Threatened and the feathertail ray is listed as Data Deficient by the IUCN. The information gathered by this research project will not only help to devise a management plan for the stingray population of St Joseph, but contribute to understanding and conserving these species throughout their wide-ranging distributions.

2. HABITAT AND RESOURCE PARTITIONING BY JUVENILE SHARKS AT ST JOSEPH ATOLL

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PRINCIPAL INVESTIGATORS: SOSF–DRC, CRIOBE
FIELD PERSONNEL: ORNELLA WEIDELI, SOSF–DRC STAFF, RESEARCH ASSISTANTS

Wherever species that are very alike ecologically and that have similar morphological traits and dietary preferences occur in the same place, it is expected that they will compete for habitat and dietary resources (Gause 1934). In order to avoid interfering with the other co-existing species, most animals show niche segregation either by using specific parts of their habitat or by foraging on different food resources (Brown and Wilson 1956). At St Joseph Atoll two very similar species, the blacktip reef shark *Carcharhinus melanopterus* and the sicklefin lemon shark *Negaprion acutidens* co-occur and have been found to use this habitat as their nursery ground. Both species give birth to live pups, which stay among the shallow reef flats of the atoll for their first years of life, finding both protection and an abundance of food.

By applying multi-faceted study methods, this project aims to understand whether the coexistence of these very similar shark species is based on a successful segregation of their use of habitats and resources. Baseline catch data will be employed to assess these two juvenile shark populations with a view to their future conservation.

A general work-up is conducted on each juvenile shark caught. The shark is measured, weighed and fitted with a PIT tag, its fins are photographed to aid identification if it is recaptured, a small sample is taken from a fin for DNA analysis, and the environmental conditions of the location are recorded. To test whether they use different habitats and resources, some of these juvenile sharks are actively tracked in their nursery ground and their diet is investigated by means of stomach eversion, gastric lavage and the stable isotope analysis of blood, plasma and fin samples.

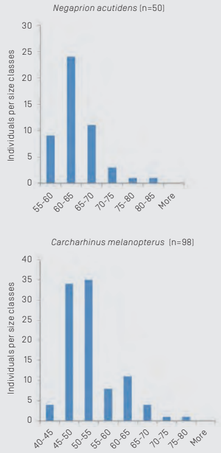
In the first sampling season, 148 sharks were caught in various locations at St Joseph Atoll. Nine of these sharks were caught twice and four were caught three times, suggesting a large population of juvenile sharks. Of the 148 sharks, 50 were lemon sharks and 98 were blacktip reef sharks; 73 were male and 75 were female. These preliminary results indicate a larger population of neonate blacktip sharks in the lagoon than lemon sharks, with a 1:1 sex ratio. Juvenile blacktip reef sharks ranged from 43.4 to 78 centimetres in total length, and juvenile lemon

sharks from 56.6 to 82 centimetres (Figure 13). These size ranges are similar to those from Aldabra Atoll (Stevens 1984), which lies 1,000 kilometres distant from St Joseph. Two-thirds of the juveniles had an open umbilical scar, which indicates that they were born two to three weeks before being caught and therefore that the pupping season may fall at about this time of year. This would also coincide with the Aldabra pupping season (Stevens 1984).

Of the 148 sharks, 10 were actively tracked for between six and 8.5 hours each to get an initial idea of potential segregation in their use of habitat. At the same time, environmental parameters such as depth (every five minutes) and temperature (every minute) were recorded. The first tracks revealed some interesting new insights into how big the habitat range of an individual shark is and how its behaviour changes in different tidal and temperature conditions (Figure 14).

Due to unforeseen logistical and methodological problems, the planned sampling of stomach contents by means of eversion has been postponed until the next field-work season between March and May 2015, when gastric lavage will also be used.

For the upcoming year, two field-work seasons are planned. The first will take place from the beginning of March to the beginning of May and the second from mid-September to mid-November 2015. The aims of both sampling seasons is to catch more juvenile sharks, categorise specific habitats, apply more active tracks with additional environmental patterns, and collect more blood and stomach samples to investigate their diet and potential dietary partitioning.



^ Figure 13: Size distributions of juvenile *Negaprion acutidens* and *Carcharhinus melanopterus* from St Joseph Atoll. Juvenile *N. acutidens* vary between 56.6 and 82 centimetres total length, with a mean of 64.4 centimetres. Open umbilical scars were found in neonates up to 73.3 centimetres, indicating considerable variance in size at birth (approximately 17 centimetres difference). Juvenile *C. melanopterus* vary between 43.4 and 78 centimetres total length, with a mean of 53.1 centimetres. Open umbilical scars were found in neonates up to 55.9 centimetres, indicating a smaller range of sizes at birth (approximately 13 centimetres).

< Figure 14: Three active tracks recorded in December 2014. (A) A juvenile female lemon shark caught at high tide in a shallow protected area moves towards the lagoon at low tide (circle). (B) A juvenile male lemon shark caught at outgoing tide in a shallow area moves to a deeper area at low tide (circle). (C) A juvenile male lemon shark caught at outgoing tide showed rapid movement towards Chien Island. At the start of low tide the shark moved shorter distances in very shallow water (circle).

Figure 12: Juvenile blacktip reef shark and sicklefin lemon shark captured at St Joseph Atoll (3).

3. POST-NESTING MIGRATIONS OF THE HAWKSBILL TURTLES OF D'ARROS ISLAND AND ST JOSEPH ATOLL, AMIRANTES BANK

AUTHOR: DR RAINER VON BRANDIS
PRINCIPAL INVESTIGATORS: SOSF–DRC
FIELD PERSONNEL: SOSF–DRC STAFF, DR JEANNE MORTIMER

Together, D'Arros Island and St Joseph Atoll host the largest number of nesting hawksbill turtles in the Seychelles, with an estimated 250–300 females nesting annually (Mortimer et al. 2011). Although significant resources have been allocated to protecting and studying these turtles while they nest at D'Arros and St Joseph, very little is known about their conservation status at the foraging grounds where they spend 85–95% of their adult lives. In fact, the location of these habitats is a mystery.

At present, satellite telemetry offers the only means of tracking long-distance movements of sea turtles. Satellite tracking of post-nesting hawksbills from beaches in the granitic islands has shown that, in most cases, the turtles migrate to offshore sites within the confines of the Seychelles Bank (<175 kilometres) (Mortimer and Balazs 2000). One turtle however, migrated to Madagascar (1,188 kilometres) (MCSS unpublished data).

The Amirantes Bank lies 200 kilometres south-west of the Seychelles Bank and is both smaller and more isolated. This raises the question whether female hawksbills nesting in the Amirantes show a similar tendency to use foraging grounds within the Seychelles territory, perhaps even within the confines of the Amirantes Bank, or whether they migrate further afield, perhaps as far as Madagascar (830 kilometres) or even the African mainland (1,500 kilometres).

Information about the location of foraging grounds and the routes taken to reach them are vital for informed protection of the species. Certain foraging grounds may be subject to offshore anthropogenic threats such as targeted fisheries or incidental capture as by-catch in fishing gear, as well as those related to shipping, pollution or seismic exploration and petroleum mining. The satellite tracking of seven post-nesting females from D'Arros and St Joseph – the most important breeding site in the Seychelles – should do much to improve our understanding of the life history of this critically endangered species and enhance its regional conservation status.

In the Seychelles, the hawksbill nesting season peaks from October to January (Mortimer et al. 2011), so we deployed the transmitters in January 2014 just before the females began their post-nesting migration. Although fewer nesting turtles were around so late in the season, we managed to deploy all seven transmitters in eight days (15–22 January). To find these turtles we circumnavigated the D'Arros beach roughly four times per day. When a turtle was located we waited for her to finish nesting and then confined her inside a mobile wooden enclosure. After the carapace was cleaned and prepared, a SPOT5 satellite tag (Wildlife Computers) was carefully epoxied to her back and after a minimum drying period of three hours, the turtle was released.

All seven turtles migrated to foraging grounds on the Seychelles Bank, 200 kilometres north-east of D'Arros and St Joseph (Figure 16). This is an encouraging result for hawksbill conservation in that the larger proportion of the sizable D'Arros and St Joseph nesting population appears to remain within the comparatively protected waters of the Seychelles. The Seychelles government and local NGOs have invested generously in the protection of turtles and their habitats and as a consequence the nation's territorial waters can be considered one of the safest for turtles in the Western Indian Ocean (especially on the Seychelles Bank, where foreign vessels are not permitted to fish). It is reassuring to know that the majority of these turtles do not migrate to other countries where they may be afforded less protection and that they do not undertake lengthy open-ocean migrations through a treacherous latticework of long-lines and trawl nets.

In terms of their detailed movements, straight-line distance from D'Arros to foraging grounds ranged between 135 and 366 kilometres and it took turtles between 33 and 80 days to reach their foraging grounds (Table 3). It appears that turtles 2 and 3 lost their way, having travelled 1,416 and 1,156 kilometres respectively.

Figure 15: A satellite-tagged hawksbill turtle (turtle 4) embarks on her voyage back to her foraging grounds on the Seychelles Bank after laying her final nest on the south-eastern beach of D'Arros Island.

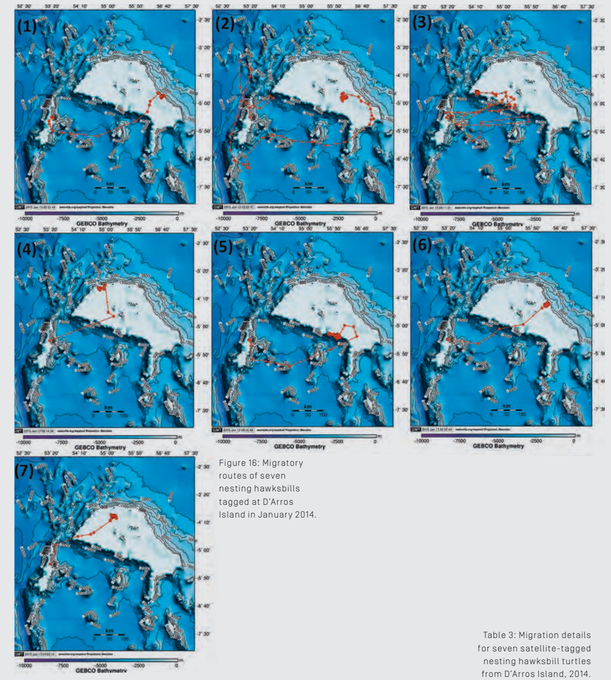


Figure 16: Migratory routes of seven nesting hawksbills tagged at D'Arros Island in January 2014.

Table 3: Migration details for seven satellite-tagged nesting hawksbill turtles from D'Arros Island, 2014.

TURTLE ID	Days travelled to reach foraging ground	Straight line distance (km)	Distance travelled (km)	Average speed (km/day)
1	42	366	440	10.5
2	44	286	1416	32.2
3	81	135	1159	14.3
4	30	236	348	11.6
5	39	261	543	13.9
6	33	351	365	11.1
7	40	231	257	5.4

4. MOVEMENTS OF JUVENILE HAWKSBILL TURTLES AT D'ARROS ISLAND AND ST JOSEPH ATOLL

AUTHOR: DR RAINER VON BRANDIS
PRINCIPAL INVESTIGATORS: SOSF–DRC
FIELD PERSONNEL: SOSF–DRC STAFF, RESEARCH ASSISTANTS

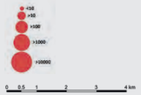
D'Arros Island and St Joseph Atoll support a dense population of juvenile foraging hawksbill turtles (up to nine turtles per hectare) that range between 25 and 70 centimetres in length (Von Brandis et al. 2010). Hawksbill hatchlings disperse from nesting beaches via oceanic currents and remain on the pelagic sea surface until they recruit into neritic habitats – such as D'Arros and St Joseph – at a carapace length of 25–35 centimetres (Diez and Van Dam 2002). Juveniles and adults generally do not share foraging grounds (Blumenthal et al. 2009), so our foraging population comprises exclusively juveniles. In comparison to other juvenile foraging sites, the area is unique in that hawksbills are afforded a greater variety of foraging habitats. Predominantly three neritic foraging habitat types are utilised by the turtles: sea-grass beds on the outer reef flat (0–2 metres), mud-flats on the inner reef flat (0–1 metre) and the deeper coral reefs (5–16 metres).

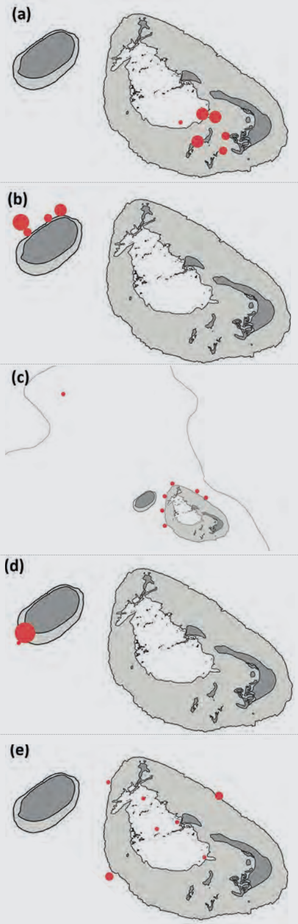
This project addresses recommendations arising from a recent PhD thesis titled 'The Foraging Ecology of Hawksbill Turtles at D'Arros Island, Republic of Seychelles'. Further investigation is required to determine the detailed movement behaviour of these critically endangered turtles for three reasons: it improves local management capacity; there is little information globally about the in-water behaviour of juvenile hawksbills; and the results will confirm the importance of D'Arros and St Joseph for this species.

Coded acoustic transmitters have been deployed before on hawksbill turtles to elucidate home range and habitat use (e.g. Blumenthal et al. 2009). However, because acoustic tags can only be attached externally, previous tag deployments have generally been short in duration (often not exceeding six months). During trials conducted on 10 turtles at St Joseph Atoll in 2013, we devised a superior attachment method that has improved tag retention significantly. Indeed, after 18 months all these tags still appear to be attached.

Currently, 25 tags have been deployed on turtles captured at various locations around the islands within the three dominant foraging habitat types listed above. To date, data suggest a variety of foraging strategies and home ranges (Figure 17). Nevertheless, 21 of the 25 turtles maintain very small home ranges within specific foraging habitats. For instance, turtles 5, 12 and 18 (see Figure 17) maintain small home ranges in the mudflats of the atoll, deeper coral reefs and the sea-grass beds respectively. Conversely, turtle 3 appears to make use of both the exterior and the interior of the lagoon, whereas turtle 23 makes more extensive use of the deeper reefs around the atoll. This turtle was last recorded at a receiver far out on the Amirantes Bank, 20 kilometres away from D'Arros. Similarly, turtle 16 was last recorded at a receiver near the eastern drop-off, five kilometres from the islands. The data suggest that these two turtles have left the islands in search of other foraging grounds. Given their small size (48- and 36-centimetre body length respectively), this is remarkable in that they appear to be embarking on developmental migration at a much earlier age than anticipated.

Figure 17: Acoustic ping data of five juvenile hawksbill turtles tagged at St Joseph Atoll.





> Figure 18: A manta photographed from the surface showing the external acoustic tag.

> Figure 19: Forest rehabilitation sites on D'Arros Island.

5. SPATIO-TEMPORAL MOVEMENTS OF MANTA RAYS IN THE AMIRANTES

AUTHOR: DR RAINER VON BRANDIS
PRINCIPAL INVESTIGATORS: SOSF–DRC, MANTA TRUST
FIELD PERSONNEL: SOSF–DRC STAFF, GUY STEVENS, RESEARCH ASSISTANTS

Reef mantas *Manta alfredi* of both sexes and all age groups occur year-round at D'Arros Island and St Joseph Atoll. Photo records of the undersides of mantas have been collected on an opportunistic basis since 2009 and show that no fewer than 100 individuals make use of the area. In 2012, a formal monitoring programme was implemented to study the population structure and general ecology of mantas in the area. However, the spatio-temporal movements of mantas encountered at D'Arros and St Joseph remain unknown. Although they appear to be most prevalent at D'Arros and St Joseph, mantas have also been encountered at other islands on the Amirantes Bank and along its drop-offs. It is thus possible that individual mantas range over the entire bank (and perhaps beyond), either randomly or, more likely, in response to certain environmental stimuli. In turn, a proportion of the population may show stronger site fidelity and thus remain within the protected realm of D'Arros and St Joseph for longer periods.

Although reef mantas are seldom targeted by fishermen in the Seychelles, an increasing international demand for gill plates and the imminent collapse of certain local fisheries raise concerns about the future. Classified as Vulnerable by the IUCN, the reef manta is long-lived, produces few offspring and is poorly understood and easily exploited. Understanding its spatio-temporal distribution is crucial for implementing effective marine protected area boundaries and management strategies.

Since 2013, we have deployed 23 acoustic tags on reef mantas around D'Arros and St Joseph in order to exploit the Amirantes-wide receiver array co-managed by Danah Divers and SOSF–DRC. However, because the tags are attached externally, tag retention has been poor (average 168 days) and currently fewer than eight tags remain attached. Of the 17 mantas that retained their tags for more than 100 days, eight were resident at D'Arros for most of this time while the remaining nine moved between the southern Amirantes islands of Desneoufs, Marie-Louise and Boudeuse. The preliminary data suggest that more mantas frequent D'Arros and St Joseph than any other island in the Amirantes Group, lending further support to the formal protection of D'Arros and St Joseph. In 2015 this project will be coordinated by a PhD student who will investigate improved tag application procedures and analyse the acoustic data in greater detail.

C. HABITAT RESTORATION

1. FOREST REHABILITATION

AUTHOR: DR RAINER VON BRANDIS
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FIELD PERSONNEL: SOSF–DRC STAFF, RESEARCH ASSISTANTS

Terrestrial ecosystems at D'Arros and St Joseph have suffered significantly at the hand of man. By the early 1800s native vegetation had been almost entirely replaced with coconut plantations and nearly all the mangroves had been cut down for timber. Fortunately, management intervention can significantly accelerate recovery in the terrestrial environment, in contrast to marine ecosystems. The D'Arros Research Centre currently manages an ambitious forest rehabilitation project in which abandoned coconut plantations are systematically replaced with indigenous forest.

In 2010, a series of experiments were initiated on D'Arros in which attempts were made to develop a simple, cost-effective and yet efficient technique of coconut forest rehabilitation (Von Brandis 2012). Although the primary aim of this research was to rehabilitate large sections of D'Arros, a secondary objective was to encourage the initiation of effective rehabilitation programmes on other affected islands. The resulting rehabilitation protocol was termed the 'canopy rehabilitation method' as it involved preserving the upper coconut canopy to provide a shaded environment on the forest floor. The benefits were threefold: improved survival and growth rates of planted native forest seedlings; reduced establishment of the herbaceous layer and other invasive plants; and enhanced natural regeneration of remnant native vegetation.

Once the native trees have formed a mid-level canopy of their own, the remaining coconut palms are gradually eliminated by injecting herbicide into their stems. Compared to clear-cutting, this method proves less labour-intensive, does not require the use of heavy machinery or expensive equipment, improves the survival and growth rates of planted tree seedlings, promotes the natural establishment of native plants and limits population explosions of alien invasive plants. Consequently a strategy for a large-scale programme was devised and implemented in May 2010.

Today, more than 16 hectares are currently under rehabilitation on D'Arros Island (Figure 19), of which about half can be considered rehabilitated. Average turnaround time from virgin coconut forest to self-sustaining broad-leaved forest is just four years, giving testament to the efficiency of the canopy rehabilitation method. The decision was made in 2014 to focus future rehabilitation efforts on the islands of St Joseph Atoll.

SOSF–DRC staff and visiting researchers have been making increasing use of the small outpost on St Joseph Island as an overnight location while working in the atoll. The outpost consists of derelict buildings from the coconut plantation era (the plantation was abandoned in the late 1970s), which house a rudimentary kitchen, toilet, shower, a rainwater catchment and two bedrooms. During 2014 we revamped these facilities considerably in an attempt to make them more habitable. The roof, windows and doors were replaced, new beds were built, the kitchen and toilet were improved, the rainwater catchment was rebuilt, a barbecue fireplace was built and a generator and solar panels were installed. However, our first task was to establish a new rehabilitation site around the outpost in order to open the area up to the breeze.

During the next few years we plan to increase the size of the new rehabilitation site on St Joseph Island and establish a broad-leaved tree nursery near the outpost. We also plan to begin rehabilitation work on some of the smaller atoll islands.

Figure 20: Planted mangrove seedlings taking root in the shallow intertidal regions of St Joseph Atoll.

2. MANGROVE REFORESTATION

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FIELD PERSONNEL: SOSF-DRC STAFF, RESEARCH ASSISTANTS

Mangroves are a vital component of healthy atoll ecosystems in that they significantly improve biodiversity and productivity. Specifically, they:

1. Provide nursery grounds for fish, rays, sharks, crabs and several invertebrates.
2. Provide leaf litter, a valuable food source for many animals.
3. Protect coastal environments from erosion.
4. Provide roosting and breeding habitat for several seabird species.
5. Provide suitable habitat for several fish, crab, mollusc and invertebrate species that would otherwise not be present in the atoll.

Although there is no historical record of the distribution and abundance of mangroves at St Joseph Atoll, they were almost certainly more abundant in the past. Mangroves were heavily exploited in Seychelles during the 1800s and 1900s for timber (the wood is resistant to termites). At one time more than 100 people lived on St Joseph Island and there is little doubt that mangroves were heavily depleted. Today only remnant stands of red mangrove *Rhyzophora mucronata* occur at Benjamin, Paul, Chien, Fouquet and St Joseph islands. Because these remnant stands are small (the largest is about 2,500 square metres), current forest expansion is slow.

Mangrove stands tend to gain momentum as they expand in size. Over time, increasing numbers of prop roots trap more silt and slow water flow, thus making conditions more suitable for saplings. In order to accelerate this expansion and create new stands in suitable areas, a mangrove reforestation programme was initiated in 2014. Through extensive trials we have designed a logistically feasible protocol that appears to be working well (Figure 20). Previous studies have shown that red mangroves can grow to more than two metres high in just seven years. Once these trees begin to bear fruit, the reforestation process should show exponential growth.

D. PUBLICATIONS

In 2014 the SOSF-DRC produced two scientific publications and one popular article, and presented one poster at a conference.

1. SOSF-DRC SCIENTIFIC PUBLICATIONS AND DISSERTATIONS

Ramos JA, Monticelli D, Engelhardt U, Von Brandis RG, Pedro P, Paiva V, Narty B. In review. Reproductive and foraging characteristics of Roseate Terns in two tropical colonies differing in local conditions.

Von Brandis RG. In press. Diet composition of hawksbill turtles in the Republic of Seychelles. *Western Indian Ocean Journal of Marine Science.*

Phillips KP, Mortimer JA, Joliffe KG, Jorgensen TH, Richardson DS. 2014. Molecular techniques reveal cryptic life history and demographic processes of a critically endangered marine turtle. *Journal of Experimental Marine Biology and Ecology* 455: 29–37.

2. SOSF-DRC CONFERENCE PRESENTATION

Elston C, Cowley P, Von Brandis R. 2014. The trophic ecology of the porcupine ray in a remote Indian Ocean Atoll. South African Marine Sciences Symposium 2014. Poster presentation.

3. SOSF-DRC POPULAR ARTICLE

Elston C. 2014. The importance of the overlooked: the story of stingrays. *Quest* 10(2).

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FEATURES

A SELECTION OF ARTICLES PUBLISHED IN THE *SAVE OUR SEAS* MAGAZINE DURING 2014 THAT RELATE TO EVENTS AND TIMELESS STORIES

HIGH-TECH CONSERVATION

MAHMOOD SHIVJI

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.

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.

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, inter-disciplinary 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 ground-breaking research found immediate application 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 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 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

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

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/*

LOSING THE TASTE FOR SHARK FIN SOUP?

SARAH FOWLER

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

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.

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?

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 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.

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

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.

THE POLITICS OF SHARK 'ATTACKS'

CHRISTOPHER NEFF

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

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

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:

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 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.

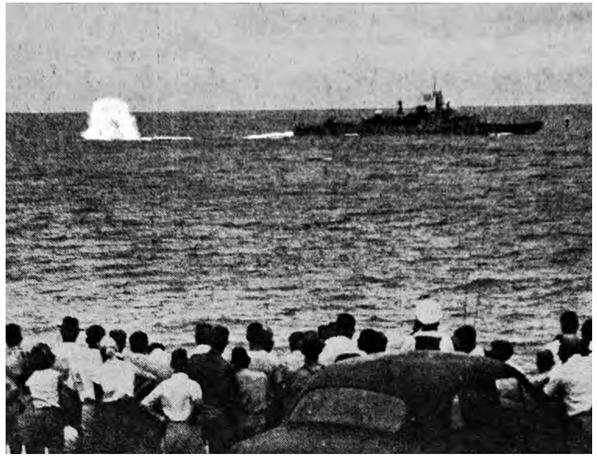
SPEAKING TO SCIENTISTS

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



< > 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.

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 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 animal 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 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.

A REFLECTION ON SHARKS INTERNATIONAL

SARAH FOWLER

In this age of digital communication, do conferences still play an important role in research and conservation? SOSF principal scientist Sarah Fowler thinks so, and she explains why.

Walking along the corridors during coffee breaks at Sharks International in Durban, June 2014, took me back in time. I don't mean just a few years to the first Sharks International conference in Cairns, Australia, in 2010, but all the way back to 1992 and 'Sharks Down Under' in Sydney. That was my first international shark conference. It was a huge eye-opener to a marine ecologist from the United Kingdom, where the subject of shark conservation was rarely mentioned and very few people even knew that there were sharks in British waters.

Although 22 years have passed since then, there were some striking similarities between the two meetings. In Sydney there was a whole symposium on shark-control programmes for bathing beaches (it reached the conclusion that once such programmes are introduced, local politics make it impossible to halt them – so don't start!). Early results of shark-tagging programmes were presented (using conventional visual tags, naturally) and there were talks warning of the vulnerability of shark species to overfishing, persecution and the threat posed by the steeply rising demand for fins in East Asia during the late 1980s. Most importantly, the delegates of almost a generation ago shared with those of today a contagious fascination and enthusiasm for, and dedication to, these animals.

In other respects, however, a great deal has changed in two decades (and I am not just referring to the grey hairs of the 'Sharks Down Under' delegates who attended the Durban and many other intervening meetings). Our knowledge of the biology, ecology, species and populations of sharks has undergone a step change during the intervening decades. So too has our awareness that their flatter cousins (skates, rays, guitarfishes and sawfishes) are just as important and many of them are even more seriously threatened.

Technology, too, has advanced at an astonishing rate. Some of the presentations during Sharks International left me open-mouthed in amazement at the huge strides in knowledge made possible by new technology, from acoustic and satellite tags to genetic analyses and novel methods for studying age and growth. No less remarkable is the ease with which such data can now be accessed. Are the stinky undergraduate dogfish dissections that I remember so well obsolete, now that the anatomical imagery presented by Gavin Naylor from the Chondrichthyes Tree of Life is available to all?

I suspect that the audience in Sydney more than two decades ago would have considered some of this year's papers to be highly elaborate practical jokes; science fiction carried to new heights of imagination. How could such tiny tags possibly record, archive and transmit such a huge range of movement and environmental data for such a long time? The first satellite tag used on basking sharks looked like a small lifeboat compared with today's salt cellar-sized instruments! Even these techniques pale in comparison with the power of stable isotope analysis of tiny tissue samples to tell us so much about a shark's lifetime of diet, habitat use and migrations.

And yet, there we were this year, absorbing new techniques, new ideas, new results – but still only scratching the surface of the scientific knowledge necessary if we are to rise to the challenge of securing the future conservation and management of shark and ray populations.

As a marine conservationist, I am sometimes challenged to explain how I can justify the air miles and fossil fuels consumed to bring scientists together at these conferences, when new technologies mean that face-to-face meetings are no longer necessary. Surely we could as easily gain this new knowledge by logging on to watch presentations online from our homes or workplaces at an hour convenient to our time zone? Or we could 'meet' just as effectively, and perhaps even more efficiently, in virtual chat rooms or video conferences?

Looking back over the past 20 years, can we estimate the extent to which advances in shark research and conservation have, at least in part, been generated by the collaboration and direct exchange of ideas between delegates at these meetings? That's a tough question to answer. After all, conferences only take place because many scientists have already generated interesting new research results for presentation, the essential prerequisite for such meetings. Furthermore, other scientific meetings dedicated to chondrichthyan research take place more frequently, including those of the American, Japanese, European, Brazilian and Oceania societies or associations, and they too stimulate the development and publication

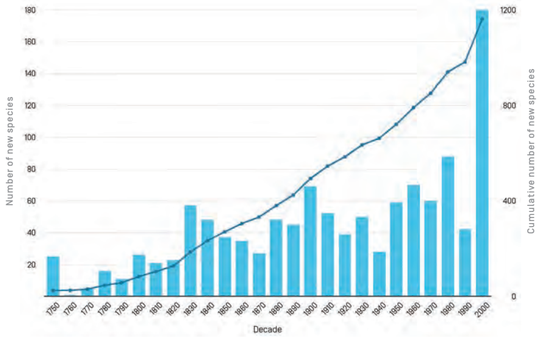


Figure 1: The number of currently recognised shark and ray species described in each decade since 1785 ( ) and the cumulative number of species ( ).
Source: White W.T. and Last P.R. 2012. A review of the taxonomy of chondrichthyan fishes: a modern perspective. *Journal of Fish Biology* 80: 901–917.

