

#02

MAY '21

Explore the **Marine Megafauna Foundation's** pioneering conservation work

OCEAN GIANTS



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MEGAFAUNA
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Madagascar

DEEP SOUTH MALDIVES



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“

Our work has led to manta rays, and their habitats, receiving protection in multiple countries. Your manta ray adoption will help us to research and protect these globally endangered rays.



Dr. Andrea Marshall
Co-founder & Principal Scientist,
Marine Megafauna Foundation.

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OUR OCEAN. OUR FUTURE.

SAVING OCEAN
GIANTS FROM
EXTINCTION.

Our mission is to save threatened marine life using pioneering research, education, and sustainable conservation solutions. Our objective is a world where marine life and humans thrive together.



FEATURES



COVER
Hammerhead school in the Galapagos Islands.
Photo by Simon Pierce

DESIGN
Madeleine Pierce

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JOIN US IN THE FIELD!



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philanthropy@marinemegafauna.org

“

*Your support enables us to research threatened ocean
giants, train the next generation of conservationists,
and protect marine ecosystems. Our work would not
be possible without you. Thank you, so much.*

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Shriyadita Ranka



Letter from the founder



WELCOME BACK TO OCEAN GIANTS!

Our scientific program at the Marine Megafauna Foundation focuses on conservation biology, the science of protecting threatened species and habitats. More broadly, I view our work as evidence-based problem-solving.

Our longest-running research programs are in Mozambique. We’ve done a good job there of identifying the most pressing problem, overfishing, and the main cause – ultimately, poverty. In this issue, it’s great to provide an introduction to our conservation work in the country from Genaye Domenico, MMFs Conservation Program Manager. To help marine megafauna recover, we’re working directly with fishers and coastal communities to identify and implement practical solutions to these issues.

We can apply the same philosophy to solve larger-scale problems in the ocean. This issue also describes MMFs recent work on the global declines in oceanic sharks and rays. Ultimately, we need to create more refuges for these species by creating large protected areas in international waters.

Clearly, we’ve got plenty of work to do. Thanks for your support! Also, talking about support, do check out MMFs new whale shark and manta ray adoption program – we’re launching that here, too. They make a great gift or, hey, treat yourself. You’re worth it.

DR. SIMON PIERCE

Co-founder, Principal Scientist



CREATING **OCEAN** AMBASSADORS

WORKING TOWARDS SUSTAINABLE
FISHERIES IN MOZAMBIQUE

PHOTOGRAPHY BY
Janneman Conradie & MMF Contributors



HEALTHY OCEANS AND HEALTHY PEOPLE ARE INEXTRICABLY LINKED.

For the people of Mozambique, fishing is steeped in history, and provides the country with 40% of its dietary animal protein. Sadly, fishers have been reporting steep declines in the size and quantity of their catch, making traditional fishing methods and management strategies difficult to sustain.

The pressures of a growing population and over-exploitation by foreign fishing fleets have led to fishers switching to indiscriminate techniques to maintain catch rates. That, in turn, has led to more accidental catches of threatened species. As preferred fish have declined, some previously-ignored endangered species have also become increasingly attractive as a target for fishers. The results have been devastating.

MARINE MEGAFaUNA DECLINES

Since 2005, the MMF research team has documented a 98% decline in sightings of reef manta rays, and 79% in whale sharks. We have seen first-hand the impact that unsustainable fishing practices can have – not just on the rays and sharks that we spend much of our time on, but on bass, sea turtles, dugongs, and dolphins too.

Our focus now is on helping these species to recover. To achieve that, we need to solve the root issues that led to their declines in the first place. That means we need to help fishers transition back to sustainable methods that still ensure food security in their communities.

The goal of MMF’s Sustainable Seas Program is to ensure that people can benefit from a healthy ecosystem that supports livelihoods and food security, while threatened and vulnerable marine species are protected so their populations can rebuild.

“

For the people of Mozambique, fishing is steeped in history, and provides the country with 40% of its dietary animal protein.



“

Empowering community leadership in management and conservation is the most effective way for us to create generational improvements in marine ecosystems.

THE SUSTAINABLE SEAS PROGRAM

Our flagship conservation project in Mozambique is the “Ocean Ambassadors” program. The MMF conservation team members work with community ambassadors to build their knowledge and technical capacity on sustainable marine resource management. The program started with 12 ambassadors in 2017, and we now have 38 people with whom we work together to continually develop a conservation curriculum that, at this stage, comprises 16 lessons encompassing topics on marine conservation, species protection, and ecology.

After we meet with the ambassadors, they in turn organize a monthly meeting to share and discuss their knowledge within their communities. Over 2,400 people have now attended these meetings. The ambassadors also work with MMF to develop and participate in ocean festivals, beach cleanups, and other environmental initiatives.

EMPOWERING LOCAL MANAGEMENT

We also work directly with the fishers themselves. Mozambican law enables the development of Community Fisheries Councils as local consultative bodies for the provincial and national governments. To help formalize their management authority, the MMF team is helping fishing communities with the process of legal registration, hosting

exchange visits with other fishing communities to share their knowledge, facilitate planning for Locally Managed Marine Areas, and finding training and apprenticeship opportunities for fishers and their family members who wish to explore alternative or supplementary livelihood opportunities.

Empowering community leadership in conservation is the most effective way for us to ensure long-term improvements in fisheries management. By providing practical help to the fishers themselves, and partnering with their communities, we can mitigate the direct threat to key marine megafauna species and their most critical habitats, while supporting sustainable development in this amazing country.

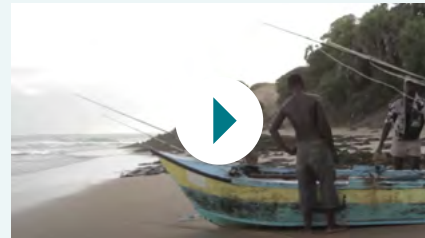


GENAYE DOMENICO

*Conservation Program Manager,
Mozambique*

WATCH THE VIDEO

The Sustainable Seas Project



SOUTHERN MOZAMBIQUE



Join us in the field!
MMF EXPEDITIONS

24 AUG – 01 SEPT 2021

Explore Africa's 'Marine Serengeti', the breathtaking coast and fantastic dive sites of southern Mozambique.

Led by MMF global manta ray researcher, Anna Flam, this luxury ocean safari is a land-based journey from Tofo Beach to the Bazaruto Archipelago. It'll be the peak of the humpback whale migration, and manta rays and whale sharks are present too. A true marine megafauna experience.

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MANTA COMMUNICATION

UNDERSTANDING MANTA
SOCIAL BEHAVIORS

PHOTOGRAPHY BY
Andrea Marshall & Robert Perryman

WATCH THE VIDEO

See manta ray behavior in action.



REEF MANTA RAYS ARE SOCIAL ANIMALS. Our previous work in the Raja Ampat region of Indonesia has indicated that manta rays have preferred social associations with other individual manta rays that can persist for at least a few months. Understanding what this means in practice – do they maintain ‘friendships’? – could offer deep insights into their ecology and long-term conservation needs.

We’ve recently published a study that takes a further step on this journey. Unlike marine mammals, or people, manta rays are not known to communicate through vocalizations. However, people often ‘talk with their hands’ when making noise is difficult – such as divers underwater, or quite literally when using sign language. We wanted to investigate if manta rays might be using their paddle-like cephalic fins (lobes) on either side of their head to signal to one another.

CLEANING STATIONS AS A SOCIAL HUB

It takes a lot of data to tease out genuine ‘manta chat’ from random fin movement, so we created a collaborative study group including scientists from MMF, the University of Cape Town, Macquarie University, and the University of Papua. We focused on video observations from ‘cleaning stations’. These are areas on the reef where resident fish make their living by checking over other fish and removing any parasites and damaged or dead tissue they find. The cleaner fish get an easy meal, while the cleanee’s benefit from the regular health checkup.

Mantas regularly visit these cleaning stations, sometimes for hours at a time. A side benefit for them is the chance to interact socially with other mantas, including courtship and mating opportunities.

“

These results add to the growing evidence that manta rays are fundamentally a social species, which is crucial knowledge for conservation.



To conduct this research, Rob waited at two high-use cleaning stations in Raja Ampat for reef mantas to turn up. When they did, he followed one reef manta ray underwater, filming that individual continuously so that we could later work through the footage to record all their behaviors. Almost 10,000 events later, we have some results to share!

CEPHALIC LOBES TELL THE STORY?