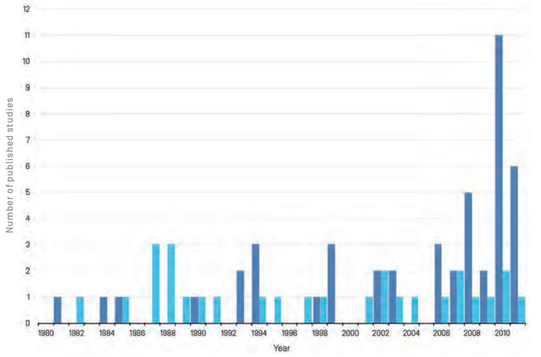


Figure 2: Recent publications on manta ( ) and mobula ( ) rays.
Source: Couturier et al. 2012. Biology, ecology and conservation of the *Mobulidae*. *Journal of Fish Biology* 80: 1075–1119.

of research within those regions. Nevertheless, I am convinced that the exponential rise in the number of scientific papers published annually since the early 1990s is due at least in part not only to the opportunities for collaboration that these major international meetings provide, but also to the contribution they make to building research capacity and encouraging engagement in conservation activity.

The rise in numbers of 'new' shark and ray species described by scientists since that first major meeting back in 1992 is also interesting. A quick look at Figure 1 shows how the relatively constant rate of species discoveries from 1758 makes a noticeable jump in the 2000s. This is primarily the result of major research efforts by Australian shark taxonomists describing a large number of recently discovered Australian endemics and subsequently other new species from the Indo-Pacific region. Some of these species descriptions are wholly 'home-grown' within the Australian research community and owe very little to international collaboration. Others, however, can be attributed to the joint initiatives of shark biologists from several countries, possibly inspired by the seeds of ideas planted during international meetings when scientists first met, face to face.

Another way to assess the direct contribution of such meetings to shark conservation and research is to consider particular taxonomic groups, such as those that have been the focus of research funded by the Save Our Seas Foundation (SOSF). In 2012, the SOSF funded an IUCN Shark Specialist Group project to develop a conservation plan for the largely forgotten and Critically Endangered sawfishes. It kicked off with a planning workshop at the Zoological Society of London that was attended by scientists from all over the world, many of whom had never met before. The same impact and degree of collaboration could never have been obtained without a face-to-face meeting. In a few years from now, when we review scientific papers about the sawfishes, I am sure that we will clearly see the results of this first sawfish meeting. They will be measurable not only in the form of increased research attention and output, but also in the methods employed to protect important species, such as including them in regional and international agreements and adding them to national protected species lists.

As another example, since its inception the SOSF has supported several long-term studies on manta rays and recently broadened its scope to include their smaller and poorly known relatives, the devil rays. Also known as mobulid rays, they are probably just as threatened as mantas – and just as interesting. A comparison of the numbers of papers published on manta rays and devil rays (Figure 2) shows a large increase in manta ray publications in recent years, whereas the more numerous species of devil rays have so far received scant attention. An SOSF call for proposals for devil ray projects has now stimulated new research into these animals in a number of regions, ranging from the eastern Mediterranean to Pakistan, the Philippines and Peru, and at the same time has provided, at a global level, the identification tools needed for these studies.

Most recently, immediately after the Sharks International conference, the SOSF funded an IUCN Shark Specialist Group conservation planning workshop

for manta and devil rays, similar to that convened a few years ago for sawfishes. Devil ray researchers who had never met before spent several days discussing and agreeing on conservation and management objectives, goals and actions for their species. I confidently predict that in a few years from now a review of the publications for manta and devil rays will show a significant increase in the number of research papers. And, as happened with sawfishes, there will be an increase in conservation and management initiatives aimed at improving the status of these poorly known animals.

Of course, virtual meetings can be very useful in many circumstances (particularly for those of us who already travel far too much and have grown to dread the journey to the airport), but they are not the same. I very much doubt whether the above success stories would have been possible if many key individuals had not been able to meet face to face.

Nothing is as effective and productive as getting away from our offices and laboratories every few years to meet old and new colleagues and exchange scientific findings and novel ideas, not just in presentation and poster sessions, but informally in coffee breaks, dining rooms, restaurants and bars. It is, literally, in the corridors and over coffee cups that researchers have the invaluable opportunity to swap, compare and generate new theories and ideas, discuss potential future collaborations and make or renew personal and professional friendships that will yield scientific dividends for years to come. It's also where students discover new mentors and realise that it's possible to meet and talk to their role models (and discover that they are ordinary people, just like them), thus setting them off on careers that will change their lives.

We are social animals and we need to meet socially every now and then if we are to create and reinforce the scientific communities that produce the amazing new results presented at Sharks International and other such gatherings. I believe that advances in research, conservation and management depend ultimately on individuals: getting to know one another and discovering common goals, then working together to achieve them. It is hugely gratifying to know that the SOSF, through its sponsorship of conferences and workshops, provides so many shark scientists with the opportunities to do just this.

LEARNING FROM EXPERIENCE

ELEANOR YELD HUTCHINGS

On the set of the South African television series *Shoreline*, Eleanor Yeld Hutchings shares her knowledge of Cape gannets.

Manager of the SOSF Shark Education Centre Eleanor Yeld Hutchings tells us about her colourful South African upbringing and why she chose to pursue a career dedicated to communicating marine science to the public.

I was born in Cape Town, into a family with ties to the sea on both sides. My father grew up in Fish Hoek on the False Bay coast near Cape Town, surfing, snorkelling and playing on the beaches. My mother hailed from KwaZulu-Natal on South Africa's east coast, with a family history of fishing and boating on the shores and estuaries of the Eastern Cape. For me this meant a childhood of holidays spent at various points along the coastline, from Fish Hoek beach in the west through Sandbaai (near Hermanus) and the Tsitsikamma National Park to Kenton-on-Sea in the east. I remember my first snorkelling experiences from the catwalk in Fish Hoek and learning early on how to catch small klipfish in rock pools, which creatures to avoid (spiny chitons and sea urchins) and how to bodysurf the waves. But it wasn't just about the sea; we were also very lucky to be taken around southern Africa by our parents, exploring nature reserves and game parks and being exposed to the terrestrial splendour of our country.

Despite this exposure to all things wild and wonderful, I did the usual flip-flops of children and adolescents as they contemplate what they want to be when they grow up. My choices were to be a figure-skater, a mathematician (that didn't last long!) or a paediatric psychologist. Then I wanted to be a writer, or maybe an illustrator. Eventually the lure of biology grew stronger and stronger and after finishing school and wandering around the world for a time, I ended up at the University of Cape Town enrolled for a degree in the life sciences. In my very first year, an inspirational lecturer stood up and started talking about parasitology. Bam! I was hooked – and on parasites, of all things.

My reaction stirred a memory of spending a holiday in Namibia when I was in my teens and meeting researchers there who were working on anthrax in wildebeest populations. This was the first inkling I had that a single incident of exposure to the natural world, be it formal or informal, can play a pivotal role in how you are inspired and where your life leads you. Although it may be difficult to look back and say that one specific event led to a career path in natural science, I am coming more and more to believe in the power of experiential learning, whether it is articulated as such or is no more than informal happenstance.

With my newfound focus I continued my studies, which included, almost incidentally, some marine ecology courses. For my BSc Honours degree I had my first opportunity to choose a real research project so, of course, parasites were at the top of my list. Any research on parasites would have done; I certainly didn't go looking for a marine focus, although I had both enjoyed and been interested in the marine courses offered at undergraduate level. But coincidences do happen and mine came in the guise of a postdoctoral research fellow who was working in the laboratory of one of the senior marine biology staff members. This researcher had just arrived and it turned out that his subject of study was nothing other than marine fish parasites! Even better, when I hopefully mentioned sharks (because, let's face it, there's no sexier marine subject matter!) he perked up and looked very interested.

Together we worked out a project that became my Honours thesis and formed the basis of what I went on to do for my doctoral research: the parasites of four endemic South African catshark species. It was a topic we were both passionately interested in and, at the same time, one that no-one else could understand the appeal of – at all! When asked, I tried to explain that most people are interested in sharks biting us; I, however, wanted to find out what bites sharks.

One of the results of my research was that over the next four years I spent a large amount of time diving, boating and fishing in and around False Bay. Through this I got to know a whole lot better an area that I had always taken for granted. I realised what an amazing and special place False Bay is and what a privilege it had been to grow up alongside it and now to be able to do my research there.

Like many other long-term graduate students, I needed to earn a living while completing my degree and this led me to what I think was the next pivotal point in how I got to where I am now. The job that I found was as the manager of a marine biology tour company. In addition to some staff, finances and marketing management, it involved a lot of tour-guiding along the Western Cape coast and most of the False Bay coastline (and for this I needed tour guide certification). Through the experience I gained taking group after group of tourists along the

In May 2009, a pod of 55 false killer whales (a species known for mass strandings) beached themselves on Long Beach, Kommetjie. A call for help was sent out and the response was both enormous and immediate, with members of the public, including Eleanor Yeld Hutchings, struggling for hours in an attempt to re-float the animals and return them to the sea.

shore, out onto the rocks, into harbours and occasionally out to sea, I learned how to communicate marine science to the public. I also discovered that this is something I am really, really interested in!

This led to my next step: I was invited to screen test for the role of marine biology presenter for the documentary series *Shoreline*, a journey of discovery around the South African coast from the border with Namibia in the west to the border with Mozambique in the east. Who could say no to such an invitation? Certainly not me! And, to my delight, I was offered the role. We have made two series so far, travelling the entire coastline twice and visiting incredible, beautiful, remote, scary and fascinating places. We've also publicised ground-breaking scientific research, and even won awards. My work with the series and my other science communication efforts were recognised earlier this year when I was presented with the 2014 Marine and Coastal Communicator Award by the South African Network for Coastal and Oceanic Research. My experience on the show taught me more than I ever thought I would know about our coastal ecology – and that this is the most important work we can do to further marine conservation in South Africa. Even this isn't enough, though; we need to direct our efforts at younger audiences and focus on education and spreading awareness of the value of the coastal environment.

Somewhere among all of this, I managed to finish my thesis, graduate and make my first move into the realm of formal marine conservation by taking a position with the South African branch of the Worldwide Fund for Nature (WWF-SA). The real appeal of this was that the project I had been appointed to run was an ecosystems-based management plan for a very special part of South Africa: False Bay, a place I know intimately and care about very much.

The process involved was an adaptation of something known as the Ecological Risk Assessment Framework, which takes people into account as part of the ecosystem, identifies the 'end goal' or vision, and then quantifies the risks that could prevent us from attaining that vision. It was a very interesting project and it brought me into contact with all kinds of stakeholders in False Bay and its surrounds. It also served to emphasise that if people have no awareness of our oceans and no basic understanding of marine conservation, the achievements of ambitious projects like this will be limited. This once again indicated to me the importance of education and how much we need it. It was at this point that I made the move to the Save Our Seas Shark Education Centre in Kalk Bay.

The opportunity provided by a place like this, with its unique location, dedicated staff and generous funding from the Save Our Seas Foundation, was one that I could not let pass, especially as it meant that I would be part of exactly what I see as the most important building block in saving the world's ocean ecosystems. So here I am, in the most beautiful location in the world.

I'm still finding my feet, but already I have seen the joy on a girl's face as she holds a sea urchin for the first time – and realises that not only does it not hurt her, but it moves and tickles, and becomes a character she can relate to. I have seen the excitement of a boy as he learns to snorkel for the first time, donning a wetsuit, weight-belt, mask and fins and beating me to the bottom of the pool to retrieve a weighted rubber goldfish. I have heard the gasp of a class of children as they watch a shark launch itself out of the water in pursuit of a seal. And I know that to be part of a team that is re-evaluating and revamping our role in environmental education, and giving children the opportunity to be educated about the sea through experiential learning, is the best place for me. After all, this is the embodiment of one of my favourite quotes of all time: Baba Dioum's 'In the end we will conserve only what we love; we will love only what we understand; and we will understand only what we have been taught.'

SPREADING THE SHARK LOVE

SONJA FORDHAM

A cowtail stingray in the Seychelles. Stingray coloration often reflects that of the sea floor, helping to camouflage the rays from predators.

While public opinion appears to be turning in favour of sharks, Sonja Fordham thinks it's time to draw attention to their lesser-known but equally threatened fellow chondrichthyans: the skates, rays and sawfishes of the oceans.

When was the last time you saw a protest outside a French restaurant serving *raie* (ray), a letter demanding the release of a captive stingray or a petition calling for an end to the cruel practice of 'winging' skates alive?

These days, thanks largely to the advent of social media, it seems the Internet is ablaze with concern about the mistreatment and mismanagement of sharks. This enthusiasm and public support is encouraging and vital, especially considering all the damage done in the 'only good shark is a dead shark' era, but it is becoming increasingly apparent that a broader view of these exceptionally vulnerable animals is appropriate – and, in fact, urgently needed.

Lately more than ever, I find myself reminding people that – in the contexts of biology and of international policy – the term 'shark' usually encompasses all the chondrichthyan fishes (that is, fishes with skeletons made of cartilage rather than bone), which include dogfishes, chimaeras and a wide variety of rays. Within this group, the chimaeras probably get the least love and dogfishes are subject to the most negative characterisations, but let us focus for the moment on the 'flat sharks', a wonderful array of cartilaginous species that encompasses skates, devil rays, mantas, sawfishes, guitarfishes and stingrays. These species share the inherent vulnerability of 'proper' sharks but perhaps not their charisma – and the consequences of this are deeply troubling.

From a conservation perspective, it is important to stress that rays are generally more threatened and less protected than sharks. In fact, five of the seven most threatened families of cartilaginous fish are made up of rays (and that's not even including the somewhat flattened angel sharks). These findings were presented earlier this year in the global Red List of Threatened Species™ paper presented by the International Union for Conservation of Nature (IUCN) Shark Specialist Group (SSG).

Of those threatened 'flat shark' families, the sawfishes are the most imperilled: all five species are classified as Endangered or Critically Endangered by the IUCN Red List. These exceptionally vulnerable shark-like rays have disappeared, practically unnoticed, from much of their former range and are assumed extinct in 21 countries where they used to be found. Indeed, the IUCN SSG has concluded that sawfishes are the world's most endangered marine fish. As a result, they are the subject of a new, first-ever IUCN SSG Global Conservation Strategy, made possible through the generous support of entities like the Save Our Seas Foundation.

Ten years after the initial proposal, the sawfishes were eventually listed under the Convention on International Trade in Endangered Species (CITES) in 2007; it took another six years to apply the global ban on international commercial trade to all sawfish species. While these were big and essential steps, trade is not the only threat to sawfishes. There is local demand for them and they are killed incidentally in fisheries targeting other species. They are also dependent on the health of their near-shore habitats. Yet only 16 of the roughly 90 countries where sawfishes occur have enacted national protective measures for them.

The good news is that there's a new proposal to list all sawfishes under Appendices I and II of the Convention on the Conservation of Migratory Species (CMS), an intergovernmental treaty. If agreed by the participating countries in November 2014, this initiative could prompt strict protection in key range states and provide a framework for implementing the IUCN's Global Conservation Strategy on a regional basis.

Also of great concern but lacking any global strategy or international treaty recognition are the guitarfishes. Killed incidentally by fisheries, landed for meat and prized for use in shark-fin soup, more than half of the guitarfish species are categorised by the IUCN as Threatened. Nevertheless, specific national protective measures are exceptionally scarce – and most of those that do exist appear to be poorly enforced.

Even more important commercially are the skates, whose conservation status is the focus of a relatively small group of dedicated interest groups, including the UK-based Shark Trust. In both the United States and the European Union, smaller skate species tend to be faring better under heavy fishing pressure than the larger-bodied ones. At least for now, the largest and most depleted species are mostly off limits, while other skates are managed rather loosely. This is due to

Spearnose skate

Bowmouth guitarfish

a lack of fine-scale information about the fisheries catches of individual species, since catches are usually aggregated across multiple species.

In the US, landings of skates dwarf those of large sharks, yet testimony from conservation advocates about the management of the nation's biggest skate fisheries (those of New England) has been rare. This is even as managers are lifting protection for the huge, famed barndoor skate, once thought to be heading towards extinction. Imagine the public outrage if a large portion of the US fishing quota for hammerhead or tiger sharks were allocated for bait in lobster fisheries. Yet this is the fate of most of the little skates caught in the US.

Of the skates landed in the US for human consumption, most are exported to Europe and Asia. Efforts are, however, being made to promote local demand for these and other 'trash fish', at the same time that opposition to the consumption of large sharks (fins and meat) appears to be gaining ground. The number of skates fished in the waters between Europe and North America is subject to a rare international fishing quota system that is administered by the Northwest Atlantic Fisheries Organization. Yet since its inception a decade ago, the overall catch limit has been set far in excess of scientific advice. During that time, similar regional bodies governing international tuna fisheries in other parts of the world have granted a number of large sharks fully prohibited status.

US fishing interests, particularly in the mid-Atlantic region, have made quite an effort to develop markets, both domestic and foreign, for cownose rays, which are taken mostly as by-catch in coastal fisheries. Not many elasmobranchs produce fewer young than this species; a female usually gives birth to just one pup per year. Yet, around 2007, various conservation-minded publications promoted cownose rays as seafood after a well-publicised (yet disputed) scientific paper claimed that cownose ray numbers had increased dramatically due to the depletion of large sharks and that the rays in turn were reducing the numbers of popular shellfish.

The fishing industry capitalised on the media attention, changed the cownose ray's name to the more palatable 'Chesapeake ray' and worked to convince people that eating the species would be good for them and the environment. Fishery managers in Virginia – the core of cownose ray promotion – have yet to seriously entertain requests from noted scientists for precautionary catch limits or to request technical advice for management. There are also no cownose ray limits in nearby Maryland, a state that has banned all possession and sale of the fins of large sharks.

On a brighter note, in the past few years the Save Our Seas Foundation has been instrumental in elevating public concern for the plight of manta rays. Arguably the most elegant and captivating of the rays, mantas have acquired relatively quickly a status comparable to that of many large, charismatic sharks, as well as a recent CITES listing. Just as importantly, mantas make excellent ambassadors for their kind and may open the door to a deeper appreciation of and better protection for other rays, from wedgefishes to pelagic stingrays.

The first case in point is devil rays. Although they have so far failed to attract the support needed for a CITES proposal, devil rays are slowly making their way to centre stage in the international policy arena, primarily because they face risks similar to those highlighted for closely related mantas: strong Chinese demand for gill plates, unregulated by-catch mortality and low reproductive rates. A proposal to list mantas and devil rays under CMS is being considered and, thanks to the Save Our Seas Foundation's support, the IUCN SSG has recently embarked on the development of a global conservation strategy for these species. Even fisheries managers are starting to take notice, at least in the eastern Pacific, where scientists have recommended specific techniques for maximising the survival of manta and devil rays taken as by-catch in the region's tuna purse-seine fisheries.

Five of the seven most threatened families of cartilaginous fish are made up of rays. This cowtail stingray is a member of the whiptail stingray family.

How you can help to spread the love

Although rays clearly do not enjoy the level of public fascination and concern afforded increasingly to big sharks, there has been progress on this front. Here are a few suggestions for how you can help the 'flat sharks':

- If you live in a country that is a member of the Convention on Migratory Species (CMS), urge officials of your environment ministry to support proposals to list sawfishes and manta and devil rays under the CMS appendices.
- Report any sighting of a sawfish – alive in the water or dead at a market – to the online International Sawfish Encounter Database.
- If you live in a warm-water coastal country, ask officials of your fishery ministry to establish measures for collecting data and safely releasing manta and devil rays caught in tuna fisheries.
- If you live in a cool-water coastal country, ask officials of your fishery ministry to work for science-based, international fishing limits for shared populations of skates.
- Spread the word and follow the conversation on social media via #RaysNeedLove2.
- Contact your government representatives as regularly as possible to express your support for precautionary local catch limits for skates and rays, protection for endangered species, conservation of critical habitats and research into population status.

PROJECT LEADER PROFILES

AN INTRODUCTION TO OUR NEW PROJECT LEADERS WHOSE PROJECTS WERE FUNDED DURING 2014

'I love learning something new every day. Each small step builds towards the big moments when I see something unique about the giant devil ray or can explain something about it that nobody understood before. The Save Our Seas Foundation is more like a colleague than a donor. Thanks to its generous support, I can spend one day surveying fish landing sites and the next using my computer to analyse the data I've collected.'

WHO I AM

My interest in aquatic organisms began at an early age as I lived on the eastern Mediterranean coast at Gaza and learned to love the ocean. The sea has been a happy place for me since I learned how to deal with strong waves at the age of 11. This was reinforced and became my focus when I was studying for my undergraduate and graduate degrees and my interest in marine and coastal studies developed. My PhD at the University of London fixed the course I would follow: to protect and conserve marine creatures and their habitats.

My current research on sharks and rays has become everything to me. As someone said recently, 'Mobula rays and Mohammed are busy thinking about each other all day.' Everywhere – at home, work and university – I never stop talking about mobula rays and what we should do to protect them in Gaza and let them enjoy their visit to the eastern Mediterranean in safety. I am enjoying this work and everyone knows it – my family, friends and the fishing communities I work with. This has given me tremendous support and encouragement.

WHERE I WORK

In Gaza Strip, Palestine, where I am based, the political situation and economic environment are extremely challenging and incredibly unstable. The Gaza Strip is a region that relies heavily on marine resources for its food. Fishermen are allowed to fish six to 12 nautical miles offshore and elasmobranch species are an important resource. There are currently about 3,500 fishers on more than 700 active vessels in the Gaza Strip, and another 2,500 people working in affiliation with the fishing industry. Recent restrictions imposed on Palestinian fishers have marginalised this sector and about 75% of fishers are now considered either poor (making a monthly income of between US$100 and US$190) or very poor (earning less than US$100 a month). This represents a sharp increase from 2008, when 50% were considered poor or very poor.

The coastal and marine environment of the Gaza Strip is facing serious anthropogenic threats that impact on the sustainability of natural resources and the health of ecosystems. Gaza, although small, contains a rapidly growing human population that has to rely on limited natural resources in a restricted area. The physical isolation of Gaza and environment management systems that are poorly developed have resulted in serious problems relating to the pollution of the coastal zone and offshore waters, the deterioration of natural resources and habitats, and a decrease in fish resources. The fisheries and tourism sectors are hit hardest by these impacts.

The giant devil ray *Mobula mobular*, which is endemic to the Mediterranean, was classified as Endangered on the IUCN Red List of Threatened Species™ in 2006 and has been protected under Annex II of the Barcelona Convention since 2001. Despite these two important international listings, local fishers in Palestine remain unaware of the species' conservation status and in 2013 they began to target giant devil rays, catching several hundred individuals.

My work focuses on the conservation of this threatened species and through targeted research and monitoring it will quickly and directly increase our knowledge of the giant devil ray, as well as other elasmobranch species of particular conservation interest.

MOHAMMED ABUDAYA

ASSESSMENT OF THE GAZA FISHERY OF THE GIANT DEVIL RAY (*MOBULA MOBULAR*)
AL-AZHAR UNIVERSITY, INSTITUTE OF WATER AND ENVIRONMENT
2014
GAZA, PALESTINE
RESEARCH, CONSERVATION
GIANT DEVIL RAYS (*MOBULA* SPP)

As part of the monitoring and survey programme, an outreach initiative aimed at fishers, consumers and processors will use various media channels to educate them about the status of this species and its conservation needs.

WHAT I DO

This project aims to assess the extent of the mobulid and elasmobranch fisheries in Gaza and promote conservation through community involvement. The lack of official, or even accurate, data on elasmobranch fisheries in Gaza hampers effective assessments of the status of elasmobranch populations in the eastern Mediterranean. In particular, the large fishing operations that target the giant devil ray in this region probably limit the ability of its populations to recover from an already depleted state. Considering its conservation status, the species may become extinct if no regulations relating to its protection in the Mediterranean are implemented in Gaza.

In addition, there is no information about the species composition of the elasmobranch fisheries and it is likely that other threatened species are being caught. This project will provide much-needed baseline information on past and current fishing activities in Gaza. More specifically, it will provide biological and fisheries data on the giant devil ray and other elasmobranchs; it will identify the main fishing methods used and when and where fishing boats are active; and it will raise awareness about conservation and provide education about marine ecology to the fishing community.

To achieve these objectives, we will monitor landing sites and fish markets in Gaza and survey the routines of many active fishermen, as well as collect information about fisheries catches in the past. We will also organise public events aimed at informing local communities about the marine environment and species conservation issues. Daniel Fernando and Giuseppe Notarbartolo Di Sciara from The Manta Trust have supervised the training of researchers and the collection of data from field surveys.

The results derived from this project will help to provide enforceable management that will prohibit the targeted fishery for the giant devil ray and to evaluate the impact of Gaza fisheries on other elasmobranch species. Data will be presented in peer-reviewed publications and scientific reports that will be transmitted to decision makers. Results from this project will also be used to inform the local community about the state of fishing resources in Gaza and the Mediterranean and raise conservation awareness.

I hope you get as much pleasure from reading about our work as we get from doing it.

WHO I AM

According to my mother, the first time I saw the sea I froze in awe and cried 'Too much water, Mom! Too much water!' I was two years old, city-born, and we were on the shore of the Gulf of Mexico, in that country's Veracruz state. As she took me into the waves I began to cry. But all that changed when I was eight and had the opportunity to live by the same sea for a whole year. I fell in love with the ocean and used to daydream about being a scuba diver with my cousin Juan, while we played by the sea with toy submarines, divers and sea creatures. Sharks were always the biggest thrill, majestic, mysterious and, in a child's mind, mortally dangerous. It wasn't until I was about 11 that I saw my first real shark in an aquarium in San Diego. Sharks remained fascinating to me throughout my studies in marine biology at the Autonomous University of Baja California in Ensenada. However, I never thought it would be possible to become a shark scientist.

But life has lots of surprises. For my first job after graduation I was charged with generating the basic information needed for the sustainable management of the shark fishery of Yucatán – the defining moment of my career! Although I knew basically nothing about sharks, I immediately fell in love with them and spent nearly five years teaching myself all I could about shark biology, ecology and fisheries.

Now, 30 years, an MSc and a PhD later, I have become a shark expert. My passion for sharks and rays has taken me around the globe conducting field research projects, attending science, management and conservation meetings, acting as a consultant and providing training courses. Perhaps most rewarding of all was working with live great white sharks. I was responsible for initiating research into the migrations and movements of great white sharks in South Africa and New Zealand, in collaboration with local scientists and government organisations. During this time I made the greatest discovery of my career: we tagged 'Nicole', a female great white shark that travelled from South Africa to Australia in the first recorded transoceanic return migration for any shark species. Interestingly, that's when I met my friend and the Save Our Seas Foundation's current CEO Michael Scholl, who collaborated with us in the project and whose own research was instrumental in completing the cycle of Nicole's return migration.

Although learning about this misunderstood, threatened and fantastically imposing fish was the highlight of my career, I have also worked in elasmobranch taxonomy and identification, fisheries data and assessment training, ecology and fisheries modelling, conservation and management.

WHERE I WORK

I have been lucky enough to work with sharks and rays while living in nine different countries (talk about a gypsy lifestyle!). However, my current gig has me dividing my time between Brazil and my native Mexico.

Our main study site in Brazil is an amazing, remote and inhospitable place of great beauty. The Archipelago of St Paul and St Peter sits right on top of the Mid-Atlantic Ridge, almost halfway between the easternmost tip of Brazil and West Africa – literally in the middle of nowhere! This equatorial rocky

RAMÓN BONFIL

outcrop hosts a great diversity of marine life: dolphins, whales, tunas and jacks, billfishes, sharks and at least two, if not three, species of devil rays (*Mobula tarapacana* and *M. thurstoni*) and one of manta ray (*Manta birostris*).

The islets' barely 15,000-square-metre jagged surface of pure volcanic rock offers no easy footing for walking around and no protection from wind or sun. There is no fresh water and we have to bring every single piece of life-support and research equipment and all our food and water on a gruelling three-day boat trip from the Brazilian port of Natal. But the research station and accommodation built here by the navy has incredible facilities, including electricity, satellite phone and of course Internet (slow and iffy, but Internet nonetheless!).

With its abundant and pristine marine wildlife, this is a unique place for research – and adventure. Just a few metres from the shoreline, the sea floor drops to a depth of more than 4,000 metres. There are numerous pelagic species, including marine turtles, which are a common sight around the islets and in the inlet, the archipelago's only shallow section. Working here and studying the majestic devil rays is truly a thrill and a privilege!

Our Mexican field site is another fabulous place: the Whale Shark Biosphere Reserve at the edge of the Gulf of Mexico/Caribbean transition zone, just off the north-eastern coast of the Yucatán Peninsula. Every summer, this very special place hosts the largest known aggregation of whale sharks in the world. Because of this it also attracts large numbers of eco-tourists – and they in turn bring additional threats to the ecosystem. The area is also known for its great biodiversity, which includes marine mammals, manta rays, devil rays, spotted eagle rays, various shark species, rock lobster, shrimp, four marine turtle species, many seabird species and large schools of sardines and anchovies, as well as hundreds of species of reef, pelagic and bottom fishes, and echinoderms, polychaetes and other marine invertebrates.