Manta rays move their cephalic lobes in specific and interesting ways during social interactions. Certain movements, such as small flicks of the lobe tips, were performed more frequently when rays were facing another individual. Tight rolling of the lobes was associated with being followed by others. Some lobe movement types were made more frequently when interacting with cleaner fish, and might be useful for attracting their attention.

It's always been difficult for us to understand communication in other species, particularly those such as manta rays that are so obviously different to us. It seems likely, though, that they use 'gestures' to interact with other mantas, and other species, in a fairly sophisticated way.

Michelle Carpenter, who co-authored this study as part of her PhD research at the University of Cape Town, notes, "the one finding that stuck out to me was that they were always moving their cephalic lobes when approaching a stimulus – another manta, a human diver, or a cleaner fish. This provides an argument that mantas are sensing their local environment with their cephalic lobes. Manta rays are incredibly complex creatures and animal behavior is a tough subject, which makes these things hard to confirm."

LOOKING FORWARD

These results add to the growing evidence that manta rays are fundamentally a social species, which is crucial knowledge for conservation.

To enable detailed records of manta behavioral interactions, we've created the first manta behavior recording methods (developed in BORIS software) to analyze their interactions in an unbiased and transferrable way. That will be very useful for us, and others, as we continue to investigate manta ray social lives.

Manta rays have been protected in Indonesia since 2014, but artisanal fishing remains a threat to their recovery. There is still little public awareness of the species, or the help they'll need to rebuild depleted populations. We hope that, as we explore the social nature of manta rays, we will help to broaden support and public enthusiasm for their management and protection – in Indonesia, and around the world.

Collecting information about manta ray social interactions at cleaning stations, which are often popular dive sites, is also important for the development of ecotourism. Manta rays need the space and opportunity to not just maintain good health through regular visits to these sites, but to interact with one another without disturbance. These are fascinating, complex animals, and we're only just starting to understand their lives.



ROBERT PERRYMAN

PhD Candidate, Macquarie University / MMF



DR. ANDREA MARSHALL

Co-founder & Principal Scientist



RAJA AMPAT



Join us in the field!

MMF EXPEDITIONS

03 – 13 MARCH 2022

Dive the world's richest coral reef ecosystem on the luxurious Coralía, voted 'world's best liveaboard', with MMF founders Dr. Andrea Marshall and Dr. Simon Pierce.

We'll be exploring the Raja Ampat region during peak manta ray season – searching for iconic marine species such as walking sharks, pygmy seahorses and wobbegongs – while enjoying the epic tropical views above water in between.

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TROUBLED **WATERS**

OCEANIC SHARKS AND RAYS SUFFER
LONG-TERM DECLINES

PHOTOGRAPHY BY

Andrea Marshall, Simon Pierce, & MMF contributors.

“

Fishing has been assessed as the most important threat to all of these species. Fishing pressure has doubled since 1970, and catches have tripled.

THE PHRASE “THERE’S PLENTY MORE FISH IN THE SEA” NEEDS TO BE RETIRED.

Our recent work on open ocean sharks and rays has shown that this simply isn’t the case – and we’ll all need to press for better fisheries management and more protected areas to turn that around.

Andrea has recently co-authored a devastating new study, published in the eminent scientific journal Nature, that has documented an alarming decline in oceanic shark and ray populations – 71% since 1970 – primarily due to overfishing.

That study builds on work that several MMF scientists co-authored in 2019, also published in Nature, that tracked whale shark and other oceanic shark movements in relation to the global fishing fleet. In that study, we found that open ocean sharks have few refuges from fishing pressure in international waters, despite this habitat covering about half of the Earth’s surface. Even for protected species, 64% of their high-use areas overlapped with longline fisheries.

THREATENED WITH EXTINCTION

This newer study confirms our fears that high fishing pressure has led to many open ocean sharks and ray species facing a high risk of extinction.

Led by the Global Shark Trends Project (GSTP), the paper synthesized global research to assess the extinction risk for the 31 oceanic sharks and rays. Three-quarters of these iconic species, including giant manta rays and whale sharks, are now threatened with global extinction. Half (16 of the 31) were assessed as critically endangered, with estimated declines of over 80%.



“

Ocean sharks have few
refuges from fishing pressure
in international waters... with
much of their high-use areas
overlapping with fisheries.