WHAT I DO

Our project combines ecological and biological research with conservation efforts. We are hoping to unveil the mysteries of devil rays: how they use different parts of the ocean and where they migrate to. We also compare the behaviour of ray species in each site and contribute to a global study led by the Manta Trust into the number of species, the relationships between different populations of devil and manta rays, and how these are exploited to supply the trade in their gill plates.

In recent years, the belief has arisen in China and eastern Asian countries that manta and devil ray gill plates possess magical powers to cure all kinds of human ailments. The trade driven by this dubious 'traditional Chinese medicine' is fuelling a huge increase in the fishing of these beautiful marine giants around the world. Brazil and Mexico have passed legislation protecting all manta and devil rays from fishing, but there are many other countries that have not joined this important conservation movement. We need to gather enough scientific evidence to convince these countries, as well as international conventions that regulate trade (such as CITES) and exploitation, that all manta and devil rays should be protected with as many types of legislation as are needed. This is why it is crucially important for their conservation that we discover where the rays go during each phase of their life cycle; how many species there are and how to recognise them; and where and which populations of each species are being over-exploited.

During our field trips we deploy cutting-edge electronic satellite tags that measure depth, water temperature and light levels every few seconds. The information from the tags is relayed to us via satellites, enabling us to follow the movements of each individual ray for several months at a time. Both difficult and exhilarating, tagging the devil rays involves free diving with them in order to attach the tags to their backs by means of small darts. The tags detach automatically after a pre-programmed period and relay the information to our laptops at home. During our field trips we also try to measure and sex each individual and obtain small samples of its muscle and skin. These samples will enable us to conduct population genetic and taxonomic studies that are essential for mapping how many different species exist, their physical differences and which populations are being exploited for the gill-plate trade.

As I go to sea during each expedition, I am always filled with joy and awe at the spectacle of swimming alongside these beautiful 'flying' sea creatures. I truly hope that with the combined efforts of everyone, we will preserve them for future generations to admire.

CONSERVATION AND ECOLOGICAL RESEARCH OF MOBULA RAYS IN BRAZIL AND MEXICO
UNIVERSIDADE FEDERAL RURAL DE PERNAMBUCO
2014
ARCHIPELAGO OF ST PAUL AND ST PETER, BRAZIL
YUCATAN, MEXICO
RESEARCH, CONSERVATION
DEVIL RAYS (*MOBULA* SPP)

WHO I AM

After completing a degree in nature conservation in Pretoria, South Africa, I spent the first part of my career in the African bushveld, where I studied the movements of white rhinos, conducted anti-poaching patrols and guided on safaris. Several years later I took a temporary job as a botanical guide at Rocktail Bay on the northern coast of South Africa. During my first encounter with a nesting turtle on the beach, I was so inspired by these vulnerable creatures that I sensed a major fork in my career path. Soon I became hopelessly addicted to the ocean and spent all my spare time getting to know it.

After hastily completing my honours degree, I returned to Rocktail as a turtle researcher and stayed there for nearly two years. My persistent hunger for adventure eventually won me a four-month voluntary position at Aldabra, a remote, untouched coral atoll teeming with turtles and other marine life. I loved it so much out there that I ended up staying for five years, working as the chief scientific officer.

In 2006 I was offered an opportunity to conduct my PhD on the foraging ecology of the Critically Endangered hawksbill turtle at D'Arros Island and St Joseph Atoll in the Amirantes, a group of islands and atolls in the Seychelles. I spent the next five years following turtles around underwater and gaining an intimate understanding of the area and its surroundings. In 2011 I completed my PhD and took up the position of scientific director of the D'Arros Research Centre.

WHERE I WORK

The natural environment of D'Arros Island and St Joseph Atoll is among the most pristine and spectacular in the world. Scores of sharks, manta rays, turtles, stingrays and fishes inhabit the lagoon and the surrounding coral reefs, while flocks of seabirds roost in trees overlooking tranquil beaches. The D'Arros Research Centre, where we are based, is situated on the beach crest of D'Arros Island and overlooks the ocean. We often spot turtles, mantas, sharks and dolphins from our office! Just this morning, while we were preparing some research equipment, a hawksbill turtle emerged from the sea and nested right in front of the centre. As we watched it, a train of several manta rays passed by just 50 metres out to sea.

Although it's the largest of the 17 islands that comprise the D'Arros and St Joseph chain, D'Arros is small enough that you can walk along its uninterrupted sandy beach and complete a circuit of the entire island in just two hours. About 30 people live here to maintain the infrastructure and conduct research, but all the remaining islands are uninhabited.

Daily activities from the centre are diverse and include regular scuba diving to monitor the coral reefs and download remote sensors, travelling on the boat to collect ID photos of manta rays and walking the beaches to tag turtles. We usually have several researchers, students and volunteers working on various projects and thus we enjoy a productive and pleasant atmosphere on the island.

WHAT I DO

Hawksbills are gentle, charismatic creatures whose global population has been decimated by more than 80% over the past century due to the demand for their shells (tortoiseshell actually comes from hawksbills). These Critically Endangered turtles spend most of their long adult lives at a particular foraging ground, where they maintain small home ranges and feed mostly on sponges. Every few years, however, females undertake epic oceanic migrations to nest on the same beaches that they themselves emerged from as hatchlings.

D'Arros and St Joseph are among the few places where the nesting population appears to be increasing because the private owners have protected the turtles since 1975. Indeed, ours is currently one of the biggest hawksbill rookeries in the Western Indian Ocean. Although significant resources have been allocated to protecting and studying these turtles while they nest at D'Arros and St Joseph, very little is

RAINER VON BRANDIS

MOVEMENTS OF JUVENILE HAWKSBILL TURTLES AT D'ARROS ISLAND AND ST JOSEPH ATOLL, SEYCHELLES

SOSF D'ARROS RESEARCH CENTRE

2014

D'ARROS ISLAND AND ST JOSEPH ATOLL, SEYCHELLES

RESEARCH

HAWKSBILL TURTLE (*ERETMOCHELYS IMBRICATA*)

known about their conservation status at the foraging grounds where they spend 85–95% of their adult lives. The reason is simple: the location of these habitats is still a mystery.

At present, satellite telemetry offers the only means to follow the long-distance movements of sea turtles. The tracking of post-nesting hawksbills from beaches of the granitic islands of the Seychelles Bank has shown that, in most cases, the turtles migrated to offshore sites within the confines of the same bank, less than 175 kilometres away. One turtle, however, migrated to Madagascar, covering a distance of 1,188 kilometres. The Amirantes Bank lies 200 kilometres south-west of the Seychelles Bank and is both smaller and more isolated. So, do female hawksbills nesting in the Amirantes show a similar tendency to use foraging grounds within Seychelles territory, perhaps even within the confines of the Amirantes Bank, or do they migrate further afield, perhaps as far as Madagascar (830 kilometres) or even the African mainland (1,500 kilometres)?

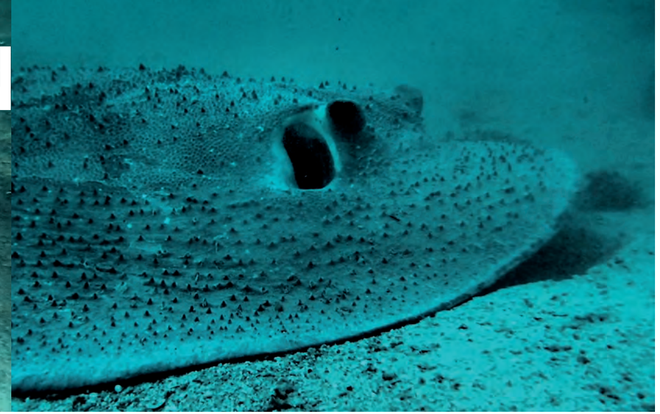
Information about the location of foraging grounds and the routes taken to reach them is vital for the effective protection of the species. At some foraging grounds the turtles may be the target of fisheries or be captured as by-catch in fishing gear, or they may face threats related to shipping, pollution or seismic exploration and petroleum mining. By tracking seven post-nesting females from D'Arros and St Joseph by satellite, we should learn much more about the life history of this Critically Endangered species and enhance its regional conservation status.

In the Seychelles, the hawksbill nesting season peaks between October and January, so we deployed the transmitters in January 2014 just before the females began their post-nesting migration. Although there were fewer nesting turtles around so late in the season, we managed to deploy all seven transmitters in eight days (15–22 January). To find these turtles, we circumnavigated the D'Arros beach roughly four times per day. Once we had located a turtle, we waited for her to finish nesting and then confined her inside a mobile wooden enclosure. We cleaned and prepared her carapace, then carefully glued a SPOT5 satellite tag (Wildlife Computers) to her back. After a minimum drying period of three hours, we released the turtle.

All seven turtles migrated to foraging grounds on the Seychelles Bank, 200 kilometres north-east of D'Arros and St Joseph. This is an encouraging result for hawksbill conservation because most of the sizable D'Arros and St Joseph nesting population appears to remain within the comparatively protected waters of the Seychelles. The government and local NGOs have invested generously in the protection of turtles and their habitats, and the nation's territorial waters can be considered one of the safest for turtles in the Western Indian Ocean (especially on the Seychelles Bank, where foreign vessels are not permitted to fish). It is reassuring to know that the majority of these turtles do not migrate to other countries, where they are likely to find less protection, and that they do not undertake lengthy open-ocean migrations through a treacherous latticework of long-lines and trawl nets.

In terms of their detailed movements, the straight-line distance from D'Arros to the foraging grounds ranged between 135 and 366 kilometres and it took the turtles between 33 and 80 days to reach their destinations. Interestingly, it appears that two turtles lost their way and travelled 1,416 and 1,156 kilometres respectively!

ANDREW CHIN



'The SOSF funding has enabled us to build a solid foundation for a future research project on stingray ecology. Now that we've worked at the One Tree Island site and tested our techniques, we can put together a realistic and detailed research bid to get a project going on these poorly known rays.'

WHO I AM

I have always had an affinity with the ocean. Even though I grew up in the urban jungle of Singapore, I could often be found in the school library reading dive magazines or books detailing the voyages of Jacques Cousteau and the *Calypso*. At home I kept fish tanks that contained anything from freshwater eels to archer fish. However, I clearly remember the exact moment when I decided that I'd spend my life working on the ocean. I was 12 years old, snorkelling off Pulau Tioman in Malaysia. I was completely absorbed in my first visit to a living coral reef when a small blacktip reef shark swam by. My immediate instinct wasn't fear but a deep sense of wonder, watching an animal so finely tuned to its environment that it glided by without a sound, like poetry in motion. I was hooked. It's fitting that, years later, blacktip reef sharks were the subject of my PhD thesis. When I came home to Australia after high school, I took every marine biology subject offered at university and saved up enough cash to go diving. A group of us started the university's first scuba-diving club, and by the time I was doing my PhD I joined up with a new group of colleagues and friends to found the Oceania Chondrichthyan Society, the first professional organisation for scientists and managers working on sharks and rays in the Oceania region.

Sharks often capture the public's interest but their close cousins, the rays, attract far less attention and are less well understood. Unfortunately, many of them are also in trouble. My years of working at the Great Barrier Reef Marine Park Authority taught me that sometimes the things – and species – we need to learn about in order to manage and conserve the ocean aren't always the most popular or iconic research topics. That's how the porcupine ray project began. This ray is both uncommon and unusual, and the loss of its habitat as a result of climate change makes it potentially one of the most threatened sharks and rays on the Great Barrier Reef.

WHERE I WORK

Hardly anything is known about the porcupine ray on the Great Barrier Reef, possibly because the species is apparently so uncommon here. A recent review found only 22 records of it in Australian museums and databases. The little information there was suggested that the species is uncommon in Australia and may only occur off shallow beaches and on coral reefs. Its rarity and dependence on certain habitats may make it vulnerable to environmental changes, such as the predicted impacts of climate change on the Great Barrier Reef. However, it's hard to be sure given that so little is known about it.

Working on uncommon species brings up several problems. To study the species, you first need to find it. As much as I would love to spend months diving on reefs hoping to find porcupine rays, this would cost far too much money and take far too long – real research just doesn't work like that. So we turned to the scuba-diving community and invited divers to take part in a citizen science project in which they could help the research team to find and photograph these rays. The results exceeded my expectations. We received notes and photographs from across northern Australia that more than doubled the number of existing records in the country. We received video footage of porcupine ray courtship, got photos from as far away as Papua New Guinea, and we extended the species' southern range by more than 100 kilometres. One of the best outcomes was that the results revealed two potential 'hotspots' on the Great Barrier Reef where porcupine rays were more regularly seen. Luckily, one of these hotspots was at One Tree Island, which just happens to have a research station on it!

The Save Our Seas Foundation (SOSF) gave us start-up funding as part of its Small Grants programme, which enabled the research team to get to One Tree Island and stay for a week to conduct a pilot study. We needed to see if we could reliably find porcupine rays and work out how to catch them for tagging and tracking studies. One Tree Island is a coral cay in the southern Great Barrier Reef. It is tiny, remote and has nothing on it except one research station and several thousand seabirds. The accommodation block has coral rubble floors and its walls are covered with names, signatures and drawings of all the researchers who've visited over the years. The station runs on solar power and rain water, yet has functional labs and decent WiFi – it really is paradise! There were only seven of us on the whole island, including the two station managers. It was the perfect spot to spend a week looking for rays and testing equipment, survey methods and working out capture techniques.

WHAT I DO

Unfortunately the weather was pretty bad during most of our time on One Tree Island and strong northerly winds and rough waves meant we were unable to use the large seine net we had brought with us. Nevertheless, we had success in other areas. Using snorkel and kayak surveys and baited remote underwater video stations (BRUVS), we found out where the porcupine rays seem to occur around the island. We also tested several ways to catch them. Unfortunately the rays we found were so large they wouldn't fit into any of the nets we had, so although all of us had our hands on a porcupine ray at one time or another, they were too large to restrain safely.

Although we were unable to tag a porcupine ray, the good news is that we collected more than 120 hours of video footage for analysis and we have worked out a new capture technique. The trip also raised a whole range of new questions: where do porcupine rays go at low tide? Do they travel between reefs? Where are the small animals, do they use different habitats? Do porcupine rays perform ecological functions for other species such as shaping habitats or providing foraging opportunities? We are now refining these questions and they will form the basis of a new research bid. This project will be real discovery science that also addresses key research priorities listed by managers of the Great Barrier Reef Marine Park. I'm excited about its future and hope you will stay in touch to see how things unfold!

EXPOSURE AND SENSITIVITY OF THE PORCUPINE RAY TO CLIMATE CHANGE AND CORAL REEF DEGRADATION
2014
ONE TREE ISLAND, GREAT BARRIER REEF, AUSTRALIA
RESEARCH, CONSERVATION, EDUCATION
PORCUPINE RAY (*UROGYMNUS ASPERRIMUS*)

PAUL CLERKIN

WHO I AM

I have loved sharks for as long as I can remember. I was raised on Discovery Channel's *Shark Week*, watching every show and memorising all the facts that I could. It's a dream come true that I've grown up to work directly with sharks and contribute to research about them. Working with and discovering species has been the focus of my life for the past four years.

I am a fourth-year San Jose State University graduate student of marine science at Moss Landing Marine Laboratories in California, with a focus on shark ecology at the Pacific Shark Research Center (PSRC). When I was aboard the fishing vessel *Will Watch* in the Southern Indian Ocean during my second semester of graduate school in 2012, I designed a comprehensive sampling protocol that enabled me to examine systematically the trawler's shark by-catch. The protocol subsequently received acclaim at a workshop that the United Nations Food and Agriculture Organization invited me to co-instruct.

Before studying at Moss Landing, I was deployed for several seasons aboard long-liners and trawlers in the Bering Sea by the National Marine Fisheries Service. As an undergraduate at Cornell University, I also participated in the Sea Education Association's Semester-at-Sea programme, conducting open-ocean research during a 4,800-kilometre voyage on a research/sailing-school vessel in the equatorial Pacific. All told, I have logged nearly 12 months of at-sea research.

WHERE I WORK

The Southern Indian Ocean has long been recognised as one of the world's last unexplored regions, where sea mounts and ridges slope steeply into its depths. Because of the difficulty and expense involved in surveying this area, very little scientific effort has been made so far to probe the sea mounts' highly productive ecosystems and, despite their rating as a hotspot of biodiversity and endemism, virtually nothing is known about their ecology.

Sharks are keystone predators, controlling fauna populations in the food web. Deep-sea elasmobranchs are known for their low fecundity and slow rate of reproduction. If they are overexploited, the vulnerable and unique ecosystems of the region's deep-sea sea mounts could be seriously affected.

The remoteness of the Southern Indian Ocean has meant that its depths have only recently become accessible, mostly to commercial deep-sea fisheries that are driven by an increasing demand for certain species of seafood. Just as our understanding of the sea mounts' ecosystems is still limited, so we know little about the impact that commercial fishing has on their population structure, community dynamics and predator–prey interactions.

WHAT I DO

I've been on two expeditions to the Southern Indian Ocean aboard the commercial trawler *Will Watch*, which was fishing for orange roughy and alfonsino. Both times the crew ventured more than 1,600 kilometres south of the island of Mauritius to fishing grounds near underwater sea mounts. My mission was to collect deep-water sharks taken incidentally as by-catch during the vessel's routine fishing operations and to examine these specimens systematically, recording biological data, photo-documenting the record, taking tissue and organ samples, and collecting intact specimens. When sharks were accidentally caught in the trawl nets the crew gave them to me to study, enabling me to make a contribution to scientific research. Any sharks


PAUL
PAUL

LAST FRONTIER OF SHARK DISCOVERY - UNEXPLORED SEAMOUNTS OF THE SOUTHERN INDIAN OCEAN

MOSS LANDING MARINE LABORATORIES

2014

SOUTHERN INDIAN OCEAN

RESEARCH

SHARKS

that came up alive were immediately returned to the ocean.

Both voyages proved successful and, in addition to discovering a dozen new species, I collected valuable data on other sharks that are rare and poorly known. My time at sea is very exciting, and I see a lot of amazing things that have never been seen before– like the live birth of a 1.3-metre false catshark.

My goal is not only to contribute to the scientific understanding of sharks, but also to educate the general public about sharks and the Southern Indian Ocean, the last frontier of ocean exploration and discovery.

I find it amazing that I can make a serious contribution to science. It's taken a lot of hard work to get where I am, as well as lots of help and luck, but I absolutely love what I do. People don't realise it, but we are living in a time of shark exploration. In this past decade, new shark species have been discovered at a higher rate than ever before in human history. They're out there. We just have to search for them.

LAUREN DE VOS

WHO I AM

For a girl born inland and raised on red African soil, it's a bit of a journey down to the sea. However, every day sees me fall a little more in love with our planet's wildest spaces – so it was almost inevitable that I would end up at that last great blue wilderness: the ocean. My research career to this point has been nothing if not eclectic – a good indication of my love of learning and my addiction to the outdoors!

When I moved to the coast for university, my first bumbling attempts at surfing and free diving unearthed a curious passion for the ocean, which had originated during childhood beach holidays and been carefully nurtured from a stash of surfing magazines hidden under my bed in my teenage attempt to 'learn the coastal lingo'. At some point during my undergraduate years, when I was fuelled by the passion of the researchers I encountered, the ocean captured my imagination.

So, after stints traipsing up the Cape Peninsula's mountains to study insects, wading through rivers for freshwater research, scaling termite mounds while studying in the Kruger National Park and learning not to run from charging baboons for my Honours degree, I was drawn back to the sea. Tackling my MSc in conservation biology opened my eyes to the need for sound scientific research to inform conservation decisions. By its end, I was determined to explore the variety of possible solutions to the conservation challenges our oceans face. And as far as office spaces go, the ocean is a pretty inspiring place to work in.

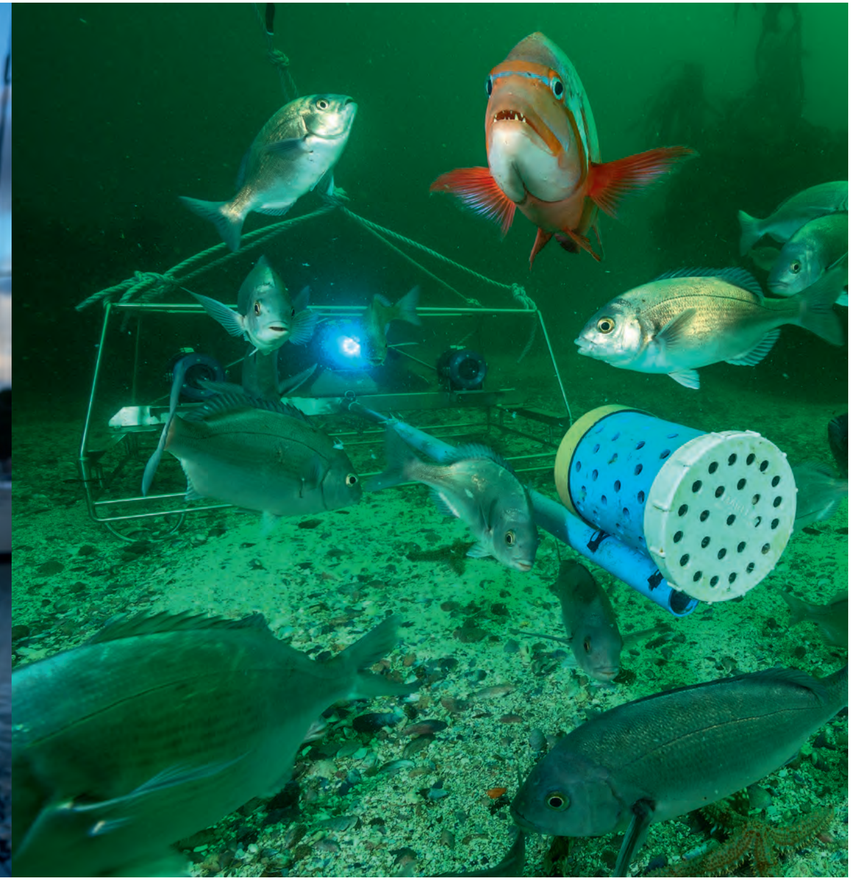
WHERE I WORK

The history of False Bay is long and colourful. The bay, near Cape Town on South Africa's south-western coast, is home to a myriad of ocean lovers, from surfers and divers to fishermen and the SA Navy. Many people who call it home have been intricately bound to its waters for centuries. Inevitably, our relationship with the ocean has consequences for the biodiversity in this region; indeed, commercial fishing has been recorded here from as early as the 1600s. As the urban population surrounding South Africa's largest true bay continues to grow exponentially in the 21st century, so too does the host of threats to the bay's biodiversity, from coastal development and pollution to overfishing and human–wildlife conflict. However, it's precisely at this intersection between False Bay's rich marine biodiversity and the humans who rely on the ecosystem services it provides that conservation-related research becomes interesting – and vital.

WHAT I DO

For the past two years I have been managing an SOSF-funded project to survey the diversity of fish life in False Bay using a baited remote underwater video system (BRUVS). During this period I unearthed yet more questions and, after spending a year hosting skills-sharing workshops with the MPA managers and rangers on this coastline to share our findings and experiences using BRUVS, I return to False Bay to pursue more answers.

I am currently registered for my PhD through the University of Cape Town and the South African Environmental Observation Network (Elwandle Node). My project aims to integrate the data obtained using low-impact, non-extractive camera monitoring into contemporary conservation planning for False Bay. Since a PhD is necessarily focused on the *philosophy*



OPTIMISING THE EFFECTIVENESS OF MARINE BIODIVERSITY MONITORING AND CONSERVATION PLANNING IN FALSE BAY, SOUTH AFRICA

UNIVERSITY OF CAPE TOWN

2014

FALSE BAY, WESTERN CAPE PROVINCE, SOUTH AFRICA

Research, Conservation

Chondrichthyans (sharks, rays & skates) and teleosts

behind the science we conduct, my real interest lies in thinking about just how we piece together rather complex ecological puzzles – and how we can do so, sustainably, for regions that are difficult to access and present challenging working conditions. My experience over the years using camera technology to put together a biodiversity picture of a region has particularly piqued my interest, and so I set myself the task of building a biodiversity map of False Bay using only remote cameras.

I am using a 'jump camera' rig fitted with a downward-facing GoPro camera to take still photographs of the sea floor and quantify the abundance and distribution of key benthic macro-invertebrates across False Bay. With stereo-BRUVS technology, I am gathering information on the seasonal distribution of fishes and extending my 2012 survey across the entire bay and to a depth of 90 metres. Finally, I am collating information on how humans are currently using the bay – focusing on activities that impact vulnerable reef fishes and sharks – to piece together an idea of where regions of overlap exist, in terms of both the exploitation and the sustainable use of biodiversity in False Bay.

CHANTEL ELSTON

WHO I AM

I'm one of those lucky people who have always known what I wanted to do in life. Even at the tender age of six, just as I was starting school, I knew I wanted to be a marine biologist when I grew up. I can't even remember who first told me what a marine biologist does, but I'm sure whoever it was did so because my passion for the ocean has always been obvious.

Perhaps this obsession with the big blue developed from my dad's love of sailing or from spending countless days at the beach all through my childhood while he volunteered for the National Sea Rescue Institute. My holidays were filled with exploring tidal pools, jumping from rock to rock and squinting into the shallow water in search of elusive starfish or sea anemones. My heart still skips a beat every time I see the shimmery blue surface of the ocean and even today one of my favourite pastimes involves peering into rocky crevices to find out what lurks beneath the waters.

After school I was fortunate enough to follow this passion by completing my undergraduate and honours studies in marine biology at the University of Cape Town and it was during these years that I was able to refine my enthusiasm – the ocean contains a wealth of information and at some stage or other you have to choose which aspect you want to focus on. My interest in rays and skates was sparked in my second year when we were going through an ichthyology module. I will always remember the lecturer telling us that rays and skates were the least studied group of vertebrates at that time. This got my curiosity ticking and ever since then I've wanted to learn more about these charismatic creatures.

WHERE I WORK

St Joseph Atoll is a beautiful gem that forms part of the Amirantes group of islands in the Seychelles. Its remote location in the Indian Ocean and its status as a marine protected area make it relatively inaccessible to the public – a near-pristine ecosystem devoid of many of the anthropogenic effects that plague most marine ecosystems.

The turquoise blue coloration of the 6- to 8-metre-deep lagoon changes to the lighter blue of the much shallower sand flats that, at only 30 centimetres to 1 metre deep, teem with a diverse array of life. Darting juvenile blacktip reef sharks, larger sicklefin lemon sharks with their characteristic fins, dozy hawksbill turtles breaking the surface for a breath of air, the gently swaying 'wings' of stingrays, the stark contrast of white fairy tern against blue sky – they all add up to St Joseph Atoll, a wonder to behold.

The beauty of the atoll makes it a great location to work in, and the abundance of stingrays and the generally calm sea conditions add to its allure. It's an ideal place to study these graceful creatures and how they live in this environment. Not only is the atoll an important and safe 'home' for the stingrays, but the stingrays are essential to its functioning. We hope to have a better understanding of this relationship by the end of the project.

WHAT I DO

I have come to realise that stingrays have been among the most overlooked and misunderstood species of the ocean. Much like sharks, they are perceived to be dangerous and should be avoided; unlike sharks, though, they have received very little scientific attention over the past couple of decades. Thankfully this situation is changing, as scientists begin to understand the importance of these animals in the

ecosystem. I am ecstatic to be part of a rising tide of contributors to our knowledge about stingrays.

The cowtail stingray, the porcupine ray and the mangrove whipray are three species that you can't avoid in St Joseph Atoll because there are so many of them. They are also species that the managers of the atoll know nothing about. Our project involves conducting a simple ecological survey of these stingrays within the atoll. Starting right at the beginning, we are currently collecting baseline information about them. Luckily, our field work is made possible by the presence on neighbouring D'Arros Island of a scientific research centre, which is funded by the Save Our Seas Foundation.

Traditionally, the scientific community has killed stingrays in order to collect the information needed. While this is sometimes necessary, we have made the decision to research and develop non-lethal methods to collect our data for this project, even though it is a bit more risky (a threatened stingray will try to jab you with its stinger!). This change in mindset from lethal to non-lethal methods is particularly important for stingrays because their slow growth, maturity and reproductive rates make them especially vulnerable to population declines. With this in mind, we trek across the shallow sand flats of the atoll to locate and catch the stingrays and then immobilise them by turning them upside down (while avoiding the barbed stingers on their tails!). We then pump their stomachs with sea water, forcing them to regurgitate their food, which enables us to determine what they eat. Finally, we surgically implant acoustic trackers into their abdomens so that we can follow their movements.

The information we collect will be vital to our understanding not only of the stingrays, but also how the entire atoll functions. Adding to the importance of the project is the fact that this knowledge can then be applied internationally, as the stingrays have wide-ranging distributions that span ocean basins.

THE ECOLOGY OF STINGRAYS IN THE ST JOSEPH ATOLL, SEYCHELLES
SOSF D'ARROS RESEARCH CENTRE
2014
ST JOSEPH ATOLL, SEYCHELLES
RESEARCH
MANGROVE STINGRAY (*HIMANTURA GRANULATA*)
COWTAIL STINGRAY (*PASTINACHUS SEPHEN*)
PORCUPINE STINGRAY (*UROGYMNUS ASPERRIMUS*)

CAT GORDON

WHO I AM

As conservation officer at the Shark Trust, I am mainly responsible for the Basking Shark Photo-ID and Great Eggcase Hunt projects, and I am project leader for the development of the Great Eggcase Hunt smartphone app.

My keen interest in nature and the environment surfaced at an early age; my favourite place was the Natural History Museum in London and I quickly became hooked on anything David Attenborough presented. However, it was only when I learned to scuba dive at the age of 14 that I truly fell in love with the ocean and its inhabitants. The realisation that it was a completely different world beneath the ocean surface was fascinating to me and I was eager to find out more. When it came to deciding upon a career, I jumped at the chance to study for a BSc in marine biology and coastal ecology at Plymouth University, followed by an MSc in conservation biology, with a view to working in marine conservation.

After graduating, I travelled and worked in various areas of conservation, including as a marine research officer on a remote island in Fiji, a dive master in Thailand and the warden of a Ramsar nature reserve in Spain. These opportunities gave me a more rounded understanding of how different ecosystems interact. Having previously volunteered at the Shark Trust, I joined full-time in 2010, and I have become a fan of the less charismatic species, such as skates. As well as organising outreach and educational events and working with the rest of the conservation team to develop campaigns, I am responsible for expanding the Great Eggcase Hunt and engaging new audiences. This led to the development of the dedicated smartphone app.

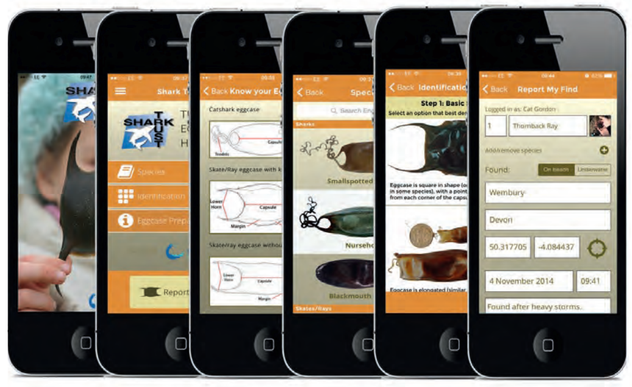
WHERE I WORK

Established by the Shark Trust in 2003, the Great Eggcase Hunt is a citizen-science recording project that aims to discover where oviparous elasmobranchs lay their eggs. As the composition of catches changed over the years and population numbers for the larger-bodied elasmobranch species declined, it became evident that we didn't fully appreciate the egg-laying phase and that it was necessary to improve our understanding of their life history strategy.

Shark conservation is often seen as something that can only be accessed by an elite few who can scuba dive in clear, tropical waters. The Great Eggcase Hunt provides a tangible link to the diverse world of elasmobranchs in the north-eastern Atlantic, making shark conservation accessible to a broader range of people who don't even need to get wet (except for the British weather!). Eggcases are washed up throughout the year, so hunting for them is a good excuse for a beach walk in winter and adds another dimension to a family holiday in summer. From casual dog walkers to participants in organised events, all our hunters have one thing in common: a curiosity and desire to learn more about their natural environment.

WHAT I DO

Oviparous elasmobranchs reproduce by laying their young in tough, leathery eggcases (also



GREAT EGGCASE HUNT SMARTPHONE APP
THE SHARK TRUST
2014
UNITED KINGDOM
CONSERVATION, EDUCATION
SHARKS

known as mermaid's purses), which are deposited on the sea floor or attached to seaweed. They remain there for several months while the embryo inside develops into a miniature skate or shark. Once the young animal has emerged, the empty eggcase often becomes dislodged and is washed ashore, where it can be found on the strandline. The eggcases of about 10 skate and two shark species can often be found on UK beaches. By looking at their size, shape and features, it is possible to identify which species they belong to.

Spent eggcases can provide an easily accessible source of information about the location of egg-laying populations and their potential nursery grounds. Once these critical areas have been identified, management measures can be proposed that could help to reverse species declines and enable us to support sustainable fisheries. In addition, the project provides an important platform to engage the public and raise awareness about the presence of elasmobranchs in British waters and the important role they play in the marine environment.

As both awareness of the Great Eggcase Hunt has grown and technology has advanced, more people are engaging with the project and it is growing bigger and better than ever. The dedicated smartphone app (available on Apple and Android devices) provides a wealth of information, including tips on how to hunt for eggcases, advice on how best to prepare eggcases for identification, an encyclopaedia of egg-laying species commonly encountered around the British Isles and a logbook for the user to keep track of their finds to date. The app encourages users to navigate through a step-by-step identification tool to discover what they have found, take photographs, record an accurate GPS location and subsequently upload their finds while *in situ*.

The Great Eggcase Hunt has helped to build a better picture of the relative abundance and broad distribution of skate and oviparous shark species around the UK, while also raising awareness about the diversity of elasmobranchs found in British waters. Although the app currently focuses on species found in the north-eastern Atlantic, eggcase hunting can take place all over the world. Records have been submitted from South Africa, Australia, USA, Israel and Malta to name just a few locations, and sister projects have been set up by organisations in France, Ireland and the Netherlands. The Shark Trust is collaborating with the Wildlife Conservation Society New York Seascape Program to engage the US public in the Great Eggcase Hunt and encourage them to search for eggcases on their nearby beaches. It is hoped that in time the app will expand to include additional species found in the north-western Atlantic.

DOVI KACEV

WHO I AM

Born in South Africa, I was fortunate enough to experience wild open spaces and amazing wildlife from an early age. When I moved to Southern California, I soon realised that the local open space and wildlife were all found in the Pacific Ocean. I became obsessed with the water, spending all my free time surfing and free diving, all the while learning about our amazing sea life.

I first started working with elasmobranchs as an undergraduate studying in Australia, where I was able to see firsthand the effects of human impacts on shark populations. Learning about how grey nurse sharks migrate across state and management boundaries helped me to realise how understanding population connectivity is vital for managing highly migratory species. Movement patterns of transient fish are difficult to study, so I became interested in both telemetry and population genetics. Telemetry enables scientists to look directly at animal movement by means of electronic tags. Genetics, on the other hand, tests for functional connectivity, as interbreeding leads to similar allele frequencies.

My PhD dissertation at San Diego State University focuses on understanding the population structure of shortfin mako sharks. Due to their reputation as good fighters that produce high-quality meat and their distribution around the world, makos are highly susceptible to fishing pressure. Through the use of both genetics and tagging, I aim to better inform management of this globally important species.

WHERE I WORK

I am a student in a joint programme in ecology between San Diego State University and the University of California, Davis, so I work in both Southern California and Northern California. As a collaborator with the Fisheries Genetics group at the Southwest Fisheries Science Center, I spend much of my time at a state-of-the-art research facility set on a hill overlooking La Jolla Shores Beach. Not only blessed with beautiful panoramic views and world-class sunsets, this location is convenient because of its proximity to amazing scientists at both the National Marine Fisheries Service and Scripps Institution of Oceanography.

The majority of my field work is conducted in the Southern California Bight. Every summer I participate in a survey for juvenile pelagic sharks. During this survey we spend two weeks offshore of Southern California, where we are away from the crazy city life and surrounded by ocean breezes and salty sea air. I am also fortunate enough to carry out field studies surveying fishing camps in Baja California, Mexico. During week-long voyages south of the border we spend time in isolated fishing communities on remote beaches. Despite being just a day's drive south of San Diego, Baja is certainly a world apart from the hustle and bustle of Southern California.

WHAT I DO

The life-history traits of many elasmobranch species make them vulnerable to human impacts such as fishing pressure and habitat degradation. At the same time, their marine way of life and often migratory nature can make them difficult to study. Molecular research has recently become more common, as technological and analytical advances have made it both less expensive to apply and more accessible to wildlife applications.

Population genetics is a powerful tool for understanding the ecology and dynamics of wild populations. If applied correctly, molecular techniques can inform management and conservation policy. In order for these tools to be most effective for elasmobranch populations, it is vital that researchers have a good understanding of what techniques are available and how to properly interpret their results.

Our workshop on molecular genetics (held in Chattanooga, Tennessee, immediately before the annual American Elasmobranch Society meeting) was conducted by current leaders in the field and helped to train students and interested ecologists in the correct use of molecular tools, as well as the best way to both interpret and communicate research results. We learned about current trends in population genetics as well as future directions. By engaging in an active dialogue, all workshop participants learned not only how to stay at the cutting edge of a rapidly expanding discipline, but also how to communicate their results clearly to a wide audience. The skills honed during this workshop are now being applied in labs around the country, furthering our understanding of shark and ray population ecology.

POPULATION GENETICS IN ELASMOBRANCHS: A WORKSHOP TO FURTHER THE FIELD
SAN DIEGO STATE UNIVERSITY
2014
CHATTANOOGA, TENNESSEE
RESEARCH
ELASMOBRANCHS

'This project wouldn't have been possible without the support of the Save Our Seas Foundation. With the funding provided by the SOSF, I have also presented these findings to every student enrolled in public school in Bimini.'

BRYAN KELLER

WHO I AM

I grew up in Tucson, Arizona, part of the Sonoran Desert. People often ask how a kid from the desert could become so interested in the ocean and quite frankly, it wouldn't have been possible without my parents. I remember taking many trips to California to visit beaches and aquariums, visits that crafted my appreciation for marine life. The animals we saw were all mesmerisingly beautiful, but I was far more intrigued by the mystery that surrounded them. Specifically, I remember watching a pufferfish swimming by itself in a fish tank and I could have sworn it was watching me through the glass. This experience ultimately shaped my desire to study animal cognition and behaviour.

Many years later I earned my BSc from the University of Arizona. Out of all my undergraduate experiences, I am most proud of reorganising the fish collection. There are more than 175,000 specimens in the collection and they were largely unorganised as recent developments in molecular biology had rearranged the phylogenies. For a research project I organised the room like a library. I felt like the stereotypical librarian who could locate any book within seconds, except I wasn't locating novels.

During my time at the University of Arizona I interned at the National Aquarium in Baltimore. This experience opened the door to the Bimini Biological Field Station, where I would spend the next three summers. The Shark Lab has greatly influenced my interest in shark research, whether it was helping Jean Finger study shark personality or swimming with a 14-foot tiger shark – my life was forever altered!

WHERE I WORK

My project, which served as my Master's thesis, was carried out at the Bimini Biological Field Station. Bimini is surrounded by the bluest water I have ever seen; it is easy to get lost staring at the picturesque scenery. Speaking of the landscape, it's impossible to get away from the ocean – it is everywhere! Bimini is so small that in certain areas I could throw a baseball right across the island, and I don't even have a good arm. The people at the Shark Lab are drawn to work on Bimini mainly for one reason: the sharks. Dr Samuel 'Doc' Gruber realised the ecologic value of this island and created the lab in 1990. Without his efforts, I wouldn't be doing what I am today. Doc has changed my life and the life of every volunteer who has walked through the doors of the Shark Lab.

Besides working on Bimini, I do a fair amount of research back in South Carolina where I attend Coastal Carolina University. The SOSF has supported my research here, which comprises conducting long-line surveys in Winyah Bay. Students of all ages, and their teachers, assist me with the field work and I hope that their experiences will increase their motivation to pursue a career in the life sciences. The goals of all my research are to advance scientific understanding, make a difference when policy is being decided, and spread awareness through society by means of a high level of communal involvement.

WHAT I DO

The possibility of determining what factors influence animal behaviour intrigues me and

FAMILIARITY IN LEMON SHARKS: RESHAPING SOCIETAL VIEWS OF A KEYSTONE TAXONOMIC GROUP

BIMINI BIOLOGICAL FIELD STATION

2014

BIMINI, BAHAMAS

RESEARCH, CONSERVATION, EDUCATION

LEMON SHARK [*NEGAPRION BREVIROSTRIS*]

my project – investigating how familiarity influences partner preference – has allowed me to do just that. Together with my advisors, I developed a protocol to examine this question and identified a behaviour that had not yet been diagnosed in sharks. The preference for associating with the familiar is widespread across the animal kingdom. Let me prove it. Take your dogs to a dog park and watch; they will hang out more with each other than with strangers. It's pretty basic behaviour, but do sharks do the same thing? Of course they do! My team found that sharks show a statistical preference for animals they live with compared to strangers.

After coming back to South Carolina for graduate school, I have given more than 20 presentations. This project has advanced scientific understanding of the mechanisms of group formation, and at the same time has educated children about shark conservation. Both of these outcomes will help to protect our oceans, the main goal of the Save Our Seas Foundation.

JEREMY KISZKA

'My partnership with SOSF helps us understand how non-lethal human activities such as shark provisioning impact shark populations. My goal is to evaluate the impact of tourism on the behaviour and ecology of the sharks of French Polynesia's coral reef ecosystems. Hopefully, this will help to ensure the sustainable use of sharks through tourism.'

WHO I AM

I am a marine biologist at Florida International University (FIU), where I study the behaviour and ecological role of large marine vertebrates, including elasmobranchs, marine mammals (mostly cetaceans) and, more recently, sea turtles. I started investigating marine mammals in the late 1990s in French NGOs, when I was still in high school. I completed my PhD in 2010 at the University of La Rochelle (France), after spending five years in the Indian Ocean investigating dolphin community ecology and behaviour.

I began working on sharks in the Western Indian Ocean in 2009, conducting initial surveys and sampling programmes in Madagascar and around remote French islands and atolls (Juan de Nova, Europa) in the Mozambique Channel. In 2012, I joined Mike Heithaus's lab at FIU in Miami, where I work on different projects on the behaviour and trophic ecology of toothed whales and dolphins, and on the ecological role of sharks in coral reef ecosystems. My work in French Polynesia started quite recently, in 2012, but is now expanding. I study the trophic ecology and behaviour of reef sharks around Moorea and in Tetiaroa Atoll. My work involves the blacktip reef shark *Carcharhinus melanopterus* and the sicklefin lemon shark *Negaprion acutidens* and focuses on the adults on the fore reef (or reef slope) and the juveniles in the shallow coastal waters.

WHERE I WORK

I am fortunate to work in multiple locations around the world, including the Caribbean, the Western Indian Ocean and French Polynesia, where I study a number of species in different ecological contexts. Nevertheless, my research questions remain the same: how do large marine vertebrates interact with their environment, and how do they affect the structure of communities and ecosystems?

When it comes to reef sharks, I work mostly in French Polynesia. To date I have been doing field work in the Society Islands, specifically at Moorea and Tetiaroa (the atoll that used to be owned by Marlon Brando). There, sharks are considered to be the reincarnation of elders' spirits and are fully protected by law. This is why working in such a location is great, as we investigate truly pristine places where the abundance of sharks has probably been the same for decades. Indeed, footage dating from the 1950s features reef sharks in French Polynesia and it seems that the densities seen now have not really changed.

Being able to undertake great research on sharks in French Polynesia aside, every morning I hit the water or dive there, it is always wonderful. There are many sharks everywhere, the coral reefs are beautiful and the people are fantastic!

WHAT I DO

My research aims to investigate how non-lethal human activities affect shark populations and disrupt their ecological role in marine ecosystems. In French Polynesia, I develop methods to study populations of reef sharks and their associated communities, and such methods include surveys by drones and stationary cameras. I also study the trophic interactions of sharks among both juveniles in nursery areas and adults along the fore reef. This is particularly important to understand their ecological importance and how human activities can disrupt their functional role, such as in coral reef environments.

Shark provisioning is a common practice around the globe. However, it affects shark behaviour and populations in many different ways, including habitat use, site fidelity patterns and increased population densities. Around the French Polynesian island of Moorea, where I am supported by SOSF, shark provisioning is a significant source of income for the local community, but it induces strong behavioural modifications in sicklefin lemon sharks. The goal of my project is to investigate the effect of shark provisioning on the diet, habitat use and abundance of lemon sharks. I assess how much shark diet comes from provisioning, and thus to what extent provisioning affects the trophic ecology of sharks, by using stable isotope analyses. To establish the effect of provisioning on lemon sharks' behaviour, how they use their habitat and the density of the population, I use passive video recording.

This project will significantly help to understand better the effect of shark feeding in Moorea, an activity that generated $5.4-million there between 2005 and 2009. We plan to communicate our results to local authorities in French Polynesia, including the Ministry of Environment, so that the management of shark provisioning activities around the island and in French Polynesia as a whole can be improved. The sicklefin is a highly vulnerable species, especially around Moorea, where the population (and the number of breeders) is small and the fragmented environment characterising these tropical islands favours inbreeding. Therefore, a management plan for lemon and other shark species is necessary to improve the sustainable use of this important resource in French Polynesia.

IMPACT OF SHARK PROVISIONING ON THE ECOLOGY OF LEMON SHARKS AT MOOREA
FLORIDA INTERNATIONAL UNIVERSITY
2014
MOOREA, FRENCH POLYNESIA
RESEARCH
SICKLEFIN LEMON SHARK (*NEGAPRION ACUTIDENS*)

JEANNE MORTIMER

'We are grateful for the support provided by the Save Our Seas Foundation that has breathed new life into the Turtle Action Group of Seychelles and is enabling it to move forward in a synergistic fashion with the projects we have planned.'

WHO I AM

Ever since I was a little girl I knew I wanted to be a scientist – but I didn't know what kind. What I did know was that I loved animals, especially 'cold' animals – reptiles, amphibians and insects – and that I loved the outdoors. I grew up in the big city of Chicago in the USA, but from the age of six to 20 I spent all my summers at my family's fishing lodge in the lakes region of north-western Ontario in Canada. There I worked as a waitress, a fishing guide and a house painter and in my free time I explored the wildlife of the marshes, lakes and forests. But it was the warmer realms of our planet that particularly attracted me, and in the end I decided to attend postgraduate school in Florida because it was located relatively close to the American tropics.

I had grown up fascinated by accounts of the adventures of naturalists who travelled to the tropical regions of the world and explored wildlife and people there – Raymond Ditmars, Osa and Martin Johnson, George Schaller, Archie Carr, Gerald Durrell, Jane Goodall and Louis Leakey were just a few of my favourites. So in 1973 I decided to join their ranks before starting my postgraduate studies. I bought an air ticket and spent three months travelling on my own and exploring the diverse ecosystems of Costa Rica in Central America, from the hot and humid lowland rainforests of the Osa Peninsula to the chilly heights of Cerro de la Muerte.

At that time Costa Rica still had 80% of its original forest cover, its ecosystems were intact and it harboured an abundance and diversity of frogs (whose populations are now much reduced). During my third month in the country I worked as a full member of Dr Archie Carr's sea turtle tagging team at Tortuguero on the Caribbean coast. Later I learned that I'd made history as the first female to do so. In those days North Americans rarely visited Central America; in the summer of 1973 I was one of only about 15 visitors to Tortuguero. Nowadays some 50,000 tourists go there each year to watch nesting sea turtles.

Dr Carr, who was regarded as the 'father of sea turtle biology' and was professor emeritus at the University of Florida where I would soon begin my postgraduate studies, was on site during my first visit to Tortuguero and we developed an excellent rapport. I felt privileged just to make his acquaintance, so it didn't occur to me at the time that he would later serve as the chair of the supervisory committees for my MSc and PhD degrees. After all, he'd made it clear that he was not taking any new graduate students, having launched his last PhD student in 1969. Nevertheless, I was his student and research collaborator from 1973 until his death in 1987.

Under Dr Carr's supervision I studied the feeding ecology of green turtles on the Caribbean coast of Nicaragua for my MSc and the nesting ecology of the same species at Ascension Island in the South Atlantic for my PhD. And it was he who provided the recommendation I needed to secure my first full-time job after earning my PhD in 1981: a three-year contract in the Republic of Seychelles to do a study of the status and management of the sea turtle populations of this vast island nation.

WHERE I WORK

Although I have worked with sea turtles in some 20 countries on six continents and visited more countries in other capacities since that time, the Republic of Seychelles has remained for me the most interesting of all my postings. This is because of its sea turtle populations with their fascinating nesting and foraging ecology, its wonderful people and its government's support for biodiversity conservation. I find the Seychelles so interesting, in fact, that I have acquired

TURTLE ACTION GROUP OF SEYCHELLES (TAGS): GROUP REVIVAL AND WEBSITE PRODUCTION
TURTLE ACTION GROUP OF SEYCHELLES
2014
SEYCHELLES
CONSERVATION
HAWKSBILL TURTLE (*ERETMOCHELYS IMBRICATA*)
GREEN TURTLES (*CHELONIA MYDAS*)

dual USA and Seychellois citizenship and made the country my home for most of the past two decades.

The Seychelles comprises some 130 islands spread over an area of about 144,000 square kilometres and divided roughly into three groups: the granitic and mountainous Inner Islands where almost all the human population lives; the sandy cay Outer Islands (including the Amirantes), most of which are located between 200 and 400 kilometres from the main island of Mahé; and the remote upraised limestone islands in the south, which lie between 700 and 1,100 kilometres from Mahé.

WHAT I DO

As well as studying sea turtles and giant tortoises, my work here entails promoting the conservation of the turtles and their habitats. It soon became apparent that among the most effective turtle conservation tools were our long-term monitoring programmes because whenever such a programme was established, the poaching of turtles immediately declined. In this way the programmes have provided three benefits: they gather valuable scientific data about turtles; they engage members of the local communities in monitoring turtles; and they are de facto anti-poaching patrols.

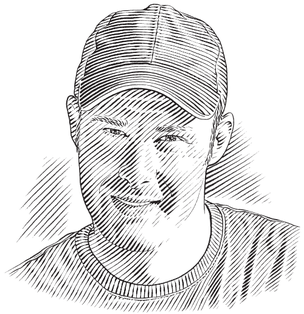
When I first arrived in the Seychelles in January 1981, nesting sea turtles were being monitored at three sites in the Inner Islands: Cousin Island since 1970, Aride Island since 1976 and Curieuse Island since November 1980. I standardised the monitoring protocols for these sites and set up new long-term monitoring projects at Ste Anne Marine Park in the Inner Islands and at the remote Aldabra Atoll. The programmes are still in operation at all five sites. In 1992, a turtle monitoring project was initiated at Cousine Island (adjacent to Cousin) and the island began to be managed as a nature reserve.

Finally, in 1994, the Seychelles government passed legislation protecting all sea turtles from slaughter, sale or disturbance. The following year I returned to the country to work as a special consultant to the government to promote sea turtle and tortoise conservation. Between 1995 and 1998 we set up long-term turtle monitoring projects in the Inner Islands: on the beaches of southern Mahé, on Bird Island, on the beaches of north-western Praslin near the Lémuria Hotel, at North Island and at Silhouette Island. All these programmes are still under way.

In 2004 we began to implement intensive long-term monitoring programmes in the Outer Islands. The first of these, in 2004, was the D'Arros and St Joseph project in the Amirantes group. This was followed by turtle programmes at Alphonse Island and St Francois Atoll in 2006 and at Desroches Island in 2009. In 2014 a new turtle monitoring programme was established at Farquhar Atoll, and more Outer Island programmes are in the planning stages.

With so many monitoring programmes operating, there was clearly a need to bring the various participants together to share their experiences and the data they collect, and we have been discussing how best to do this since before 2008. In 2008 the stakeholders in the turtle monitoring programmes legally registered an association, which we named the Turtle Action Group of Seychelles (TAGS). The group was dormant for several years, but in 2014 we received funding from the Save Our Seas Foundation to revive it and establish a website. We are currently in the process of fulfilling these goals, and have a number of plans for other exciting activities in the pipeline.

'To investigate the effect of provisioning on shark and ray populations, we have developed a methodology that uses UAVs to monitor population densities in Moorea lagoon, including the provisioning sites. The same method can be used for habitat mapping or the long-term monitoring of marine fauna. This project has been funded by the Save Our Seas Foundation.'



WHO I AM

Although I was born inland, in Lyon in France, I have always been attracted to the sea and especially to sharks. This interest may be due, at least in part, to summer holidays spent every year with my family either on the Mediterranean coast in the South of France or in Brittany in the north-west, where the waters are colder but richer. As soon as I was old enough to swim, I was given a mask and snorkel to investigate what life is like underwater. Having seen my first shark in an aquarium and followed all the media programmes I could about sharks, I quickly became intrigued by the mysterious ecology and behaviour of these misunderstood animals. At an early age, therefore, I promised myself that I would dedicate my life to learning more about the behavioural ecology of sharks and their relatives.

The route to achieving this personal goal was unusual and long, but it helped me to improve my general knowledge and skills. Instead of simply opting for an ordinary university education, I chose the more challenging preparatory classes that enabled me to enter an engineering school in agronomy. After studying plant and zoology science as well as wine-growing and oenology in Bordeaux, I moved on to study fishery science in Rennes, Brittany. Unusually for this course, my Master's thesis was on the behavioural ecology of great white sharks and their interactions with cage-diving vessels, and I carried out the research for it in Mossel Bay, South Africa, in 2005. After participating in a basking shark project in Brittany in 2006, I started a second Master's thesis on the reproductive behaviour and genetic structure of a population of sicklefin lemon sharks in French Polynesia in 2007. This was followed by a PhD thesis on the behavioural ecology of blacktip reef sharks in Moorea, French Polynesia, between 2008 and 2011.

I am still leading various scientific projects on elasmobranch ecology in French Polynesia and am also involved in the management of the Observatoire des Requins de Polynésie (ORP), a network of shark observers spread across the islands of French Polynesia.

WHERE I WORK

For the past seven years I have been spending my time between France and French Polynesia. CRIOBE (Insular Research Centre and Environment Observatory) is a lab that has the peculiarity of being divided between two locations, one in Perpignan in the South of France and the other in Moorea in French Polynesia. Although I have been conducting some field expeditions on sharks and rays between the Marquesas Islands and different atolls of the Tuamotu Archipelago, most of my field work is done on the reef of Moorea, which is a small tropical island located 20 kilometres from Tahiti. Moorea is surrounded by more than 60 kilometres of barrier reef, which delimits a lagoon connected to the ocean by 11 channels. Moorea's coral reefs are characterised by the presence of different elasmobranch species, including sicklefin lemon sharks, grey reef sharks and blacktip reef sharks, as well as stingrays and eagle rays. Over the past decade, the island has seen an increase in its human population and in the activities in its lagoon, including the shark provisioning that forms part of my research interests.

JOHANN MOURIER

WHAT I DO

For the past eight years I have been investigating the behavioural ecology of reef sharks in French Polynesia, working at different scales, from individuals to populations, and using different approaches and tools, including underwater behavioural observations and photo-identification techniques, acoustic and satellite telemetry, blood samples and molecular analysis. These combined approaches have helped us to understand how the behaviour and ecology of individuals shape the organisation of groups and populations. For example, my research has demonstrated that adult sharks can have preferred 'friends' and build up a natural social network based on long-term stable associations within communities and short-term non-stable associations between communities.

Using parentage analysis, I have also revealed that female reef sharks follow a pattern of reproductive philopatry by migrating every year to the same nursery to give birth. It is even possible that they themselves were born in that nursery. Sometimes the females migrate annually across deep open ocean to give birth at another island.

During my research in Moorea, I have also been interested in the effect of provisioning on shark and ray populations. One of the hypotheses proposed is that provisioning may change the spatial distribution and increase natural animal densities, and we are using UAVs to investigate it.

USING DRONES TO INVESTIGATE ABUNDANCE OF SHARKS AND RAYS IN SHALLOW-WATER HABITATS
CENTRE DE RECHERCHES INSULAIRES ET OBSERVATOIRE DE L'ENVIRONNEMENT (CRIOBE)
2014
MOOREA, FRENCH POLYNESIA, PACIFIC OCEAN
RESEARCH
BLACKTIP REEF SHARK (*CARCHARHINUS MELANOPTERUS*)
SICKLEFIN LEMON SHARK (*NEGAPRION ACUTIDENS*)
PINK WHIPRAY (*HIMANTURA FAI*)

WHO I AM

I am a father, a husband and a marine biologist. I love sharks, my wife loves sharks and my daughter loves sharks (as much as a seven-month-old can). We buy her shark everything: shark socks, shark pyjamas, shark toys, shark bathrobes, shark bibs and shark shoes. For Halloween this year she was an adorable shark! I look forward to snorkelling and scuba diving with her to share the company of sharks in their natural environment.

We are teaching our child to appreciate nature – all of it, including (and especially) sharks. I believe the public's fear of sharks is mostly learned – it has become a societal norm – and that fear translates to a reluctance to protect these threatened animals. We hope to teach our child not to fear sharks, but rather to respect and admire them. It's a hope that has inspired me to step out of my research comfort zone of shark behaviour and ecology and rather focus on human behaviour and one social aspect that contributes to the public's fear of sharks: the ominous background music that too often accompanies shark footage in documentaries. I am delighted to have the Save Our Seas Foundation (SOSF) as a partner in this endeavour.

How did I get where I am? I grew up in suburban New Jersey, about an hour outside New York City. During the summers my family would visit the Jersey Shore (which, by the way, is not as trashy as some reality shows would suggest), where I developed an early appreciation for the ocean. My parents, along with an influential high school biology teacher, nurtured this interest and before I knew it, I was at the University of Virginia working towards a BSc degree in biology and specialising in environmental and biological conservation.

Before I graduated in 2007, I had the life-changing opportunity to study abroad for a semester at the University of Queensland in Brisbane, Australia. Here I took my first classes in marine biology, biodiversity and conservation, and saw my first shark in the wild – only a common whitetip reef shark, but a thrilling experience all the same. It was also a peaceful encounter without any fear. I would have more encounters with sharks during my time in Australia and in none of them did I feel threatened. I became increasingly captivated by these animals, and at the same time troubled by their plight around the world.

WHERE I WORK

I study the behaviour, ecology and conservation of coastal sharks and rays at Scripps Institution of Oceanography in La Jolla, California. My field site is just off La Jolla Shores Beach, within a no-take marine reserve. It is quintessentially California: palm trees, surfers and beautiful homes perched atop Mount Soledad and overlooking the Pacific Ocean. This site lies at the confluence of rocky reef, kelp forest, submarine canyon and sand-flat habitats, making it a uniquely diverse ecosystem. Cruising these waters are leopard, soupfin and sevengill sharks, guitarfish, bat rays and stingrays, many seals, sea lions and dolphins, and the occasional whale that ventures close to shore. It is a magical place and I am fortunate it is only a kilometre down the beach from my institution.

WHAT I DO

Having decided to pursue my interest in shark behaviour, ecology and conservation, I started my PhD at Scripps Institution in 2007. My dissertation investigated the reasons why hundreds of leopard sharks gather at my field site in La Jolla. During this time, I became increasingly aware of the public's fear of

ANDREW NOSAL

sharks, even of the harmless leopard sharks that mill around in waist-deep water. I was often amused by the snorkel-muffled screams I could hear as I conducted field work nearby.

Once I'd completed my PhD in 2012, I stayed on at Scripps as a postdoctoral researcher and continued my studies into the behaviour and ecology of coastal sharks, but now with the additional social components of shark conservation that have always interested me. Although the mass media perpetuate negative stereotypes of sharks in many ways, one of the more subtle, yet very powerful means is with the use of ominous background music (as in the film *Jaws*) accompanying shark footage in documentaries. I had always wondered whether our fear of sharks is mostly learned or even subconsciously programmed by societal norms. Could the overuse of ominous background music subconsciously incite fear and loathing of sharks and, by extension, a reluctance to protect them? Alternatively, could beautiful and uplifting background music (as in *Flipper*) arouse positive sentiment for sharks and counteract their maligned image?

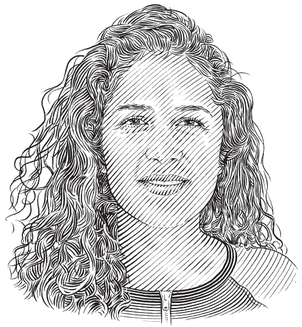
These are precisely the questions my SOSF-funded research project intends to answer. It will ask thousands of human subjects to watch one-minute footage of swimming sharks accompanied by ominous or uplifting music, or none at all (experimental control). The subjects are then asked to complete a survey that measures their perception of sharks (such as scary or beautiful) and their willingness to protect them (such as how much they would donate to a shark conservation charity).

Although this project takes me away from the beauty of my field site and places me in front of a computer, it is vitally important because documentaries are the general public's primary source of information about sharks. At the very least, I hope the project will raise awareness to the extent that informed viewers will be more likely to recognise scary background music in documentaries and not be affected by it. What makes my project special is that it transcends geography and language; everyone can appreciate the emotional power of music.

I recognise that this is only one small part of the broader, complex challenge of improving shark PR. However, if everyone plays a small role and chips away at this problem piece by piece, from every angle, then together we can make a difference. I want my daughter to grow up in a world that values nature and acknowledges the ecological importance of all living things – not a world that values only cute and cuddly animals and vilifies others, like sharks. And, for the record, an argument could be made that sharks are also cute and cuddly!

THE EFFECT OF DOCUMENTARY BACKGROUND MUSIC ON VIEWERS' PERCEPTION OF AND WILLINGNESS TO PROTECT SHARKS
SCRIPPS INSTITUTION OF OCEANOGRAPHY
2014
SAN DIEGO, CALIFORNIA, USA
RESEARCH, EDUCATION
SHARKS

DENÍ RAMÍREZ-MACÍAS



'Thanks to the Save Our Seas Foundation, I was able to conduct four years of monitoring at La Paz that led to my PhD. This new project on the whale sharks of Peru will expand our knowledge of the species in the Eastern Pacific and will attempt to transform a community of fishermen into protectors of this gentle giant.'

WHO I AM

I am originally from Mexico City, and there is no ocean there! But my parents were divers and during our holidays we used to go to the beach and camp. I remember once watching a sea turtle lay her eggs. It was awesome yet sad, because the local people took the eggs. I knew then for the first time that I wanted to do something for conservation. My parents also took us to Cozumel where my brother and I would snorkel, following the bubbles from the surface while they were diving below us. When I was about seven years old, I did my first dive with them in Chankanaab, Cozumel. It was amazing. I felt like I was in a documentary film, with thousands of fishes in so many different colours; I even saw a huge ray. From that moment on, I would tell my school friends that I was going to be a marine biologist with my own research boat, like Jacques-Yves Cousteau.

I didn't go back to Chankanaab until I was 17. It was so sad to see the changes there: the reef was badly damaged, the water was polluted and there were very few fishes. I wanted so much to be a marine biologist so I would know how to protect the ocean. Today, thanks to better management, Chankanaab is recovering.

When I was 20, I went to La Paz on the Gulf of California to follow my dream to become a marine biologist. That was when I had my first encounter with a whale shark. The visibility was terrible and a whale shark appeared out of nowhere, right in front of me – it was the best ocean experience of my life! I was fascinated and started to read about whale sharks, but soon realised that very little is known about them. I wanted to learn more and make my own contribution to our understanding of these magnificent animals.

And here I am, a whale shark expert who has studied the species since 2001. I did my Master's degree on whale shark population genetics in the Gulf of California, the first such study in the world. In 2005 I started studying whale sharks around Holbox Island, just off the Yucatán Peninsula, and from this work we now know that the aggregation around the peninsula is the world's largest. My PhD, on worldwide whale shark population genetics, took me to the Philippines to collect tissue samples and involved collaboration with whale shark experts from around the globe. It also looked at whale shark population structure and abundance in the Gulf of California and at Holbox Island.

I travel extensively as a whale shark researcher and have had incredible adventures in the world's oceans. In the Revillagigedo Archipelago, for example, I once saw three of my favourite species on a single dive. I started off with a group of giant manta rays, then I saw a huge pregnant female whale shark and finally I encountered a school of hammerhead sharks!

WHERE I WORK

I am the director of Whale Shark Mexico, a project of ConCiencia Mexico, an NGO based in La Paz. I started research into the whale sharks in the Gulf of California and over the past 10 years have built up a great group of colleagues. We have generated a network in and around the Gulf of California

that stretches about 1,200 kilometres from San Luis Gonzaga in the north to Nayarit in the south. With modern photo identification techniques we have been looking into connections between whale sharks in these distant localities, which is very exciting! I feel so grateful to be contributing not only to knowledge about this species in Mexico and around the world, but also to its protection. In Mexico there are currently two protected areas for whale sharks, one in Quintana Roo and the other in Bahia de Los Angeles, Baja California, and my research was used in the management plans for both these areas.

Our research has demonstrated that juvenile whale sharks remain in the coastal waters and ocean bays of the Gulf of California and tend to leave once they become mature. Many of them don't return, which raises a number of questions. Where do they migrate to? And are they related to whale sharks elsewhere in the Eastern Pacific?

One day I received an e-mail from Rossana Maguiño that told me about whale sharks in Peru and asked if I could help her to study them. I was surprised because there was nothing in the literature about a whale shark presence in Peru. I was excited, too, to be part of a new project that would investigate connections between the whale sharks of Mexico and of Peru.

Working with EcOceánica, a Peruvian NGO, we have begun to interview local fishermen and divers to find out more about whale shark sightings. The Save Our Seas Foundation is supporting us as we gather this information and begin to generate the outline for research into the whale sharks in Peru, with the objective of conserving them and their habitat. Based in Zorritos, in the north of the country, we conduct interviews in Puerto Pizarro, Zorritos, Acapulco, Punta Sal and Cancas, whose inhabitants make a living as fishermen. Occasionally they catch mobula rays, giant manta rays and juvenile hammerhead sharks as well as whale sharks. Some people here fear whale sharks because they have heard about these huge sharks that swim around the boat. Few of them know that the sharks are gentle and docile and pose no threat to humans. One of the challenges is to determine whether there is potential for whale sharks to become a tourist attraction in Peru, generating for the local communities a solid economic alternative to fishing for them.

Now I am preparing to visit Peru and assist the team with its field work. On this project we are all women (Rossana, Ximena, Shaleyla, Alejandra and myself) and we are all passionate about marine animals and about generating baseline research into the whale sharks of Peru in order to conserve them and their habitat.

WHAT I DO

I started my research into whale sharks in La Paz Bay in 2001, using different techniques such as photo-ID, genetics and tagging. For the first two years there were no whale sharks in the bay and despite going out to look for them every month I didn't see a single one. Then in 2003 I went to Los Cabos and I saw four pregnant females, huge and beautiful like submarines. To be with them is an incredible experience: they are so peaceful and transmit a wonderful energy, and I feel so small and so privileged to have the opportunity to share time and space with these big mamas.

My goal was to collect tissue samples so that we could study the genetics of these whale sharks, but their skin is hard and it took us some time to figure out how to collect the tissue. The whale sharks returned to La Paz Bay in 2004 and I have been monitoring them since then, determining the size of the population, its fidelity to the site and whether it is connected to other populations in the Gulf of California and other parts of Mexico's Pacific coast.

It is amazing that each shark has a unique pattern of spots, and as we began to recognise individuals we started to name them. This has helped us to answer two important questions: do individuals spend a long time in the bay; and do they return year after year? The juveniles in particular, I have discovered, like La Paz Bay and some of them do return year after year. The best part of being able to identify individuals is that it gives me a sense of connection with them. I once placed a tag on Tiki-Tiki, a young female from La Paz Bay, but she lost the tag when she dived very deep. When I saw her again in the bay, I asked her, 'Why don't you just tell me what you were doing down there?'

Part of using marine biology to protect the ocean is working with communities and passing on to them the skills necessary to conduct baseline research. The projects at Bahia de Los Angeles and Nayarit are monitoring programmes that are conducted and controlled by the communities there, using locals as guardians of the sharks.

In La Paz Bay I have been helping to develop of a management plan for whale shark tourism. Each year we train tourist companies in the guidelines for interacting with whale sharks. Education is important too, and we present a programme about ocean protection to high schools.

Because the whale shark is a migratory species, we promote its conservation on a regional basis along the entire Pacific coastline of Mexico. Our work in Peru will enable us to expand knowledge about whale sharks in the Eastern Pacific by generating initial baseline research about, among other things, abundance, site fidelity and population structure. Two months in, we have entered into agreements with associates who will assist us in our studies. In the field, we have registered the presence of humpback whales, marine turtles, sea lions and mobula rays. Whether they come from Mexico is still a mystery.

EVALUATE THE PRESENCE OF WHALE SHARK OFF PERU
ECOCEÁNICA
2014
EL ÑURO, PERU
RESEARCH
WHALE SHARK (*RHINCODON TYPUS*)

JUSTIN RIZZARI

'Without the support of the Save Our Seas Foundation I would not be able to carry out a large portion of this work. I would like thank everyone at the Save Our Seas Foundation who has made this project, and countless others, possible.'

APEX PREDATORS ON CORAL REEFS: DO MARINE PARKS NEED SHARKS?
AUSTRALIAN RESEARCH COUNCIL CENTRE OF EXCELLENCE FOR CORAL REEF STUDIES
2014
GREAT BARRIER REEF, AUSTRALIA
RESEARCH
GREY REEF SHARK (*CARCHARHINUS AMBLYRHYNCHOS*)
WHITETIP REEF SHARK (*TRIAENODON OBESUS*)
BLACKTIP REEF SHARK (*CARCHARHINUS MELANOPTERUS*)

WHO I AM

For as long as I can remember, I have been fascinated by the ocean and the animals that call it home. I grew up in Texas on the Gulf of Mexico coast, where the ocean's appeal expanded exponentially when I began surfing and fishing. Subsequent family trips to the Caribbean and Central America solidified my desire to pursue a life that is at one with the ocean. This eventually prompted me to enrol in a Bachelor's degree course in marine science, with a focus on marine and coastal resources.

A major turning point came when I learned to scuba dive while studying for my undergraduate degree. The first dive I did was near the jetty of the ship channel at Port Aransas on Mustang Island, a barrier island off the coast of Texas. I can still remember my instructor asking me to repeat the skills I'd learned in the pool, but I could barely follow his actions as the visibility was, at best, slightly less than a metre. At the time I didn't care what I could (or couldn't) see; just the fact that I could comfortably stay underwater and marvel at all the fishes swimming by was enough to keep me hooked.

Learning to scuba dive coincided with being accepted to study for a semester in the Turks and Caicos Islands in the Caribbean. The programme involved courses in tropical marine ecology and resource management and it culminated in my first taste of conducting my own field research. Shortly afterwards, as part of my undergraduate degree, I did an internship in the Red Sea's Gulf of Aqaba, Jordan, where I worked on an artificial reef project. These two experiences led me to realise that I could turn my love for and curiosity about the ocean into a fulfilling career.

Also while I was an undergraduate, I worked every summer as a deck hand on a sport-fishing boat that went out to catch and tag blue marlin, sharks and other large pelagic fish in the Gulf of Mexico. Through this I became fascinated by animals that dwarf humans – and large predatory animals in particular.

These experiences in combination landed me at James Cook University in Queensland, Australia, to do my postgraduate studies. I began the research for my Master's degree by looking at the influence of marine reserves on the behaviour of reef sharks. I was subsequently fortunate enough to receive a PhD scholarship, which brings to me to where I am now.

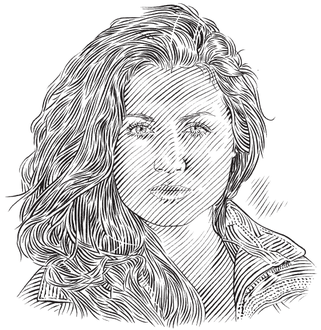
WHERE I WORK

I am based at Townsville, which is located smack in the middle of Australia's Queensland coast adjacent to the Great Barrier Reef World Heritage Area. My study area is the outer edge of the reef stretching from Lizard Island in the far north to One Tree Island in the extreme south, with individual sites at many of the offshore reefs between these two islands. When I send pictures home to show my family what I do, my father typically responds that I look more retired than he is. However, what they don't see is me immersed in Excel spreadsheets and data analysis software, which actually takes up more of my time than swimming around looking for sharks.

WHAT I DO

Although there have been some cases of management success, reef shark populations around the globe are declining. Recent studies on many coral reef systems have come to differing conclusions about the importance of reef sharks to coral reef ecosystems. This variation indicates that the mechanisms that shape ecosystem processes may be location specific; in other words, what occurs in the Hawaiian Islands or Western Australia may not be applicable to other locations around the world.

This brings me to the overall purpose of my research: to assess the trophic importance of reef sharks to the coral reef ecosystems of the Great Barrier Reef. To do this involves a two-pronged approach. Firstly, I will use chemical tracers, stable isotopes in particular, and stomach contents to get an idea of the trophic groups and species on which the reef sharks are feeding. Secondly, I will look at the large-scale relationships between reef sharks and fishes in other trophic groups, such as mesopredators and herbivores, and will try to discover to what extent their interactions are influenced by fishing or by the protection afforded by marine reserves. To do this work involves diving on a range of coral reefs within the Great Barrier Reef and, in effect, counting everything that moves. The project's findings will identify the importance of reef sharks in maintaining the health of these reefs and will assess the effects of declining reef shark populations on the broader ecosystem.



MATT RUTHERFORD NICOLE TRENHOLM

WHO I AM

In 2004 I bought my first sailboat for US$2,000. I knew nothing about sailing and learned the hard way, making numerous mistakes as I navigated from the Chesapeake Bay to the Florida Keys. I ripped my sails, ran hard aground and was hit by lightning and three hurricanes – all in the first six months. But this rough introduction to sailing only made my desire to learn grow stronger. By 2008 I had accumulated enough experience to sail solo across the Atlantic Ocean. I was alone at sea for 34 days, which felt like a long time back then. I then spent a year sailing from the North Sea to West Africa before voyaging back across the Atlantic to the Caribbean in 2009.

By this time the Arctic was where I really wanted to sail, but I had no idea how I was going to make that happen. I started doing volunteer work for Chesapeake Region Accessible Boating (CRAB), a small non-profit in Annapolis, Maryland, that helps people with disabilities to go sailing. One day I was talking to CRAB's executive director and asked, 'Why don't you let me take one of your small sailboats up to the Arctic and we'll try to raise some money for the organisation?' He said 'Okay, go for it.'

So in 2011 I left on the biggest sailing adventure of my life. I decided that instead of just sailing in the Arctic, I would navigate around the Americas, non-stop and alone. To do this I had to sail north between Canada and Greenland, then across the top of Canada, around Alaska, down the Pacific Ocean, around Cape Horn and back north to the Chesapeake Bay. I was alone at sea for 309 days, covering 43,576 kilometres non-stop. By the end of the circumnavigation I had raised US$120,000 for CRAB.

WHAT I DO

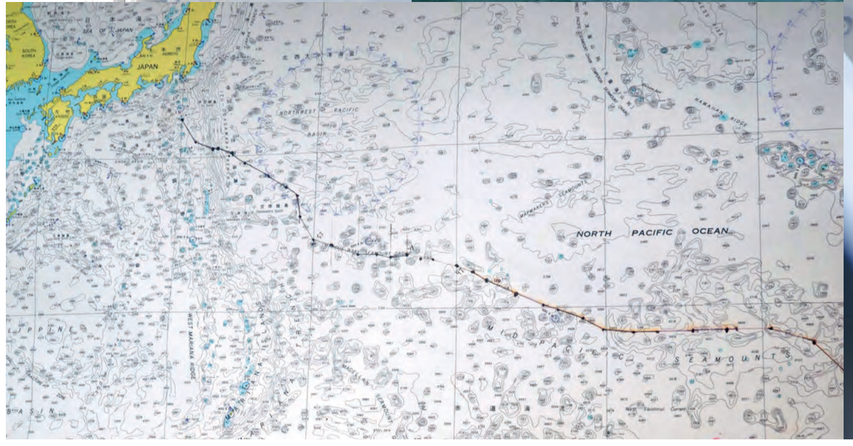
When I returned from the circumnavigation of the Americas I realised that I would never stop sailing, so why not do it in a way that gives back to the ocean? That's when I decided to create my own non-profit organisation, and I called it Ocean Research Project. Getting 501 (c) 3 status from the IRS was an expedition in itself, an expedition in bureaucracy, which is my least favourite type. But after months of paperwork Ocean Research Project was official.

The project is dedicated to science, education and exploration. During expedition planning we work with universities and organisations to make sure that the research we are conducting will have maximum impact. While on the expeditions we engage with Maryland public schools by having students follow our progress with a weekly Q&A.

The first environmental problem I wanted Ocean Research Project to tackle was plastic trash in our oceans. When sailing around the Americas, time and time again I would see a piece of plastic floating by my boat – sometimes every 10 to 15 minutes. It was heartbreaking.

A gyre is a large area of slow-moving circular current – a giant vortex – and there are five major gyres in our earth's oceans. These are located in the North Atlantic, South Atlantic, North Pacific, South Pacific and Indian oceans. And there is a 'garbage patch' within each one of these gyres.

TRANS-PACIFIC PLASTIC POLLUTION SURVEY
OCEAN RESEARCH PROJECT
2014
NORTH PACIFIC OCEAN
RESEARCH
MARINE PLASTICS



In 2013 we sailed to the eastern side of the North Atlantic gyre. No-one had done any plastics research into the garbage patch there; it was still a black space on the scientific map. We sailed 11,250 kilometres non-stop, spending 73 days at sea collecting samples of micro plastics along the way. We processed our samples in a laboratory in Baltimore and are co-publishing a paper with the 5 Gyres organisation about the problems of plastic trash in the North Atlantic.

In 2014 we turned our attention to the Pacific Ocean, sailing from San Francisco to Yokohama in Japan over 63 days and collecting samples of micro plastic along the entire 11,000-kilometre route. Once the samples have been processed, we will begin working on another scientific paper. We shot footage of both expeditions and hope to have a short adventure-based film about plastic trash in our oceans completed in 2015.

The 2014 Pacific Plastics Expedition could not have happened without the help of the Save Our Seas Foundation. From all of us at Ocean Research Project, thank you!

'With the support of the Save Our Seas Foundation, I am using a conservation genetics technique to determine the status of Florida's hammerhead shark populations. I'm also comparing them to our local populations of other shark species that aren't listed as Endangered by the IUCN.'

WHO I AM

Although I grew up far from the ocean in Pittsburgh, Pennsylvania, I've been interested in sharks for as long as my family can remember. I loved sitting by the shark tank at Pittsburgh Zoo and I read every book about sharks that I could get my hands on. As soon as I was old enough, I learned to scuba-dive and got my certificate. I then spent five summers at the marine biology summer camp SeaCamp in the Florida Keys. Now I'm a graduate student at the University of Miami studying shark ecology and conservation and, between my research and my diving vacations, I've been lucky enough to interact with more than 3,000 sharks of over 50 species on five continents!

WHERE I WORK

Our lab is out on the water in south Florida, USA, where we catch, measure, tag and release sharks more than 50 days a year. It's a great place to study sharks because the water is so warm that they're close to shore year-round. Our main field research site in Florida's Biscayne Bay is visible from my office and only a few miles from where I live.

When I'm not in the field tagging sharks, I love talking to people about ocean science and conservation. I speak to hundreds of middle school and high school students a year, in person and over Skype, and earned the Florida Marine Science Education Association's educator of the year award this past year for my efforts. I also use social media to talk to the public on a larger scale.

WHAT I DO

My research focuses on the ecology and conservation of local shark species and I'm particularly interested in hammerheads, of which great and scalloped hammerheads are classified as Endangered on the IUCN Red List of Threatened Species™. Our lab's research has shown that hammerheads are particularly vulnerable to stress resulting from fishing capture and often die even when they're released by anglers. Our work was used to help get these species protected in Florida waters a few years ago.

In addition to our ongoing research, environmental education outreach is a big part of what we do. On every field trip we take a group along, including high school science classes, community organisations, and companies. In 2014, we were accompanied by more than 1,200 citizen scientists from 40 countries, ranging in age from 10 to 73!

AN ASSESSMENT OF THE POPULATION STATUS OF COASTAL SHARK SPECIES IN FLORIDA USING MOLECULAR TOOLS

RJ DUNLAP MARINE CONSERVATION PROGRAM

2014

FLORIDA KEYS, EVERGLADES NATIONAL PARK | THE BAHAMAS

RESEARCH

GREAT HAMMERHEAD SHARK (*SPHYRNA MOKARRAN*)

BLACKTIP SHARK (*CARCHARHINUS LIMBATUS*)

NURSE SHARK (*GINGLYMOSTOMA CIRRATUM*)

DAVID SHIFFMAN

WHO I AM

I was born in Aberdeen in the far north-east of Scotland within sound of the sea. My parents moved south to the coast of Devon when I was four years old and from that day on I grew up in, on and under the sea. I have never lived further than half a mile from it in my 58 years. The sea has been the single most important factor in my life, and its wild inhabitants have been my passion.

WHERE I WORK

In the late 1980s I was working part time as a professional yacht skipper, sailing yachts in the English Channel. During that time I became familiar with many of the spectacular species that inhabited those waters: seals, seabirds and cetaceans, as well as basking sharks (my favourites). By the end of the decade I had made my first tentative steps towards working in the research field, by recording many of the creatures we encountered on a regular basis. In the early '90s I was lucky enough to work with one of the world's leading cetacean researchers as skipper on some of his voyages among Scotland's Western Isles – a life-changing experience.

WHAT I DO

Through working with such experienced scientists, I learned a huge amount about the biology and ecology of the animals we were studying; and through constant exposure to those creatures in their natural habitat, I gained an understanding of their behaviour, especially in relation to boats and people. It soon became clear that their responses to man varied widely: one dolphin species might readily approach a boat, another close relative might be far more reticent, and a third would avoid contact on most occasions. Clearly there was much to learn, and at that time there were very few of us out there to do that.

As the years went by, public enthusiasm for encountering nature 'up close and personal' was growing exponentially. The new buzzword was 'ecotourism', which carried within it the dual implication that it was a commercial leisure pursuit and entirely benign. There was no doubt that the commercial side brought benefits, and certainly as an activity it was regarded as less of an evil than other forms of commercial exploitation such as hunting. But any suggestion that it was 'entirely benign' was hard to sustain. Badly managed ecotourism had (and still has) the potential to do more harm than good, especially when combined with other factors such as increasing boat traffic, sub-sea noise and loss of favoured habitats. And no-one was looking at what could be done about minimising the potential threats from ecotourism.

One day I found myself heading out on survey in the vicinity of a very busy port at the height of the summer. Not far from the harbour we saw a small group of bottlenose dolphins, part of a local pod we often encountered that included one animal known as 'Benty', which had a number of spinal deformities. Despite his lack of speed and mobility, Benty was always the first to come to bow-ride with boats and the last to leave, and we always enjoyed his company. As the group approached us we maintained our course and speed, and the animals settled down to bow-ride ahead of us. But this hadn't gone unnoticed and within minutes we were surrounded by boats, their passengers all eager to see the dolphins. By this time we had gently slowed to a stop to let the animals leave. But the group, surrounded by surface craft and underwater noise, was in a state of panic, which was an awful thing to witness. None of the boat captains around us had any kind of malicious intent – they just wanted to see the dolphins, as you do on TV. But that was beside the point; well-intentioned or not, the result was clearly harmful. I realised it was time we did something about it.

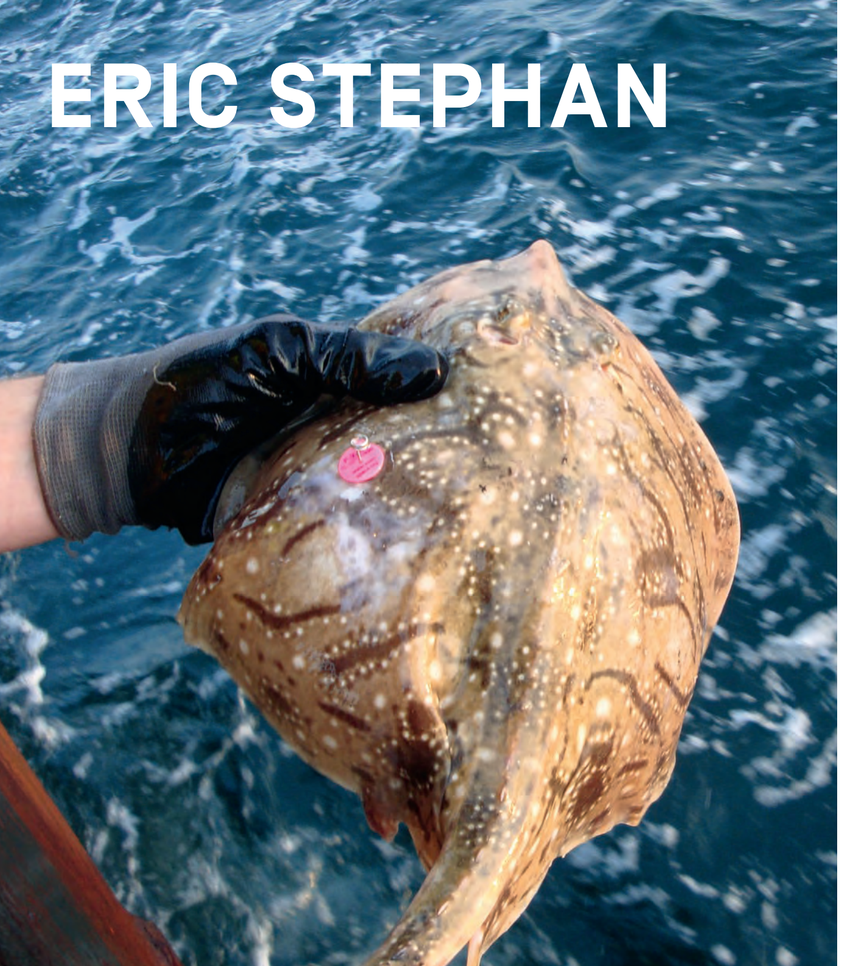
WISE ON THE WATER
WAVE ACTION
2014
UNITED KINGDOM
CONSERVATION, EDUCATION
BASKING SHARK (*CETORHINUS MAXIMUS*)
AND OTHERS

So I put together a simple educational project called WiSe (a shortened version of Wildlife Safe) that aims to train all commercial boat operators in safe and sustainable ways to watch marine life – sharks, cetaceans, seals and seabirds – around the shores of the British Isles. Since the project commenced in 2003 more than 3,000 people have attended courses, which now vary between Standard courses, which cover the basics, to Masters level, which concentrates more on biology and ecology and is targeted at dedicated ecotourism operators.

Our most recent development has been the creation of a shorter, graphic version of the WiSe course, to be delivered by trained volunteers to boating and marine leisure audiences, dive clubs, yacht clubs and surfers, for example. We recognise that the ever-growing number of people taking to the water means that a proactive campaign to educate the public is a responsibility that must be accepted. If we are to reduce unintended disturbance to a minimum, education is a must. Otherwise, we are likely to further diminish our precious right to share our seas with our most wonderful wild neighbours.

Science, education and legislation. We need them all to protect the marine world we love so much.

COLIN SPEEDIE



ERIC STEPHAN

POPULATION STRUCTURE OF THE UNDULATE RAY IN FRENCH WATERS
ASSOCIATION POUR L'ETUDE ET LA CONSERVATION DES SÉLACIENS (APECS)
2014
ENGLISH CHANNEL I BAY OF BISCAY
RESEARCH
UNDULATE RAY (*RAJA UNDULATA*)

'The funding from the Save Our Seas Foundation has given us the opportunity to start an investigation into the population structure of the undulate ray in French waters by taking tissue samples and conducting a preliminary genetic analysis.'

WHO I AM

When I was a child, I spent all my summers in my grandparents' house on the west coast of France. I used to play on the beach, but my favourite moments were when my grandfather showed me the exciting life of the rocky shores. It was my first experience of the extraordinary marine fauna. A few years later I started my university studies in Paris near the French Natural History Museum, an amazing place where my interest in nature and biology developed. From there I moved to the University of Brest on the north-western coast of France to specialise in marine biology. It was while I was a student in Brest that my real interest in elasmobranchs began to develop and I discovered the basking shark, a species seen each year feeding at the surface off this part of the French coast.

For 10 years, I divided my time between studying basking sharks for APECS, a small French NGO, and researching marine mammals such as the grey seal and bottlenose dolphin for several other organisations. I coordinated a scientific and educational project on basking sharks in France, managed a public sightings recording scheme, did field work and set up projects to raise public awareness about these huge sea creatures. I also participated in an international basking shark satellite-tracking project in the north-eastern Atlantic.

For the past three years, I have been working for APECS on a new project on skates – elasmobranch species that are less iconic. This is a new challenge for me, not only because I'm dealing with a new species, but also because this project is conducted in collaboration with fishermen. We hope that by working with fishermen to better understand the status of skates, we will be able to contribute to setting up appropriate, efficient and accepted management measures.

WHERE I WORK

I am based in Brest at the tip of Brittany, a part of France with a very long coastline that is made up of beaches, rocky cliffs, sand dunes, coves and islands. Brest faces the Iroise Sea, an area bordered by the Celtic Sea, the Atlantic Ocean and the English Channel and known for its diversity of marine habitats and its biodiversity. It is around Brittany that I spent a lot of time at sea collecting zooplankton and looking for basking sharks to photograph their fins and tag them with satellite tags. It's also in Brittany that I spent many hours in the air scanning the sea from an aircraft to count small cetaceans and other marine megafauna.

Since the beginning of my new project, my field work has moved to two other locations along the French coast: one on the Atlantic side and the other in the English Channel. These two areas are of particular interest for skates and are known for their local skate fisheries. So my main playgrounds are in French waters, and I am convinced that elasmobranch conservation efforts need to be developed here.

WHAT I DO

The undulate ray *Raja undulata* is one of the lesser-known skates on the continental shelf of the north-eastern Atlantic Ocean and in the Mediterranean Sea. Within this relatively broad geographical range, the species' distribution seems to be quite fragmented, with some localised areas where it is abundant and may even be the dominant skate species. But further studies are needed to determine the most appropriate management measures for it.

In 2012, we started a new project whose aim is to investigate this species' population structure in French waters. During several fishing trips made in collaboration with fishermen along the Atlantic coast and in the English Channel, we have collected tissue samples by non-lethal methods and have tagged and released most of the skates caught. Working with the fishermen is very interesting. It's an opportunity to talk with them during long periods at sea and convince them of the importance of adopting appropriate management measures to preserve what is a resource to them, but is also part of the marine environment's biodiversity.

The samples we collected are being analysed as I write these words. I hope that this study will provide first insights into the population structure of undulate rays. But it's just the beginning; a lot of hard work remains to be done on this species and for its conservation, as well as for the conservation of other skate species.

GUY STEVENS

Manta TRUST

WHO I AM

I have been fascinated by the natural world all my life and growing up on a farm in south-western UK provided me with a seemingly limitless supply of weird and wonderful creatures to discover. I always knew that I wanted to make studying animals my career, but it was only when I was given a tropical fish tank at the age of 11 that my passion for the underwater world began. From that moment forward I would say 'I want to study fish!' when asked what I planned to do when I grew up. True to my word, I progressed through school and college with this in mind and in 2002 graduated from the University of Plymouth with a degree in marine biology and coastal ecology.

University opened my mind to the rest of the world and I was hungry to explore as much of it as I could. Having visited and dived in the Caribbean, Africa and Asia, I realised that I wanted to work in one of these tropical destinations, and when a job for a marine biologist in the Maldives came up in 2003 I knew it was for me.

WHERE I WORK

A marine biologist's paradise, the Maldives has the world's largest-known population of reef manta rays *Manta alfredi*. It was here that I had my first underwater encounter with any manta ray, and I was enthralled by these amazingly graceful and inquisitive creatures. Since then I've been driven by a desire to learn as much as possible about them.

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. Highly regarded within the scientific community as a non-profit and independent organisation, it is also the founding project of the Manta Trust. The MMRP was formed with a view to collecting robust and long-term data records on manta rays throughout the Maldivian archipelago to further their conservation. The information gathered relates not only to the mantas encountered, but also to environmental and climatic factors, human interactions and tourism, all of which influence the manta ray population.

WHAT I DO

Since beginning our research we have identified more than 3,700 individual manta rays from over 30,000 photo-ID sightings. We can do this because each individual has its own unique pattern of black spots on its predominantly white belly. And since the patterns do not change during the course of a manta's life, they enable us to track individuals as they are sighted over a period of decades.

Every sighting – whether of a new manta or of one already known to us – is an important piece of a huge jigsaw puzzle, enabling us to better understand the size of a population and its composition, migratory routes and reproductive output, as well as areas of critical habitat. All this information is crucial to developing effective management and conservation strategies for these increasingly vulnerable animals.

Because we have been collecting data over a long period, the population of manta rays in Maldivian waters is one of the most intensively studied manta populations globally. Our long-term research enables us to record and identify key trends and patterns within this population over time. Manta rays are an incredibly important 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 dollars for the economy annually. Being able to improve our understanding of manta

A GLOBAL STRATEGY AND ACTION PLAN FOR THE LONG-TERM CONSERVATION OF MOBULID RAYS
THE MANTA TRUST
2014
WORLDWIDE
RESEARCH, CONSERVATION, EDUCATION
OCEANIC MANTA RAY (*MANTA BIROSTRIS*)
REEF MANTA RAY (*MANTA ALFREDI*)
DEVIL RAYS (*MOBULA* SPP)

rays and pinpoint the reasons for any observed trends in – or threats to – the Maldivian population is crucial for the ongoing management and protection of these animals, and not just in the Maldives but globally too.

The Save Our Seas Foundation funded my work in the Maldives for six years and for the past two years it has supported the Manta Trust's global mobulid ray conservation project. This project aims to see all species of mobulid ray protected or effectively managed for sustainable or non-consumptive use, ideally by the people closest to them in a way that promotes wider ocean conservation. The foundation's support and guidance throughout this time has been key to my successes. I hope that through my role on the Save Our Seas Foundation's Scientific Advisory Panel I have been able to repay some of this support by assisting other manta and mobula scientists and conservationists.

DIPANI SUTARIA

WHO I AM

It was a lovely day on the water. A gentle breeze, a calm, deep blue sea with just a slight ripple – a perfect day for scanning the horizon for dolphins. And lo and behold, we caught sight of a mega-pod of spinner dolphins and were soon busy with data sheets, camera, hydrophone, stopwatch and all that jazz. We got back to shore satisfied with our day on the water. At the docking site, our fisher friends were emptying their catches from their gill-net and hook-line fishing boats. I stopped short when I noticed the largest mobulid I had ever seen, and then the largest sharks I had ever seen too. A whole school of thresher sharks, about 11 of them, an almost equal number of males and females, and each one two metres or more long. I was bewildered. I frowned. It stayed with me. The pain of seeing beauty dead. The wonder at their presence. Questions about why these adult males and females were hanging out together.

As often happens, thoughts that stick lead somewhere. Later in the year I was asked to attend a discussion on banning the practice of shark finning in India. As I prepared for the meeting, I was intrigued by how little we know about sharks in India – their diversity, ecology and life history – or about shark fisheries. At the time, CITES 2013 made a recommendation to the Indian government to list four species of elasmobranchs and manta rays under Appendix II, and Humane Society International proposed a 'Fins Attached Policy' recommendation to the Ministry of Environment, Forest and Climate Change. The project with the SOSF came about as a result of these two recommendations. I needed to know more before I could jump on any bandwagon.

I hold a PhD degree from James Cook University, Australia. My thesis focused on Irrawaddy dolphins and my research interests cover the areas of conservation, biology and behavioural ecology. I have been working as an independent ecologist in India and am currently involved in four projects on marine mammal ecology and conservation. I am interested in studying human–animal interactions in urban and wild areas, and in projects that require local community involvement in conservation. Sharks represent new research territory for me, but working in fishing communities provides a perfect opportunity to explore the relationship between people and the natural world.

WHERE I WORK

SOSF project teams are based in two states on the west coast of India: Gujarat and Maharashtra. We have chosen landing sites so that at least two types of fishing gear are covered: gill nets and trawl nets.

We are lucky to have Dr Rima Jabado advising us and, most importantly, teaching us to identify sharks and rays. When we started out, I decided to invite as many students and researchers as possible to join us and be trained by Rima. I was thrilled to see so many of them interested to learn and be part of a shark research initiative, especially students from St Xaviers College, Bombay, who are helping Mayuresh and have taken it upon themselves to voluntarily assess landings and study shark biology over the weekends. It has been so satisfying to see this enthusiasm and interest in the younger generation. Back here in Gujarat, Alissa is leading volunteers and doing her Master's thesis via our SOSF project. She has even managed to engage a young fisherman to collect data with us.

With this SOSF project I have entered territory that, for me, is uncharted –endless fishing vessels,

UNDERSTANDING SHARK FISHERIES AND STAKEHOLDER ROLE IN SHARK CONSERVATION ON THE NORTH-WEST COAST OF INDIA
JAMES COOK UNIVERSITY
2014
GUJARAT AND MAHARASHTRA, INDIA
RESEARCH, CONSERVATION
SHARKS

overcrowded landing sites, the wondrous diversity of sea life, the enormous volume of catch and by-catch, the lives of fishermen and of women in charge of selling the catch, being offered chai while waiting in ankle-deep squid ink for the sharks to be offloaded. It is a glimpse of what I guess is the bigger picture: many perspectives that need to be understood.

Fishers face a huge range of problems, from a lack of fresh water to very low fish catch per unit effort, not to mention the substantial number of foreign and out-of-state fishing vessels carrying out large-scale fishing in Indian waters. At first the top-down conservation approach makes them wary of interacting with us, but then they see us in the squid ink and rotting muck, working away just like they do. We are connected by what we both need. Somewhere, somehow it's a relationship that is working at the moment.

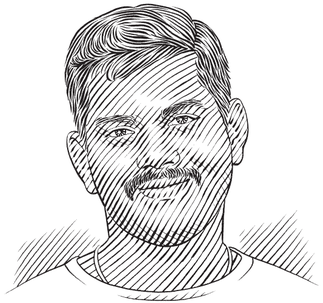
WHAT I DO

Identifying sharks is addictive, just like that crossword puzzle you can't put aside on a Sunday morning.

Our SOSF project aims to answer a host of questions relating to India's fishers and sharks. What are the different shark species landed and is there a seasonal variation in landings and life-history stages? Are there nursery grounds for different species off the Indian coastline? Is there a seasonal variation in breeding cycles across species? Do fishers know of these and can we collect data useful for sustainable fishing?

We also want to look at the impact of government policies. How successful are they? How do the fisher communities, buyers and suppliers interpret and perceive such policies? How do these policies reach ground level and what are the repercussions of them? Do Indian fishers 'fin' live sharks? Is there a target fishery for sharks, or was there in the past? What is the economic importance of sharks and shark products to stakeholders? How do fishers perceive any changes in fish and shark catch over the years?

I have seen sharks in the water only twice. Once it was a large tiger shark chasing a bottlenose dolphin in Shark Bay, Australia, and we were so relieved to see the rest of the pod arriving quickly enough to repel the shark! The next time was beneath a pink sunset off the coast of Orissa in eastern India, sitting on the top of a trawler after finishing a full day's work. It was one of those unforgettable moments: a large whale shark surfaced right next to our boat, lingered, made us smile and then disappeared into the deep emerald green. Having spent most of my time at sea rejoicing every time dolphins in our focal pod succeeded in munching down nice fat mullets, spending time with fishers and working at fish landing sites is altogether a grounding experience. This project has been very interesting and enlightening, and our research team and volunteers wish to make it a long-term adventure. We hope that we can show our results to fishers, fishery unions and stakeholders in the supply chain of shark and shark products, and to hear from them how best we can sustain their livelihoods and at the same time manage our coastal and deep-sea diversity in the long term.



'The Small Grants funding from the Save Ours Seas Foundation has enabled me to expand my pioneering research into the mobulid fisheries of India and helped to reveal the extent to which mobulids are exploited on the subcontinent.'

WHO I AM

I was born in a remote village in India and completed my secondary school education there. From childhood I had always been interested in research and so when it came to deciding what to study for my BSc I chose zoology because it's a live subject and offers more research opportunities than any other field. Usually in India, parents advise their children to become either a doctor or an engineer. But that wasn't the case for me. On my first day at college I said to myself that I should become a professor cum researcher. In pursuit of this ambition, and an MSc in zoology, I moved to Tuticorin at the southern tip of India and started working on sea turtles in collaboration with the Salim Ali Centre for Ornithology and Natural History (SACON). My MSc project, on the exploitation of sea turtles in Tuticorin District, provided new insights into the utilisation of these threatened species in the region.

In 2007, under the auspices of the Ashoka Trust for Research in Ecology and the Environment (ATREE), I began a PhD research project on 'Canopy studies in Western Ghats, India'. There I mastered the Single Rope Technique to ascend to the tree-tops to study the insects in the canopy. The following year I won a senior research fellowship from the Tuticorin Research Centre of Central Marine Fisheries Research Institute and studied the seed production of various mollusc species and rearing them in a hatchery. This gave me the opportunity to learn about the diversity and ecology of many different kinds of marine life. In the meantime I applied to pursue my PhD in zoology.

In June 2012, while visiting fish landing centres to conduct my own research, I met Daniel Fernando of the Manta Trust at Tuticorin. I learned that no work on mobulids had been done in India at that time and so I stepped forward. The Manta Trust was generous with advice and ideas about how I could study mobulids and I started out by surveying the fisheries in Therespuram and Tuticorin and working out the role they play in the local economy. The data I collected from these areas provide insight into India's mobulid fisheries. In 2014 I was awarded my PhD degree in zoology, which has encouraged me to continue my research into mobulids. As part of this journey, I have published articles about various aspects of marine biology and aim to learn more so that people will understand the importance of marine biodiversity around the globe.

WHERE I WORK

India is not only my country; it's home to many organisms from the majestic Bengal tiger to mighty whales. Many of these organisms, including my targeted species, mobulid rays, have not yet been studied. The country's mainland coastline is 6,100 kilometres long. Include the Andaman Islands in the Bay of Bengal and the Lakshadweep Islands in the Arabian Sea and it stretches to 7,517 kilometres. The subcontinent is surrounded by the Arabian Sea to the west, the Bay of Bengal to the east and the Indian Ocean to the south. India's Exclusive Economic Zone covers more than two million square kilometres. Marine fishing is therefore important, providing employment to millions of people and contributing to the country's food security. At present, fisheries and aquaculture make up 1.07% of the national GDP. That is why I want

MOHANRAJ THEIVASIGAMANI

NATIONAL ASSESSMENT OF THE INDIAN MOBULIDAE FISHERY
THE MANTA TRUST
2014
INDIA
RESEARCH, CONSERVATION
MOBULA SPP AND *MANTA* SPP

to study fisheries in detail and, in particular, find out more about the economic role of mobulid rays.

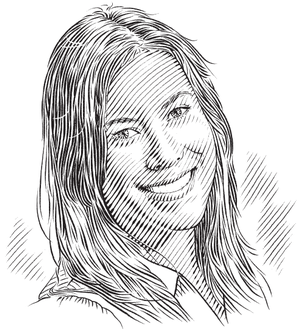
WHAT I DO

It has been observed that mobulid rays are included in the catches at many fish landing centres in India. Thus every morning I start my research at either Tuticorin or Tharuvaikulam, calling the local fishers beforehand to check whether they were going out to catch tuna (gill nets for tuna are the main source of mobulid by-catch). Fortunately I have a good relationship with the fishers in all my study areas. Once at the landing centre I measure the disc width and body length of the rays that have been caught and take tissue samples for genetic studies, keeping the samples in micro centrifugal tubes with ethanol to preserve them.

The data I collect shed light on the size structure and diversity of mobulid rays in India as well as the size of the fishery. Importantly for the sustainable management of this fishery, they also provide insight into the trade in meat and gill plates. By-catch data from the past two years indicate that the exploitation of mobulids in this country is significant. The fishing villages of Tharuvaikulam and Tuticorin contribute approximately 360 tonnes and 225 tonnes of mobulid rays per year respectively. In local markets the price for meat is Rs70–100 (US$1–US$1.6) per kilogram; for gill plates it varies between Rs7,000 (US$112) and Rs9,000 (US$145) per kilogram. Based on annual landings, this study is vital for the conservation of mobulid rays in India.

SUE-ANN WATSON

'Thanks to the Save Our Seas Foundation, I am conducting a research project to determine the potential for light to mitigate the negative effects of global change on giant clams through their relationship with symbiotic algae. If water clarity can be maintained, we may be able to ensure that there is adequate light for giant clams – and a future for them.'



WHO I AM

I was born near London in England, quite far from the sea and even further from coral reefs. But I've always loved being in, on and by the ocean. I studied biology at the University of Nottingham to gain a broad background in biological sciences and by my second year I knew I wanted to focus on the ocean and become a marine biologist. After finishing my undergraduate degree, I moved to Southampton on the south coast of England where I studied for a Master's degree in oceanography at the National Oceanography Centre, with a special research project on deep-sea biology. Fascinated by the secrets of the ocean, I gained a place on a research ship to investigate the unknown deep-sea creatures of the Indian Ocean. It was a real privilege to be a part of new scientific discoveries and to encounter species of the deep that no-one had ever seen before, such as giant purple sea cucumbers.

I continued at Southampton for my doctorate degree, and also teamed up with the British Antarctic Survey. My research focus moved from the deep oceans to the shallow seas, as I investigated patterns in shellfish evolution from the polar oceans to the tropics. I became particularly interested in studies that would help us understand the effects of global change on marine organisms, so I could help conserve marine ecosystems and ensure their continuance into the future in our rapidly changing world. I am really fortunate to have explored a range of marine habitats around the world and to have worked with many different people along the way.

WHERE I WORK

Queensland, where I now work, is home to Australia's Great Barrier Reef. More than 2,300 kilometres long, this is the world's largest coral reef system and it comprises over 2,900 reefs covering about 344,400 square kilometres of the Coral Sea. I am based at the Australian Research Council Centre of Excellence for Coral Reef Studies and College of Marine and Environmental Sciences at James Cook University in Townsville, near the middle section of the reef. Field work takes me to research stations such as the Australian Museum's centre on Lizard Island and James Cook University's station on Orpheus Island, and I also conduct field surveys on the reef. However, I also spend a lot of time at the aquarium that we have at James Cook University in Townsville. It contains 1.3 million litres of sea water – enough to fill half an Olympic-size swimming pool – and covers 2.2 hectares of space. This is where most of my giant clam and global change research projects are conducted.

WHAT I DO

Giant clams are iconic species on coral reefs. The largest giant clam, *Tridacna gigas*, is the biggest bivalve (two-shelled) animal in the world and can grow up to 1.3 metres long and weigh up to 500 kilograms. Giant clams are the most harvested invertebrate among Pacific Island communities and provide a vital protein source to millions of people. However, the illegal fishing of giant clams in the Indo-Pacific leads to losses of about 300,000 of them per year. These animals are consequently at risk of being overexploited and populations of most giant clam species are in decline. Some species are now extinct in parts of their former range. As a result, all giant clam species are protected under the Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES) and are listed on the IUCN Red List of Threatened Species™. Four giant clam species (*Tridacna derasa, T. gigas, T. rosewateri and T. tevoroa*) are listed as Vulnerable, which means they face a 'high risk of extinction in the wild'.

But now giant clams also face other threats. I started working on ocean acidification in 2009, when I began to study the effects on marine animals of rising carbon dioxide levels and the consequent acidification of the ocean. Since the Industrial Revolution 250 years ago, we've been burning fossil fuels that emit

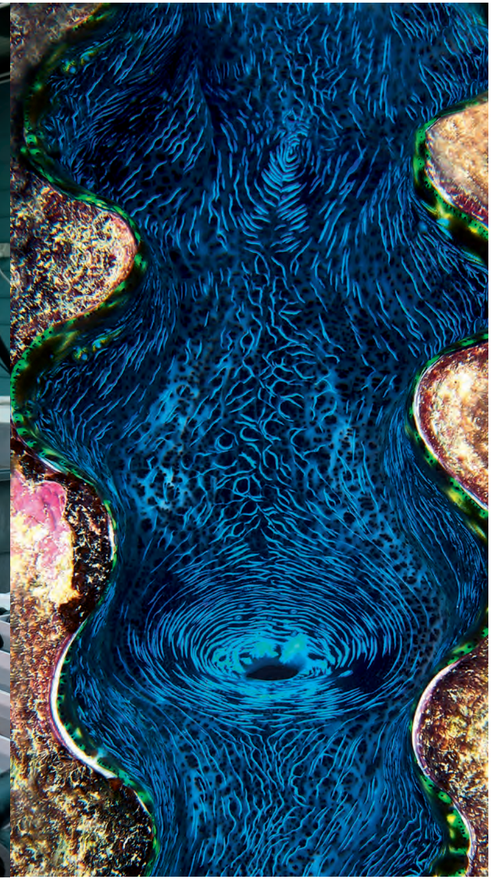
GIANT CLAMS AND CLIMATE CHANGE: OCEAN ACIDIFICATION AND GLOBAL WARMING RESEARCH FOR CONSERVATION AND MANAGEMENT
MARINE AND TROPICAL BIOLOGY, JCU I ARC CENTRE OF EXCELLENCE FOR CORAL REEF STUDIES
2014
QUEENSLAND, AUSTRALIA
RESEARCH
GIANT CLAMS (*TRIDACNA* SPP)

carbon dioxide and other greenhouse gases into our atmosphere. The oceans are in balance with the atmosphere and take up about a third of all this carbon dioxide. However, in the ocean carbon dioxide reacts with water to form an acid. Oceans are already 30% more acidic than they were 250 years ago; if we continue the current trajectory of emissions, they will be 150% more acidic by the end of this century. In addition, this rate of change is so rapid (currently 100 times faster than anything oceans have seen in the past 650,000 years) that we don't know if animals can adapt fast enough.

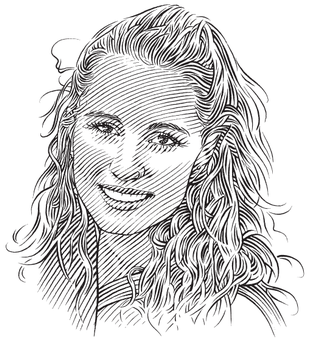
So now giant clams face not only local pressures such as overexploitation, but also global change, including the acidification and warming of the oceans. Currently, little is known about the effects of global change on giant clams and this knowledge gap limits the capacity to mitigate any impacts. Marine animals like clams, snails, urchins and corals have a large limestone shell or skeleton, but the extra acidity in the oceans hinders shell formation.

Giant clams are special, but they may also be particularly vulnerable to global change because as well as having a large limestone shell (up to 230 kilograms) to make, they are very long-lived (up to about 63 years) and take a long time to reach maturity (up to 10 years). These factors could mean that their capacity to adapt to environmental change is diminished compared to that of short-lived, fast-maturing species. My research has found that ocean acidification and ocean warming reduce growth and survival in giant clams.

But giant clams are also solar-powered animals. Like corals, they have symbiotic algae within their tissues that provide energy from sunlight – and this means that global change could bring hope for the survival of giant clams. Cloudy, turbid water and sedimentation, which result from activities such as dredging, can reduce light availability. Preserving the quality of water, and its clarity in particular, could be important in providing adequate light for giant clams. Information about giant clams' light requirements will help managers to improve the resilience of these coral reef icons in a changing ocean and help mitigate the effects of environmental change on them.



ORNELLA WEIDELI



WHO I AM

While a humpback whale and her calf surface for air, majestic killer whales chase their prey, a pod of dolphins plays in front of a stunning sunset and several shark fins mysteriously break the surface of the waves.

No, this is not a gaudy daydream, but an image of the ocean my young self created while growing up in landlocked Switzerland. Countless drawings like this from my childhood depict my early fascination for marine life, especially the large mammals. Years later, I am a doctoral student working passionately with sharks and I wonder why only their fins appeared in my paintings. Were sharks too difficult for a nine-year-old to draw? Or did I leave them hidden on purpose, so I could discover these amazing creatures at a later stage in my life?

Fourteen years later and having completed a BSc degree, in October 2009 I found myself snorkelling in the crystal-clear turquoise waters of the Bahamas within a group of Caribbean reef sharks while the famous Dr Samuel 'Doc' Gruber watched from a nearby boat. Yes, I am at the world-renowned Bimini Biological Field Station (also known as the Shark Lab) and yes, living there was the turning point in my life! After a two-month internship at the Shark Lab, I returned to Switzerland and cancelled my enrolment in a cell biology MSc programme and a project at a laboratory for infectious diseases. I moved out of my apartment, focused on a graduate programme in animal biology and purchased a plane ticket back to Bimini.

On my return to the Bimini Biological Field Station in early 2011, I dedicated my time to my research project, in which I examined the diet of juvenile lemon sharks and the effects of anthropogenic habitat destruction on their diet. Through the application of stomach eversions (a non-invasive method in which the stomach of an unconscious shark is gently pulled out of its mouth) I was able to determine what the juveniles had been eating. While most people would be disgusted by smelly, half-digested fishes and crabs, my interest in sharks, especially juvenile sharks, became even more intense.

During my seven-month tenure at the Shark Lab I acquired in-depth knowledge of the biology and ecology of sharks by also assisting with several other projects. In most cases the information came from the highly experienced Shark Lab members right there in the field, but I would extend and deepen what I learned from them by studying books and papers back on shore. From the practical perspective, there was much else that I learned about capturing and studying sharks, such as how to track juvenile lemon sharks acoustically in their shallow, mangrove-fringed nurseries; how to check long-lines throughout the night; how to catch large tiger sharks from the depths of the Gulf Stream; and how the endless scraping of fish carcasses can eventually attract hammerhead sharks. I absorbed every bit of information available. And whenever a Bahamian day ended and we were returning to the Shark Lab after a long, arduous day in the field, I would watch the setting sun. I realised how happy and fulfilled I was and decided that I would pursue my passion and become a marine biologist.

WHERE I WORK

As studying sharks requires extensive knowledge, special techniques and unique skills, it's challenging and highly competitive to find a PhD position in shark research. It took various shark-related work experiences in Florida, the Seychelles and French Polynesia, successful graduation from university, participation at international conferences and continuous networking before I was finally granted the opportunity of a lifetime: I am now a PhD candidate investigating the ecology of juvenile blacktip reef sharks

Carcharhinus melanopterus and sicklefin lemon sharks *Negaprion acutidens*, which co-occur at a remote nursery atoll in the Seychelles. St Joseph Atoll, which is part of the Amirante Islands of the Republic of Seychelles, is home to the newly established SOSF D'Arros Research Centre to which my study is affiliated. This project is perfect because it fulfils my aspirations as a research scientist and at the same time offers me the opportunity to participate in the field study of my favourite animals.

WHAT I DO

Wherever ecologically similar species co-exist in a habitat, interspecific competition can be avoided if the natural resources are partitioned between the species. As blacktip reef and sicklefin lemon sharks in other locations show overlaps in their use of nursery habitat, their diet and their reproductive cycles, we expect to find potential competition patterns at St Joseph Atoll. The main objective of my study is to ascertain how the juveniles of the two shark species are able to co-exist in a small and resource-restricted habitat. By looking at where and when they use their habitat and at their preferred diet, I will unveil the strategies of each species that enable them to occur together in one habitat.

While scientific data about the blacktip reef shark are available from several locations, data about the sicklefin lemon shark are very rare. The sicklefin lemon shark is assessed as globally Vulnerable by the IUCN Red List, is locally extinct in India and Thailand and is endangered in South-East Asia. Therefore, the published results of my study will on one hand contribute valuable scientific knowledge, and on the other hand will improve and promote the conservation of this data-deficient shark species.

HABITAT AND RESOURCE PARTITIONING OF JUVENILE SHARKS AND THEIR ROLES IN REMOTE COASTAL ECOSYSTEMS

SOSF D'ARROS RESEARCH CENTRE | CRIOBE | EPHE

2014

D'ARROS ISLAND AND ST JOSEPH ATOLL, SEYCHELLES

RESEARCH

BLACKTIP REEF SHARK (*CARCHARHINUS MELANOPTERUS*)

SICKLEFIN LEMON SHARK (*NEGAPRION ACUTIDENS*)

BARBARA WUERINGER

PILOT STUDY OF THE DISTRIBUTION AND ABUNDANCE OF ENDANGERED AND RARE SHARK-LIKE BATOIDS OFF CAIRNS
SHARKS AND RAYS AUSTRALIA (SARA)
2014
NORTH QUEENSLAND, AUSTRALIA
RESEARCH, CONSERVATION
NARROW SAWFISH (ANOXYPRISTIS CUSPIDATA)
SHARK RAY (RHINA ANCYLOSTOMATA), PRISTIS SPP

'Just like the Save Our Seas Foundation, I believe that long-term conservation goals can only be achieved if they are based on sound science, public outreach and working with local stakeholders –not against them. With this in mind, I aim to put Cairns and Cape York on the map when it comes to research-based tourism.'

WHO I AM

I grew up in Austria, a land-locked country in the heart of Europe. My parents love travelling and whenever they could take time off, they would pack the Volkswagen Kombi and drive to the sea with my brother and me. We spent all my childhood summers on the Mediterranean coast and one of my first memories of the ocean – I was too young to remember my age – is from Turkey. My mom left an empty, but not clean, soup can overnight in shallow water. When we returned to it the next day there was an octopus inside. What a fascinating animal to discover at such young age. Of course we released it alive!

At the age of 14 I became an Open Water Diver at the Great Barrier Reef, Australia. When I saw my first shark in the wild, I realised that these animals were nothing like the media portrayed them to be. After volunteering at Doc Gruber's Shark Lab in the Bahamas, I was completely hooked on sharks and rays.

My studies allowed me to return to Australia, where I now live. Here I started to work on the sensory biology of shovelnose rays. They always say that you are what you eat, but I think you also are what you perceive. Imagine you could see the UV patterns on flowers as bees do, or you could hear like an owl! We never think about how strongly our own sensory abilities influence our behaviour, thoughts and feelings. I believe that people fear sharks because our senses do not work as well underwater as they do on land, our natural habitat. The discomfort that people experience when, for example, they swim in the ocean and cannot fully perceive what is moving underneath them is then projected onto predators that are perfectly adapted to their environment – sharks.

I moved to Cairns more than six years ago while investigating the sensory abilities and feeding behaviour of sawfish for my PhD. I was collaborating with a local company that caught sawfishes in the remote regions of Cape York to be put on display in public aquaria around the world. This trade has since stopped, but the sawfishes I worked with continue to inspire people all over the globe.

WHERE I WORK

The city of Cairns in Far North Queensland, Australia, is often called the gateway to the Great Barrier Reef, which well over 100,000 people flock to every year. Interestingly, when it comes to shark research or shark-based tourism, Cairns is not really on the map. It is, however, the last city you pass through en route northwards to the remote regions of Cape York.

As well as being ancient, the landscapes of Cape York are highly variable due to the alternating dry and wet seasons. Since Aboriginal settlement more than 40,000 years ago, fires have also had a major influence on the vegetation. Cape York country is wild and sparsely populated. When the monsoonal rains kick in, river crossings along the few roads become impassable and remain so for months. Field work in Cape York's remote rivers and along its coastline is carried out under the watchful eyes of saltwater crocodiles, an ancient predator that can easily reach five metres in length. Few people know that these rivers and the coastline are also inhabited by some of the last remaining healthy populations of four species of sawfishes.

I will never forget the moment that I saw my first wild sawfish. We were in a very remote location close to the tip of Cape York in the north-eastern Gulf of Carpentaria. It was a 4.5-metre green sawfish that had become entangled in our gill net in knee-deep water. The animal was so massive that when we first caught sight of it from the shore we thought we had caught a dugong. We tagged and released it. But the question of how these animals live has mesmerised me ever since.

WHAT I DO

Working in the firm belief that long-term conservation goals can only be achieved if they are based on sound science and if local people understand and support them, I intend to bring research-based tourism to Cairns and Cape York. Sharks and Rays Australia (SARA) has been set up and a network of local volunteers, local tourism providers, NGOs and indigenous rangers has been created. A pilot study into the feasibility of the project, funded by the Save Our Seas Foundation, is ongoing. Its aims are to identify how local stakeholders can be involved in the project and how a tagging study of sharks, rays and sawfishes out of Cairns and in Cape York can be publicly funded in order to ensure its continued long-term existence.

PROJECT LEADER PROFILES - SUMMARY

AN INTRODUCTION TO OUR PROJECT LEADERS WHOSE PROJECTS ARE A CONTINUATION FROM THE PREVIOUS YEAR(S) AND WERE FUNDED DURING 2014. THEIR COMPLETE PROFILES ARE AVAILABLE IN THE 2013 EDITION OF OUR ANNUAL REPORT AS WELL AS ON OUR WEBSITE.

LILIANA AYALA

FIRST ASSESSMENT OF MANTA AND MOBULA RAYS FISHERY IN PERU
ASOCIACIÓN PERUANA PARA LA CONSERVACIÓN DE LA NATURALEZA (APECO)
2013, 2014
TUMBES DEPARTMENT, PERU

Research, Conservation
Manta (*Manta* spp) and devil ray (*Mobula* spp)

Slow-breeding manta and mobula rays are easily overfished. Liliana is conducting the first study of mobulid fishing in Peru – a vital step to ensuring these species' survival in the region.
We need to know the size of this fishery in order to inform authorities and establish strategies to manage it. This project will assess the species, gear characteristics, quantities, ports and seasons in which fishermen are catching mobulid rays.

ADAM BARNETT & RICHARD FITZPATRICK

ACTIVITY PATTERNS OF REEF SHARKS: DOES TOURISM AFFECT THEIR HEALTH?
OCEANS IQ
2013, 2014
OSPREY REEF, CORAL SEA, AUSTRALIA

Research, Conservation, Education
Whitetip reef shark (*Triaenodon obesus*)
Grey reef shark (*Carcharhinus amblyrhynchos*)

Divers love seeing sharks, which often means attracting them with food. But how does this affect their behaviour and metabolism? Adam and Richard's project will provide best-practice guidelines for shark ecotourism operators.
Shark ecotourism is a growing, multi-million dollar industry worldwide, with many dive companies marketing trips specifically to feed sharks. Although this is a controversial issue, information about how provisioning sharks, or tourism in general, affects their natural behaviour and health is still limited.

PETER BUSHNELL

OLD AND COLD; CONSERVATION OF GREENLAND SHARKS
INDIANA UNIVERSITY SOUTH BEND
2011–2014
QEQERTARSUAQ (GODHAVN), DISKO ISLAND, GREENLAND

Research, Conservation
Greenland shark (*Somniosus microcephalus*)

A remarkable creature lives beneath the ice floes of the Arctic. Greenland sharks swim excruciatingly slowly, have been known to eat polar bears and live for an implausibly long time. Peter is bringing their mysteries to the surface.
Fishing pressure and a lack of basic knowledge about the species' natural history are threats to the future of the Greenland shark *Somniosus microcephalus* – thought by some to be the longest-lived vertebrate on earth. Effective conservation and management of any fish species requires a thorough understanding of growth rates, age at first reproduction, fecundity, distribution, population structure, etc.

PAUL COWLEY

THE ACOUSTIC TRACKING ARRAY PLATFORM (ATAP) - A NATIONWIDE MARINE SCIENCE PLATFORM
SOUTH AFRICAN INSTITUTE FOR AQUATIC BIODIVERSITY
2013, 2014
SOUTHERN AFRICA COASTLINE, EASTERN ATLANTIC & SOUTH WESTERN INDIAN OCEAN

Research, Conservation, Education
Marine megafauna

The Acoustic Tracking Array Platform (ATAP) covers thousands of kilometres of the southern African coast. Scientists are able to use this collaborative array to paint a picture of how fish and shark species behave along the coastline to better manage and protect them in the future.
South Africa is a biodiversity hotspot boasting a high degree of endemic marine species that are biogeographically restricted by the presence of two contrasting boundary currents. The ATAP provides a fantastic opportunity to study multiple-year migration patterns and shed light on the possible effects of climate change.

NICK DULVY

A GLOBAL MANTA AND DEVIL RAY CONSERVATION STRATEGY
IUCN SHARK SPECIALIST GROUP | SIMON FRASER UNIVERSITY
2013, 2014
WORLDWIDE

Conservation
Manta (*Manta* spp)
and devil ray (*Mobula* spp)

Globally, manta and mobula rays are under serious threat as they are targeted for their gill plates, which are sold as a treatment in traditional Chinese medicine. Nick is developing a worldwide network and strategy to ensure these rays remain a part of our oceans.
Manta and devil rays are threatened by the international trade in their valuable gill plates. This, combined with their slow life history, high catchability and global distribution, means that we need a global focus to ensure effective conservation.

IGBAL ELHASSAN

POPULATION GENETICS OF SOME SHARK SPECIES FROM THE RED SEA
UNIVERSITY OF BAHRI
2013, 2014
THE RED SEA (SUDAN,YEMEN, ERITREA AND SOMALIA)

Research, Conservation
Sharks

Igbal is Sudan's first shark scientist. She has spent years collecting tissue samples of sharks at local landing sites. Using genetics, she hopes to crack the code of shark populations in the Red Sea.
To date no studies have been conducted on the genetic diversity or population structure of sharks along the Red Sea. Information about stock structure and migration rate and estimates of population size are important for effective conservation and management strategies for this fragile resource.

DANIEL FERNANDO

GLOBAL MOBULA RAY TAXONOMIC, MORPHOLOGICAL AND GENETIC IDENTIFICATION GUIDE
THE MANTA TRUST
2013, 2014
WORLDWIDE

RESEARCH, CONSERVATION, EDUCATION
MANTA (*MANTA* SPP) AND
DEVIL RAY (*MOBULA* SPP)

Vulnerable mobulids include two manta and nine mobula species. Because they all look alike, it is difficult to identify different species. Daniel is compiling the world's first mobulid ID guidebook and genetic identification kit.
Species identification of mobulid rays has proven to be very problematic due to their similar external features, resulting in misidentification even in current scientific literature and highlighting the necessity for a set of clear identification tools to help current and future researchers fill in the large gaps in knowledge. This lack of available data for mobulid rays is currently severely impeding the conservation process.

SONJA FORDHAM

BUILDING SHARK ADVOCATES INTERNATIONAL
SHARK ADVOCATES INTERNATIONAL
2011–2014
WORLDWIDE

CONSERVATION
SHARKS & RAYS

There are more than 1,000 species of sharks and rays in our oceans. Sonja champions their survival by attending meetings all over the world and convincing policy-makers to show some love to even the smallest skate.
The International Union for Conservation of Nature (IUCN) classifies nearly one-third of the world's 1,044 assessed shark species (including rays and chimaeras) as Near Threatened or Threatened; some local populations are assumed already extinct. Scientists warn of negative consequences for marine ecosystems and biodiversity if the populations of these predators are depleted. Fishermen and divers, as well as coastal communities, also rely on healthy shark and ray populations.

CAT GORDON

BASKING SHARK COMMUNITY PROJECT
THE SHARK TRUST
2003–2014
UNITED KINGDOM, NORTH ATLANTIC

RESEARCH, CONSERVATION, EDUCATION
BASKING SHARK
(*CETORHINUS MAXIMUS*)

Basking sharks were heavily fished in the past. Now these gentle and elusive giants are protected in Europe, but we still have a lot to learn about them. Using a collaborative photo-ID database, Cat wants to understand their life history and movements.
At up to 10 to 11 metres in length and five to seven tonnes in weight, the basking shark *Cetorhinus maximus* is the second largest fish in the world. However, as a result of fishing pressure, its global existence is now seriously threatened, with the species' total population thought to have diminished to about 8,200 individuals.

SAMUEL GRUBER

ELASMOBRANCH RESEARCH, EDUCATION AND CONSERVATION IN BIMINI, BAHAMAS
BIMINI BIOLOGICAL FIELD STATION FOUNDATION
2013, 2014
BIMINI, BAHAMAS
RESEARCH, CONSERVATION, EDUCATION
SHARKS

Samuel, better known as Doc, has been studying sharks for 50 years. He discovered how sharks see and even gave us insights into how they think. He founded the Bimini Biological Field Station in 1990, and has been training and inspiring young shark researchers ever since.
Adequate conservation and management of shark populations is becoming increasingly important on a global scale, with declines documented worldwide. A recent study estimated the total catch and fishing-related mortality for sharks globally was more than 100,000,000 sharks per year. There is an urgent need for the collection of biological information about many shark species, which the Bimini Biological Field Station Foundation aims to address.

TRISTAN GUTTRIDGE

ELASMOBRANCH RESEARCH, EDUCATION AND CONSERVATION IN BIMINI, BAHAMAS
BIMINI BIOLOGICAL FIELD STATION FOUNDATION
2013, 2014
BIMINI, BAHAMAS
RESEARCH, CONSERVATION, EDUCATION
SHARKS

To protect Bimini's great hammerheads, we need to know where they go. With the help of a network of receivers, Tristan, director of the Bimini Biological Field Station, is recording and studying the movements of this shark and other species around the island.

BIMINI BIOLOGICAL FIELD STATION FOUNDATION
SHARKLAB · SOUTH BIMINI, BAHAMAS

JASON HALL-SPENCER

ASSESSING THE ECOSYSTEM EFFECTS OF OCEAN ACIDIFICATION
PLYMOUTH UNIVERSITY
2009–2014
WORLDWIDE
RESEARCH
MARINE ECOSYSTEM

Our planet is warming and the chemistry of ocean waters is changing. Jason wants to understand the significance of this. He is studying underwater volcanoes to see how increased levels of carbon dioxide affect marine ecosystems.
Our seas currently absorb more than 25 million tonnes of CO_2 every day. This has caused surface waters to become 30% more acidic since the widespread burning of fossil fuels began. We need to understand the effect this will have on marine communities.

ALI HOOD & CAT GORDON

THE GREAT EGGCASE HUNT (GEH)
THE SHARK TRUST
2010, 2012–2014
UNITED KINGDOM, NORTH ATLANTIC

RESEARCH, CONSERVATION, EDUCATION
SHARKS, SKATES AND RAYS

Have you ever found a strange-looking, leathery pocket washed up on the beach? It was probably the empty eggcase of a shark or skate. Recording where you have seen these eggcases helps Ali and her team learn about the animals that laid them.
The Great Eggcase Hunt not only raises awareness of the diversity of elasmobranchs in British waters, but also engages the public in the intrigues of the UK foreshore and the myriad of items they can discover.

ROBERT HUETER & KIM BASSOS-HULL

TRINATIONAL CONSERVATION RESEARCH ON THE SPOTTED EAGLE RAY
MOTE MARINE LABORATORY, INC.
2013, 2014
USA, MEXICO AND CUBA | GULF OF MEXICO AND CARIBBEAN SEA

RESEARCH, CONSERVATION, EDUCATION
SPOTTED EAGLE RAY (*AETOBATUS NARINARI*)

Kim and Robert are creating a portrait of the spotted eagle ray in the United States, Mexico and Cuba. Their work is providing important insights into protecting these graceful creatures across international boundaries.
The spotted eagle ray is a highly vulnerable elasmobranch species about which little is known, and yet target fisheries are taking these rays in the Gulf of Mexico and Caribbean Sea. By sharing information, expertise and experience among colleagues, students and stakeholders of multiple nations, they will be able to make significant gains in understanding the biology of the spotted eagle ray and the threats it faces, and in forging management strategies to ensure its survival.

FRANCES HUMBER

SHARK ASSESSMENT AND CONSERVATION IN MADAGASCAR USING MOBILE PHONE TECHNOLOGY
BLUE VENTURES CONSERVATION
2013, 2014
ATSIMO ANDREFANA AND MENABE REGIONS, WEST MADAGASCAR

CONSERVATION
SHARKS

Madagascar's sharks are in steep decline. Frances has trained members of the Vezo community to collect real-time information about local shark fishing using mobile phones.
A major stumbling block to establishing effective and broad-scale conservation of shark species is the paucity of information on their ecology, fisheries and socio-economic value. In the absence of any such understanding, diverse and unconnected stakeholders have no basis or motivation to enact meaningful conservation measures.

LUCY KEITH DIAGNE

AFRICAN MANATEE RESEARCH AND CONSERVATION
SEA TO SHORE ALLIANCE
2009, 2011–2014
GABON AND SENEGAL

RESEARCH, CONSERVATION
AFRICAN MANATEE
(*TRICHECHUS SENEGALENSIS*)

Although they are found in 21 countries, West African manatees are rare and incredibly secretive. Lucy is creating a network of collaborators to help her learn more about this forgotten sirenian and how to conserve it.
The West African manatee is one of the least understood and least studied marine mammals in the world. Conservation efforts are hindered by a lack of basic information about the species and are also unsustainable without local capacity building.

SARAH LEWIS

INDONESIAN MANTA RESEARCH PROJECT
THE MANTA TRUST
2011–2014
INDONESIA

RESEARCH, CONSERVATION, EDUCATION
REEF MANTA RAY (*MANTA ALFREDI*) AND
OCEANIC MANTA RAY (*MANTA BIROSTRIS*)

Despite being a top manta tourism destination, Indonesia was one of the largest manta fishing nations. Sarah has been there since 2010 learning about these vulnerable rays and raising awareness about their plight.
Increased demand for manta gills used in Chinese medicine is changing what was previously a limited-scale subsistence fishery in Indonesia into an expanding commercial fishery, and the number of mantas caught each year has risen dramatically. Due to their life history (slow growth, late age of sexual maturation and low fecundity) manta rays have a limited capacity to recover from overfishing, and population declines have already been observed in certain areas of Indonesia where fishing pressure is high.

LARA MARCUS ZAMORA

ENVIRONMENTAL AND BIOLOGICAL FACTORS DRIVING WHALE SHARK DISTRIBUTION AND ABUNDANCE
INSTITUTE FOR MARINE AND ANTARCTIC STUDIES
2013, 2014
NINGALOO REEF, WESTERN AUSTRALIA, INDIAN OCEAN

RESEARCH
WHALE SHARK (*RHINCODON TYPUS*)

Every year, hundreds of whale sharks congregate at Ningaloo Reef in Western Australia. Lara wants to know why. She believes that the secret behind their annual visit is hidden in their stomachs.
Although it's the largest fish in the world, the whale shark is also one of the least-studied shark species and its status is vulnerable. It is very important to gain new insights into the basic ecology of the whale shark in order to assist in the development of national and international management and conservation programmes.

JEANNE MORTIMER

COMMUNITY MONITORING OF NESTING SEA TURTLES AT D'ARROS AND ST JOSEPH, SEYCHELLES
SAVE OUR SEAS FOUNDATION
2013, 2014
D'ARROS ISLAND AND ST JOSEPH ATOLL, SEYCHELLES

RESEARCH, CONSERVATION, EDUCATION
TURTLES

The beaches of D'Arros Island and St Joseph Atoll are very important places for mother sea turtles to come and lay their eggs. Jeanne is training Seychellois monitors to observe nesting turtles and collect data about them.
IUCN lists the hawksbill as Critically Endangered globally and the green turtle as Endangered. Green turtle populations are particularly endangered in the Inner Islands and the Amirantes Group of Seychelles. The Government of Seychelles recognises this endangerment and has passed legislation to protect turtles and implemented policies to encourage conservation efforts at the local level. More than 15 long-term sea turtle monitoring programmes have been implemented in Seychelles since 1968 and most of them are ongoing.

NICOLAS PILCHER

SEA TURTLE CONSERVATION IMPERATIVES IN MALAYSIA
MARINE RESEARCH FOUNDATION
2009–2014
SABAH, MALAYSIA

RESEARCH, CONSERVATION, EDUCATION
GREEN TURTLE (*CHELONIA MYDAS*)

Nick is on a mission to save Malaysia's turtles. By convincing policy-makers and fishermen to equip shrimp trawlers with Turtle Excluder Devices and studying the ecology of the turtles, he's tackling the problem head on.
Marine turtles are integral components of the Sulu–Sulawesi marine ecosystems, and provide tangible ecotourism services as well as support for cultural and traditional values. Marine turtles also possess, through their charismatic qualities, an ambassadorial value for wider conservation issues. The conservation of marine turtles is thus a critical step in promoting conservation of the wider marine ecosystem, enhancing marine stewardship and promoting more sustainable fishery practices.

GUY STEVENS

SPATIO-TEMPORAL MOVEMENTS OF MANTA RAYS
SOSF D'ARROS RESEARCH CENTRE | THE MANTA TRUST
2013, 2014
D'ARROS ISLAND AND ST JOSEPH ATOLL, SEYCHELLES

RESEARCH
REEF MANTA RAY (*MANTA ALFREDI*)

There is a very lucky population of manta rays that lives at D'Arros Island in the Seychelles. These mantas not only live in a relatively pristine habitat, but are also safe from fishing. This gives researchers a unique opportunity to learn about how these intriguing animals live when they are free from human influence. Investigating the spatial and temporal habitat usage of these rays will have important uses in assessing habitat selection and may allow us to define critical habitats based on behavioural as well as environmental attributes. For a species listed on the IUCN Red List as 'Vulnerable' and recently added to CITES Appendix II, this will enhance the capacity for conservation and will identify critical habitats within the region for protection.

ALISON TOWNER

PASSIVE ACOUSTIC MONITORING OF *CARCHARODON CARCHARIAS* IN GANSBAAI, SOUTH AFRICA
DYER ISLAND CONSERVATION TRUST
2013, 2014
DYER ISLAND, SHARK BAY, GANSBAAI, WESTERN CAPE, SOUTH AFRICA

RESEARCH, CONSERVATION, EDUCATION
WHITE SHARKS (*CARCHARODON CARCHARIAS*)

Alison is researching great whites in this hotspot of shark cage diving to uncover how the industry affects the animals' behaviour and what other factors make Gansbaai the white shark capital of the world. The unique environmental characteristics of Gansbaai make it the ideal site to test hypotheses regarding the influence of physical oceanography, prey species distribution and the activities of cage diving vessels on great white shark behaviour. This will be the first study of its kind to quantify and establish how white sharks of different sizes and both sexes use an aggregation site that is impacted by dynamically changing environmental drivers, such as upwelling.

SARAH WARIES

SHARK SPOTTERS: FINDING A BALANCE BETWEEN RECREATIONAL WATER USER SAFETY AND WHITE SHARK CONSERVATION
SHARK SPOTTERS
2010–2014
CAPE TOWN, SOUTH AFRICA
RESEARCH, CONSERVATION, EDUCATION
GREAT WHITE SHARK
(*CARCHARODON CARCHARIAS*)

Cape Town is a city of ocean lovers – and great white sharks. But rather than eliminating these beautiful animals, the City has found a way to live with them. Shark Spotters are always on the lookout for sharks and warn beach-goers when one is approaching. They believe that if they can reduce the already small risk of a shark bite, then they can make a meaningful contribution to white shark conservation, contribute to community well-being, and set a precedent for how people and sharks can co-exist.

ALISON KOCK

& MONWABISI SIKWEYIYA

SHARK SPOTTERS
SAFETY CONSERVATION EDUCATION RESEARCH

ELIZABETH WOOD

COMBATING DESTRUCTIVE FISHING IN SABAH USING AN INNOVATIVE ACOUSTIC SYSTEM
MARINE CONSERVATION SOCIETY
2013, 2014
SABAH, EAST MALAYSIA
CONSERVATION
REEF CORALS

Fishing using explosives is severely destructive and illegal, but perpetrators are seldom prosecuted. Elizabeth is developing underwater listening devices that will alert rangers to the site of an explosion, enabling them to catch bombers red-handed.
Fish bombing is one of the most destructive forms of fishing known and has been rampant in the park area for the past 50 years, causing severe damage to the health and biodiversity of coral reefs, the local economy and the livelihoods of other fishermen. The project will not only help protect biodiversity in this exceptional area in the heart of the Coral Triangle, but will provide a model and inspiration for similar initiatives elsewhere in Sabah and further afield, where fish bombing is still causing major habitat destruction.

JANIE WRAY

& HERMANN MEUTER

IDENTIFYING CRITICAL HABITAT FOR KILLER WHALES IN NORTHERN BRITISH COLUMBIA
NORTH COAST CETACEAN SOCIETY (CETACEALAB)
2012–2014
CAAMANO SOUND, BRITISH COLUMBIA, CANADA
RESEARCH, CONSERVATION
NORTHERN RESIDENT KILLER WHALES

Janie and Hermann are working for the protection of orcas in the Great Bear Rainforest by tuning into underwater hydrophones and deciphering the secret language of these majestic animals.
The information collected is particularly important to the recovery efforts for northern resident killer whales (NRKW) in light of increased risks to these animals. They send all their data to Fisheries and Oceans Canada's (DFO) Cetacean Research Program so that they can be incorporated into its assessments of NRKWs along the coast. Their project will also increase the community's capacity to manage cetaceans and will provide sound information that can be applied to the management of numerous proposals for development and other human activities.

JEANETTE WYNEKEN

TRACKING NEONATE SEA TURTLES TO DISCOVER THEIR OFFSHORE HOMES
FLORIDA ATLANTIC UNIVERSITY
2009–2014
FLORIDA, USA
RESEARCH, CONSERVATION
LEATHERBACK (*DERMOCHELYS CORIACEA*)

Sea turtles need a safe place to live during each of their life stages. To protect them, we need to know where they go. Jeanette has spent years learning how to tag hatchlings of different turtle species to discover their early travel destinations.
Recovery of sea turtles requires an understanding of their spatial distributions, potential threats and life stage-specific survival, as well as the identification of important nursery habitats. But the early life histories of neonate sea turtles remain poorly understood because of technological limitations. This project will develop methods for tagging young turtles to help close this knowledge gap.

SCHOLL MICHAEL | CHIEF EXECUTIVE OFFICER

Michael is the chief executive officer of the Save Our Seas Foundation, which allows him to merge decades of experience in science, conservation and education and his lifelong passion for conserving sharks and the oceans.

Born in land-locked Switzerland along the shores of Lake Geneva, Michael's love for the ocean transcended his personal geography. He attended the University of Lausanne in Switzerland and graduated from the University of Aberdeen in Scotland with a BSc in zoology.

His initial field experience with sharks began in 1995 at the Bimini Biological Field Station in the Bahamas. He then spent the next decade studying the population and ecology of white sharks around Dyer Island in South Africa. In 2002, he founded the White Shark Trust to support research, education and conservation projects focused on white sharks.

His genetic, tagging and fin-printing studies were integral to discovering a link between South African and Australian white shark populations. This work was a major factor in the decision to list white sharks on CITES in 2004.

Michael's research and conservation efforts have been featured in numerous television documentaries produced by the likes of BBC, National Geographic, and Discovery Channel as well as publications such as *Science*, *Nature*, *BBC Wildlife Magazine*, and *Africa Geographic*. In 2006, Michael co-authored *South Africa's Great White Sharks* (Struik Publishers) with photographer Thomas P. Peschak.

Michael taught bilingual high school and IB level biology, mathematics and physics classes in Lausanne, Switzerland, and worked for South African explorer Mike Horn on the Pangaea Expedition, assisting Young Explorers worldwide to establish environmental and social projects.

PESCHAK THOMAS | DIRECTOR OF CONSERVATION

As well as being director of conservation for the Save Our Seas Foundation (SOSF), Thomas is an assignment photographer for *National Geographic Magazine*. Also a senior fellow of the International League of Conservation Photographers, he is regarded as one of the 40 most influential nature photographers in the world. He leads a near-continuous nomadic existence, spending most of the year in the field on assignments around the globe.

Originally trained as a marine biologist, Thomas retired from science field work in 2004, choosing to become an environmental photojournalist when he realised that photographs could make a greater conservation impact than statistics do. As SOSF's director of conservation, he strives to merge photojournalism, documentary filmmaking and cutting-edge science to create powerful media projects that tackle some of the most critical marine conservation issues of our time.

Thomas has written and photographed five books: *Currents of Contrast*, *Great White Shark*, *Wild Seas Secret Shores* and *Lost World*. His latest publication, *Sharks and People*, was released in 2013 and chronicles the relationship between humans and sharks around the world. He is a multiple winner in the BBC Wildlife Photographer of the Year Awards and in 2011 and 2013 he received World Press Photo Awards for his work.

FOWLER SARAH | PRINCIPAL SCIENTIST

Sarah has a first class joint honours degree in zoology and marine zoology from the University College of North Wales, an MSc in conservation from University College London and 30 years of professional experience as a marine biodiversity conservation expert. She has worked in various capacities for government departments, national and international NGOs and a biodiversity consultancy. Having been appointed to the IUCN Shark Specialist Group in 1991, she chaired it for many years and is now its vice-chair for international treaties.

Sarah founded the European Elasmobranch Association and its UK member, the Shark Trust (and is a trustee of the latter). She was appointed Officer of the Order of the British Empire for services to marine conservation in 2004, and a Pew Fellow in Marine Conservation in 2005. She became principal scientist for the Save Our Seas Foundation in 2011.

SOSF STAFF

BRUYNDONCKX NADIA | EXECUTIVE ASSISTANT AND SCIENTIFIC ADVISOR

Nadia is a doctor in biology who joined the team of the Save Our Seas Foundation in spring 2013. Based in Geneva, she works with Michael Scholl as an executive assistant and scientific advisor.

Animals and nature have fascinated Nadia since her childhood so it was a natural progression for her to study biology to better understand the wonders of the animal kingdom. For her PhD she researched the conservation and co-evolution of bats and parasites using several molecular tools. Bats, she established, are fascinating animals that can help to explain the role of scientists and make people sensitive to conservation and other environmental issues. Having completed her own PhD, Nadia became the coordinator of a doctoral programme, organising courses and workshops for PhD students in ecology and evolution. In 2012 she took over the administration of a biology department, dealing with finances and human resources.

A field biologist familiar with unpopular animals, Nadia also has solid expertise in administrative management. But it was while qualifying for her advanced diver certificate that she became sensitive to the vulnerability of the oceans and the importance of preserving them. After several years in science and administration, she decided to use her diverse skills to help to promote the conservation and protection of marine environments.

STEVENS GUY | SPECIAL MOBULIDAE ADVISOR

Guy has always been fascinated by the natural world, especially life under the sea. He progressed through school and university with this in mind, graduating from the University of Plymouth in 2002 with a degree in marine biology and coastal ecology. After university he moved to the Maldives to work as a marine biologist and in 2005 he founded the Maldivian Manta Ray Project (MMRP) to help protect the country's manta population through active research and education. Guy's conservation efforts in the Maldives have led to the creation of several Marine Protected Areas (MPAs) at key manta aggregation sites. For six years his MMRP work in the region was funded and supported by the Save Our Seas Foundation (SOSF). In 2011 Guy went on to found the Manta Trust. The mission of this UK-registered charity is to advance the worldwide conservation of mobulid rays and their habitat through robust science and research and by raising awareness about them and providing education, influence and action. With a vision of a world in which manta and mobula rays thrive within a globally healthy marine ecosystem, the trust now has projects in 16 different countries.

The SOSF also supports various other mobulid ray research and conservation projects globally. As a leading expert on the science and conservation of mobulid rays, Guy has a role within the Foundation to advise it on such projects so that an effective conservation strategy for these increasingly vulnerable species is realised.

Guy is also working towards the completion of his PhD on his manta research at the University of York in the UK.

KUBICKI STEFAN | IT AND WEB OFFICER

Stefan grew up in North Dakota, about as far away as it's possible to get from the coast in the USA. He first developed a fascination with sharks and the underwater world thanks to nature documentaries and well-worn issues of *National Geographic*. He began his career as an analyst at a UN-based NGO in New York before moving to London, where he worked as a web developer and advisor to several startup companies. He joined the Save Our Seas Foundation in 2010. Aside from his work for the foundation, Stefan is an award-winning filmmaker whose films have screened at festivals around the world.

BOONZAIER LISA |
CONTENT MANAGER AND SCIENCE EDITOR

Growing up in Cape Town with weekends spent at the coast, roaming freely along the shoreline, exploring rock pools and falling asleep to the sound of the waves led Lisa, not unexpectedly, to fall in love with the ocean. She completed her undergraduate and Honours degrees in biological sciences at the University of Cape Town in 2007 before entering the world of digital magazines and publishing at BigFig Digital Media a few years later. There she learned her first lessons in science communication and magazine production and worked her way up to become the editor of *Planet digimag*, produced in association with WWF.

After some time in the publishing world, Lisa decided to turn her focus back to science and embarked on the pursuit of her Master's degree at the University of British Columbia (UBC) in Vancouver, Canada. Under the supervision of Daniel Pauly, she conducted a global assessment of the effectiveness of marine protected area management, which she completed in 2014. While working on her degree, she kept one foot in the world of science communication by also coordinating outreach for her research group and editing newsletters for the UBC Fisheries Centre.

Lisa is now back in her home city, where she's very happy to have settled and joined the Save Our Seas Foundation's (SOSF) Conservation Media Unit. Here she is able to put her communication and science skills to good use as she works on compelling projects to convey the importance of marine conservation and the SOSF's work.

EHRLICH PHILIPPA |
MULTIMEDIA JOURNALIST

Pippa first fell in love with conservation media after reading the story of the Knysna elephant; she was mesmerised by the animal and the characters and mysteries that surrounded it. After graduating with a Bachelor of Journalism, she spent a year in Thailand and the USA, where she came to appreciate fully the rarity of healthy ecosystems. On her return to South Africa she was inspired by the rich underwater worlds of False Bay and southern Mozambique.

After two years as an investigative journalist for the television programme *Carte Blanche*, Pippa decided that the only stories she really wanted to engage with were those that explored nature and our relationships with it. This was unfortunate because next she found herself in the world of corporate campaigns and commercial media production. Luckily nature won out and she was appointed conservation journalist for the Save Our Seas Foundation (SOSF).

Now, armed with a deep connection to the ocean and a 'colourful CV', Pippa aims to find the balance between traditional journalistic storytelling and a more popular, creative and emotive approach. She is increasingly amazed by the SOSF scientists she speaks to and is excited to help them share their stories.

SCHULTZ JADE |
CONTENT MARKETER AND SOCIAL MEDIA MANAGER

From a young age when she and her family would go on holiday to nature reserves and the seaside, Jade has felt a very strong connection to the natural world and a great appreciation for its overwhelming beauty. With time however, she realised that this was a view few others shared. Having experienced in particular how little other people know about the wonders of the ocean, she became acutely aware that they know even less about the dangers that the marine realm faces.

With a background in marketing and media experience, Jade understands that the media is extremely powerful when it comes to spreading a message and raising awareness– and, in fact, in today's digital world it is an invaluable conservation tool. She believes that the knowledge and experience that she is able to bring to the Save Our Seas Foundation's Conservation Media Unit, together with the passion and dedication of the other team members, can and will make a positive difference in the mindset of the public – and, ultimately, the health of our oceans.

BONORA ALESSANDRO |
CREATIVE DIRECTOR

Alessandro is the creative director of the Conservation Media Unit, a newly established division of the Save Our Seas Foundation that focuses on the celebration and publication of funded project teams' work so that it has maximum conservation benefit.

After studying journalism and media studies at Rhodes University in South Africa, Alessandro worked briefly as a hard news reporter before opting for a career on the visual side of the creative world. A four-year spell in Rome, during which he worked as a designer for an advertising agency, was followed by his return to Cape Town, where he was the art director of an award-winning conservation magazine. He then spent more than four years working on innovative digital publishing solutions that focused on novel ways to use multimedia in magazine story-telling, and subsequently joined the Save Our Seas team in 2013.

Alessandro has a broad knowledge of all areas of publishing, whether print or digital, and is particularly passionate about the power of story-telling to both inform and inspire change. He considers himself very fortunate to be able to combine this with his love for wildlife and the great outdoors on a daily basis.

VON BRANDIS RAINER |
SCIENTIFIC DIRECTOR

After completing a degree in nature conservation in Pretoria, South Africa, Rainer spent the first part of his career in the African bushveld, where he studied white rhino movements, conducted anti-poaching patrols and guided safaris. Several years later he took a temporary job as a botanical guide at Rocktail Bay on the northern coast of South Africa. During his first encounter with a nesting turtle on the beach, he was so inspired by these vulnerable creatures that he sensed a major fork in his career path. He soon became hopelessly addicted to the ocean and spent all his spare time getting to know it. After hastily completing his honours degree, he returned to Rocktail as a turtle researcher and stayed there for nearly two years.

Rainer's persistent hunger for adventure eventually led him to a four-month voluntary position at Aldabra, a remote, untouched coral atoll teeming with turtles and other marine life. He loved it so much out there that he ended up staying for five years, employed as the chief scientific officer. In 2006 he was offered an opportunity to conduct his PhD on the foraging ecology of the critically endangered hawksbill turtle at D'Arros Island and St Joseph Atoll in the Amirantes group of the Seychelles. He spent the next five years following turtles around underwater and gaining an intimate understanding of the area and its surroundings. Having completed his PhD in 2011, he took up the position of scientific director of the D'Arros Research Centre.

BOYES CHRISTOPHER ALAN |
LAB MANAGER

For Chris Boyes, being the lab manager at the research centre on D'Arros Island in the Seychelles means that he is the full-time person on the ground who maintains a world-class facility for research and education. At the same time, he manages the long-term studies and rehabilitation projects on and around the island and neighbouring St Joseph's Atoll.

Since gaining a BSc in forestry (nature conservation) from the University of Stellenbosch in 2004, Chris has worked on many diverse research projects, from nesting sea turtles in Costa Rica and Maputaland, South Africa, to wetland birds in Botswana's Okavango Delta. He specialises in working with nesting sea turtles and is currently completing his MSc thesis on leatherback sea turtles in Maputaland with the University of Stellenbosch.

**YELD HUTCHINGS ELEANOR |
EDUCATION CENTRE MANAGER**

Dr Eleanor Yeld Hutchings currently works for the Save Our Seas Foundation, managing the Shark Education Centre in Kalk Bay, South Africa. She is also the specialist marine biologist presenter for the award-winning South African television documentary series *Shoreline*, which has just completed its second season exploring the coast of South Africa.

Eleanor gained her PhD from the Marine Biology Research Centre, University of Cape Town. Her research was on the parasites of a number of endemic South African shark species, focusing on the discovery and description of several species new to science, the transmission of blood parasites and the ecology of parasite communities with potential for application in the assessment of fisheries stock.

Demonstrating a special affinity for connecting civil society with the marine environment, Eleanor in the past has managed WWF-South Africa's People and the Coast programme and, with a tourist guide certificate for marine and coastal tourism, has run a specialist company guiding tours of the marine environment. She is a qualified scuba diver (both commercial and PADI Rescue level) and dive/boat skipper, and she is kept level-headed by trail-running in the Table Mountain National Park. She lives with her husband and son in the seaside village of Kommetjie.

**MILLAR PAUL JAMES |
EDUCATION OFFICER**

As an educator and conservationist whose own fascination with the marine world began with surfing and diving around Cape Town, Paul believes that initiating or growing people's experience, knowledge and appreciation of our oceans has a vital role to play in protecting our natural world. In between chasing swells up and down the coast of South Africa and enjoying the icy waves of local surf spots, he squeezed in some terrestrial time at the University of Cape Town, studying environmental and geographical science and education.

Paul draws on his significant experience in schools and environmental education when running the SOSF Shark Centre's programmes. His classes welcome the range of strong opinions inevitably encountered when educating people about sharks.

**THORMÄHLEN HEIDI |
FACILITIES ADMINISTRATOR**

Heidi joined the Save Our Seas Shark Education Centre team in December 2011. Moving home from the Seychelles marked a welcome return to South Africa – and an exciting opportunity to support the foundation's education work in the region. With more than 19 years' experience in the hospitality, office and property management industry, Heidi loves interacting with people. The Shark Education Centre's situation in the vibrant hub of False Bay makes this an interesting – and a rewarding – task! With diplomas in Travel & Tourism Management, Business Economics and a Swiss post-graduate degree in Hospitality/Property Management, she brings a strong administrative background to the centre. On a philosophical note, the arrival of her baby girl Maya highlighted something very close to Heidi's heart: the need for her to use her skills to support a cause that extends beyond tourism – to leave our planet a better one for our children. If anything, motherhood represents the strongest confirmation for Heidi of our role as custodians. And if the Shark Education Centre's work contributes to the sustainability of the oceans when baby Maya and her generation have grown up, then Heidi is in the right place!

**MAYIYA ZANELE |
ASSISTANT EDUCATOR**

Zanele was born in the northern part of South Africa's Eastern Cape. As a young girl she enjoyed cooking very much, so when she completed her matric she decided to make hotel and catering management her career. In March 2008 she started working for the Save Our Seas Foundation (SOSF) as a housekeeper at the Shark Education Centre. As well as carrying out her housekeeping duties, she assisted with the bookshop and showed the public around the centre. In June 2009 she joined Alison Kock on the research boat to Seal Island in False Bay and there she saw a great white shark for the first time in her life. By the end of that trip she had fallen in love with the sea and decided to become an educator so that she can pass on her enthusiasm to the upcoming generations of South Africans.

Although she enjoyed her job during those years, she told herself that one day she would fulfil her dreams. Her previous duties at the centre were the steps of the ladder that enabled her to get where she is today. The experience that she gained by showing the public around the centre, reading marine books and helping with school groups helped her a lot. Getting an opportunity to teach young people about marine life makes her very proud, in particular because most South African children, especially those who grow up in townships and rural areas, do not have a direct connection to nature or the ocean. After the training that she did during the probation period in her new role as assistant educator, Zanele explained, 'I can truly say that to achieve success you have to believe in yourself, have a vision and work hard because there were so many challenges during the training, like presenting in front of big school groups.' But through hard work she's made it.

**SHIVJI MAHMOOD |
DIRECTOR**

Mahmood is professor of marine science at Nova Southeastern University's (NSU) Oceanographic Center in Florida and a director of the SOSF Shark Research Center. He received his undergraduate degree in biological sciences at Simon Fraser University in Canada, his masters from the University of California, Santa Barbara, and his PhD from the University of Washington. He has been a faculty member at NSU since 1993 and a director of the SOSF Shark Research Center since 2010.

Mahmood credits his life-long fascination with biology to growing up in Kenya, where he was routinely exposed to African wildlife and undersea environments as a child and teenager. His interests in marine science in particular were boosted when as an undergraduate student he assisted one of his professors with kelp-bed ecology research in a pristine part of British Columbia. That experience proved transformative, leading to a career in marine and conservation science and education.

In addition to leading the research and education programmes of the shark research centre, Mahmood directs the Guy Harvey Research Institute, emphasising collaborative projects between the two entities to achieve larger and more impactful research and conservation outcomes. He specialises in integrating laboratory genetics-based and field-work approaches to study and solve problems pertaining to the management and conservation of sharks and rays, billfishes and coral reef ecosystems.

Mahmood's work consistently receives worldwide attention. His research developing rapid DNA forensic methods to identify shark body parts is being used by US and other national fisheries management agencies to reduce the illegal fishing of threatened species. This work is also on exhibit at the Smithsonian Museum's Sant Ocean Hall in Washington, D.C. and his team's research discoveries have been widely reported in the national and international media.

**DODGE RICHARD |
DIRECTOR**

Having conducted research on coral reefs worldwide, Dr Richard E. Dodge is a recognised authority on reef ecosystems. With expertise involving reef ecology and ecology, he is also the author of many publications in scientific literature. His interests include the study of natural and man-induced impacts on coral reefs from factors including climate change, ship groundings and oil spills with their related mitigation, pollution and sedimentation; coral skeletal growth and sclerochronology; coral reef restoration; reef mapping and assessment; and Habitat Equivalency Analysis.

Richard gained a BA degree from the University of Maine in 1969 and an MPhil and PhD in geology and geophysics from Yale University in 1973 and 1978. He is dean of the Nova Southeastern University Oceanographic Center as well as executive director of the center's National Coral Reef Institute, which is dedicated to providing management research outcomes on reef monitoring, assessment and restoration.

SOSF ISLAND SCHOOL SEYCHELLES
MAHÉ, SEYCHELLES

MARCH ABIGAIL (ABI) | PROJECT MANAGER AND EDUCATOR

It could be said that Abi came to the Seychelles via Australia, for it was on Ningaloo Reef that she first encountered a whale shark, 'the best thing in the ocean'. She was in Australia between completing her BA in art and studying to be a secondary school teacher, and while learning to scuba dive she developed a love for the ocean. During the following years as a teacher she spent her evenings poring over marine-related books and documentaries and her holidays diving – and looking for whale sharks.

It was Abi's enthusiasm for these giant, spotted sea creatures that first brought her to the Seychelles, as an intern on a whale shark-monitoring programme with the Marine Conservation Society Seychelles (MCSS). She worked another two seasons on the programme and then led three whale shark-monitoring expeditions in Djibouti before returning to university to study for an MSc. For her placement she set up the 'Academy by the Sea' in the Seychelles and developed this marine education programme over the next 18 months.

Five years after first setting foot in paradise, Abi feels very lucky to call the Seychelles home. Comprising approximately 115 islands in the Indian Ocean, the country relies heavily on marine resources – and they are at risk of serious depletion because they are not used sustainably and because the general public is not sufficiently aware of their importance. As Abi sees it, education is an essential tool in efforts to conserve the Seychelles' marine environment and resources, and her skills as an educator and her knowledge of the ocean can help to make a difference in the country.

She now manages the SOSF Lekol Zil Sesel – Island School Seychelles marine education project. In the close-knit family community of the Seychelles, young people play an influential role on their parents and extended family members, and as their knowledge and interest develop they become the voice of marine conservation within their community.

HINE ABBIE | PROJECT ADVISOR AND EDUCATOR

A marine educator and coral researcher, Abbie has more than 12 years' experience of educating people of all ages and abilities – and many more years submerged and passionately embracing everything marine related. She worked in various countries on coral reef research expeditions, coordinating volunteers and training them to identify and survey vulnerable reefs, liaising with in-country partners and providing advice on coastal management issues. She subsequently undertook an MSc in tropical coastal management. Her final research paper, on marine education being used as a form of management to reduce damage to coral reefs, was presented at the 2007 International Pacific Marine Educators Conference (IPMEC) in Hawaii.

As the resident marine biologist and environmental advisor for luxury resorts in the Maldives for three years, Abbie learned about putting into practice an educational programme for resort guests. She simultaneously worked on a coral propagation project and started another initiative for the Save Our Seas Foundation (SOSF) that not only demonstrated an improvement in the health of the reef, but also acted as an educational tool for resort guests and local schools, and a means of spreading awareness about coral reefs.

Abbie subsequently worked in the Kingdom of Saudi Arabia on a reef restoration and education project for the SOSF, expanding its education element and moving it to the Seychelles in 2010. There she set up, developed and ran an extensive marine-awareness project that has now been integrated into the SOSF Island School Seychelles, with Abbie as project advisor.

In 2011 Abbie founded WiseOceans, a concept she'd been mulling over for many years. It's based on a culmination of her experiences in coral recruitment, reef monitoring and rehabilitation, turtle nesting surveys, research into manta rays, whale sharks and plankton, and studies into fish identification, abundance and diversity.

SOSF CENTRES

SOSF Headquarters
Geneva, Switzerland | Scholl Michael

SOSF Shark Education Centre –
Kalk Bay, Western Cape, South Africa
(105) | Yeld Hutchings Eleanor

SOSF Shark Research Center – Nova
Southeastern University (NSU),
Oceanographic Center (OC), Dania Beach,
Florida, USA (157) | Shivji Mahmood

SOSF Conservation Media Unit – Kalk Bay,
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Boonzaier Lisa

SOSF D'Arros Research Centre – D'Arros
Island and St Joseph Atoll, Les Amirantes,
Seychelles (285) | von Brandis Rainer

SOSF Island School Seychelles |
SOSF D'Arros Experience – Mahé,
Seychelles (286) | March Abi & Hine Abigail

SOSF SPONSORSHIPS

SOSF Marine Conservation
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Thomas Peschak

Student Travel Grant – Northeast Pacific Shark
Symposium, March 2014 | Seattle, USA (259)
Ebert David

Student Travel Grant and Keynote Speakers –
Sharks International, June 2014 | Durban,
KwaZulu-Natal, South Africa (261)
Cliff Geremy

Student Travel Grant – American Elasmobranch
Society (AES) Scientific Conference, July 2014 |
Chattanooga, Tennessee, USA (229)
Lowe Christopher

Student Travel Grant and Keynote Speakers –
European Elasmobranch Association (EEA)
Scientific Conference, November 2014 |
Leewarden, Netherlands (228) | Walker Paddy

Social Network Blogging, July 2014 |
Chattanooga, Tennessee, USA (266)
Shiffman David

WaveScape 2014, December 2014 | Clifton
Beach, Cape Town, Western Cape, South Africa
Frylinck Ross

A: ALL SOSF PROJECTS FUNDED IN 2014, IN ALPHABETICAL ORDER OF THE PROJECT TITLE

A global manta and devil ray
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of ocean acidification (193)
Hall-Spencer Jason

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sharks off Japan (269)
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giant devil ray (*Mobula mobular*) (265)
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Gordon Cat

Building Shark Advocates
International (176)
Fordham Sonja

Combating destructive fishing
in Sabah using an innovative
acoustic system (243)
Wood Elizabeth

Community monitoring of nesting sea turtles
at D'Arros and St Joseph, Seychelles (256)
Mortimer Jeanne

Conservation and ecological
research of Mobula rays in Brazil
and Mexico (295)
Bonfil Ramón

Elasmobranch research, education
and conservation in Bimini,
Bahamas (260)
Gruber Samuel

Elasmobranch research, education
and conservation in Bimini,
Bahamas (260)
Guttridge Tristan

Environmental and biological
factors driving whale shark distribution
and abundance (241)
Marcus Zamora Lara

Evaluate the presence of whale shark
Rhincodon typus off Peru (270)
Ramírez-Macías Dení

Exposure and sensitivity of the
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coral reef degradation (271)
Chin Andrew

Familiarity in lemon sharks, *Negaprion*
brevirostris: reshaping societal views
of a keystone taxonomic group (272)
Keller Bryan

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mobula rays fishery in Peru (240)
Ayala Liliana

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ocean acidification and global
warming research for conservation
and management (273)
Watson Sue-Ann

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morphological and genetic identification
guide (242)
Fernando Daniel

Habitat and resource partitioning
of juvenile sharks and their roles
in remote coastal ecosystems (290)
Weideli Ornella

ID-photos of southern right whales
collected from a remote controlled drone (274)
Vinding Petersen Katja

Identifying critical habitat for killer
whales in northern British Columbia (217)
Wray Janie & Meuter Hermann

Impact of shark provisioning on the
ecology of lemon sharks at Moorea
(French Polynesia) (275)
Kiszka Jeremy

Indonesian manta research project (164)
Lewis Sarah

Last frontier of shark discovery –
Unexplored sea mounts of the Southern
Indian Ocean (276)
Clerkin Paul

Movements of juvenile hawksbill turtles
at D'Arros Island and St Joseph Atoll,
Seychelles (289)
Von Brandis Rainer

National assessment of the Indian
Mobulidae fishery (277)
Theivasigamani Mohanraj

Old and cold; conservation
of Greenland sharks (134)
Bushnell Peter

Optimising the effectiveness of marine
biodiversity monitoring and conservation
planning in False Bay, South Africa (292)
De Vos Lauren

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South Africa (248)
Towner Alison

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Wueringer Barbara

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a workshop to further the field (293)
Kacev David

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Elhassan Igbal

Sea turtle conservation imperatives
in Malaysia (152)
Pilcher Nicolas

Shark assessment and conservation
in Madagascar using mobile phone
technology (238)
Humber Frances

Shark Spotters: finding a balance between
recreational water-user safety and white shark
conservation (149)
Waries Sarah, Kock Alison & Sikweyiya
Monwabisi

Spatio-temporal movements of manta rays
in the Seychelles (230)
Stevens Guy

The Acoustic Tracking Array Platform (ATAP) –
A nationwide marine science platform (227)
Cowley Paul

The ecology of stingrays in
St Joseph Atoll, Seychelles (288)
Elston Chantel

The effect of documentary background
music on viewers' perception of and
willingness to protect sharks (281)
Nosal Andrew

The Great Eggcase Hunt (GEH) (50)
Hood Ali & Cat Gordon

Tracking neonate sea turtles to discover
their offshore homes (160)
Wyneken Jeanette

Trans-Pacific plastic pollution survey (294)
Rutherford Matthew

Trinational conservation research on the
spotted eagle ray, *Aetobatus narinari* (237)
Hueter Robert & Kim Bassos-Hull

Turtle Action Group of Seychelles (TAGS):
group revival and website production (287)
Mortimer Jeanne

Understanding shark fisheries and
stakeholder role in shark conservation
on the north-west coast of India (282)
Sutaria Dipani

Using drones to investigate the abundance of
sharks and rays in shallow-water habitats (283)
Mourier Johann

B: ALL SOSF PROJECTS FUNDED IN 2014, SORTED BY CATEGORY AND IN ALPHABETICAL ORDER OF THE PROJECT TITLE

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SMALL GRANTS

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Shiffman David

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Rizzari Justin

Assessing the structure and habitat use of a novel aggregation of hammerhead sharks off Japan (269)
Gallagher Austin

Assessment of the Gaza fishery of the giant devil ray (*Mobula mobular*) (265)
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Ramírez-Macías Dení

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Sutaria Dipani

Using drones to investigate the abundance of sharks and rays in shallow-water habitats (283)
Mourier Johann

KEYSTONE GRANTS – NO-COST EXTENSION

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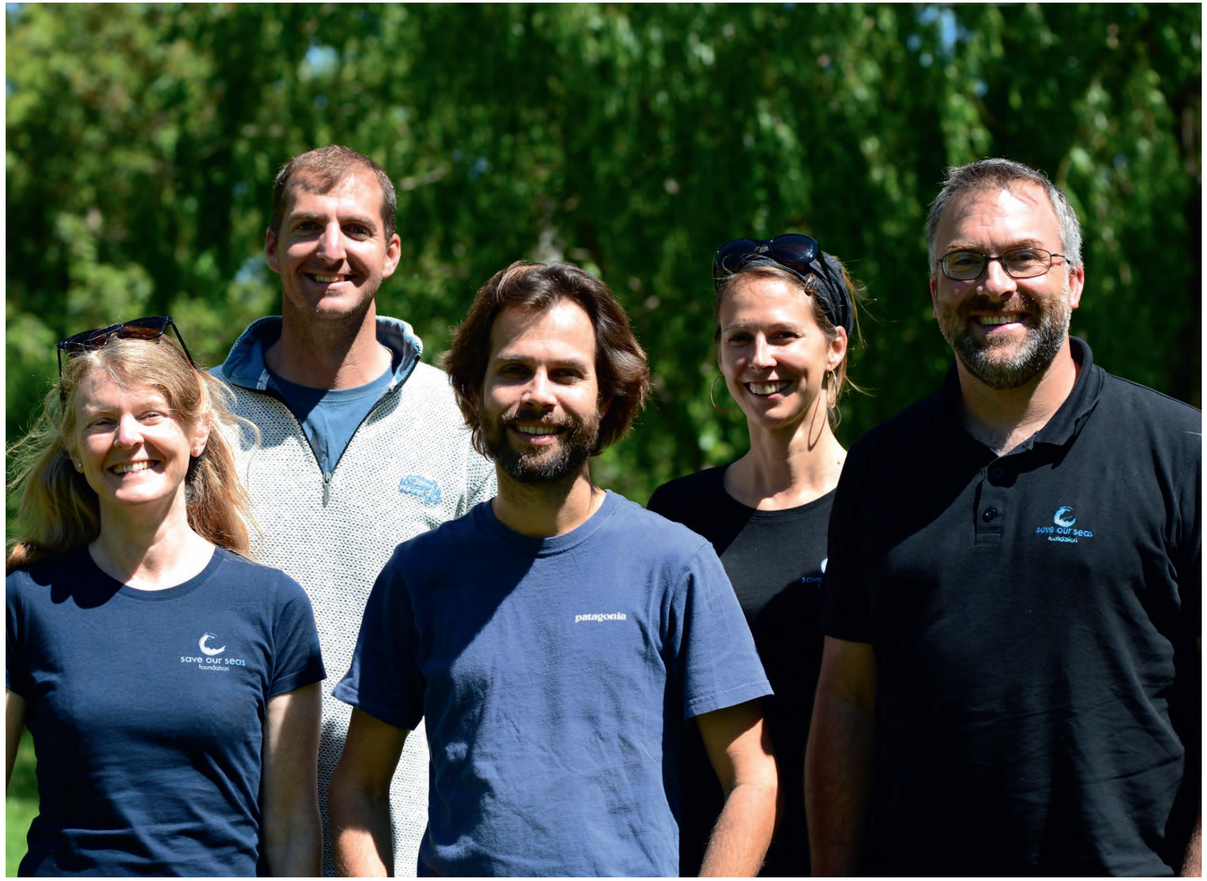

SOSF team at the annual meeting of the scientific advisors in October 2014 in Greyton, South Africa (from left to right): Sarah Fowler, Guy Stevens, Thomas Peschak, Nadia Bruyndonckx and Michael Scholl.

Published by the Save Our Seas Foundation (SOSF)

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Rue Philippe-Plantamour 20, 1201 Geneva, Switzerland

SaveOurSeas.com | *SaveOurSeas.org*

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Portraits: Keith Witmer | *KeithWitmer.com*
Content coordinator: Philippa Ehrlich
Sub-editor & proofreader: Leni Martin
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Printed by Polygravia Arts Graphiques SA,
Route de Pra de Plan 18, 1618 Châtel-St-Denis, Switzerland
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