Fishing has been assessed as the most important threat to all of these species. Fishing pressure has doubled since 1970, and catches have tripled, with an 18x increase in a metric known as Relative Fishing Pressure: the level of exploitation relative to the number of fish left to catch.

These declines point to increasingly unhealthy open ocean ecosystems, which impacts all of us.

RAYS AT RISK

Andrea contributed monitoring data to this study from MMFs 20-year mobulid ray (mantas and devil rays) research in southern Mozambique. Sightings in this region, previously one of the world's hotspots for these species, declined more than 90% from 2003 to 2016.

Again, the biggest threat to this population has come from fisheries. This decline sounds bad on paper, but watching it happen – with more and more manta rays that we 'know' disappearing – has been a nightmare.

These results have been a big part of the impetus for the Ocean Ambassadors conservation program, which Genaye describes in another article in this issue. Thankfully, at least the manta rays are also now legally protected (as we announced in the last magazine).

REBUILDING POPULATIONS

The open ocean is vital to our wellbeing, regulating much of the global climate, but it's not a habitat that many of us are familiar with – it's out of sight, and out of mind. Outside national waters, there are also fewer management tools for avoiding overfishing.

Ultimately, more of the open ocean needs to be closed to fisheries. Less than 3% of the open ocean is fully protected right now, whereas the best science suggests that 30% needs to be the goal for the long-term sustainability of fisheries. Many countries, including recently the US, have adopted 30% as their national goal for marine protection. The next step is to expand this to international waters, to help safeguard our own futures.



DR. ANDREA MARSHALL

Co-founder & Principal Scientist



DR. SIMON PIERCE

Co-founder & Principal Scientist



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Official MMF Manta Ray Symbolic Adoption includes:

- Personalized PDF symbolic adoption e-certificate.
- Subscription to MMF's Ocean Giants Magazine & our conservation updates.

“



Our work has led to whale sharks, and their habitats, receiving protection in many countries around the world. Your whale shark adoption helps to save these endangered giants.

Dr. Simon Pierce
Co-founder & Principal Scientist,
Marine Megafauna Foundation.

LEARN MORE

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INVESTIGATING
MANTA RAY MIGRATIONS
USING GENOMICS

PHOTOGRAPHY BY
Andrea Marshall & Lauren Peel

MANTA CONNECTIONS

UNTIL RECENTLY, SCIENTIFIC STUDIES ON MANTA RAYS

have focused on photo-identification and tagging to answer questions such as “how big is this population?” or “how far do individuals travel?” There’s good reason for that – these techniques are useful. However, both rely on us being able to study individual rays underwater. Recently, MMF has been developing new tools that enable us to ‘work remotely’ with far-flung manta populations.

Genetic and genomic techniques give us the means to investigate how manta populations are connected through time. For those of you who are new to these terms, genetics refers to the study of specific genes, which sometimes have a known function, within a species’ DNA. Genomics, which has become more popular as computational power has increased, is where we examine a much larger number of genes (we’re talking thousands here) throughout the genome.

MANTAS IN MOZAMBIQUE

MMF scientists have been studying manta rays in Mozambique since Andrea Marshall started her PhD research on this population in 2003. The work that she and others have conducted with photo-ID and electronic tags has suggested that individual mantas usually prefer certain areas along the Mozambican coast, often not moving far over time. However, as reef manta rays are fast swimmers that are definitely capable of long-distance movements, we thought that this was a good topic to revisit using some of the latest genomic techniques. These give us insights into movements over generations of mantas, not just months or years in the lives of certain individuals.



Our research team collected tiny skin samples from 120 wild manta rays at different sites along the southeast African coast, from the Bazaruto Archipelago in Mozambique south to Port St Johns in South Africa. We extracted the DNA from these samples and sequenced thousands of genetic markers known as Single Nucleotide Polymorphisms (or simply, SNPs).

Our broad aim was to crunch this massive dataset to determine whether the mantas along this coast are a single breeding population. We found relatively low genetic variability between the individuals, even those found over 1,200 km apart, indicating that they all belong to the same population. The one manta ray sampled in South Africa was genetically linked to the larger Mozambican population.



“
Genomics give us insights into movements over generations of mantas, not just months or years in the lives of certain individuals.”

An aerial photograph showing a coastline with turquoise water, sandy beaches, and green vegetation. The water is clear, revealing the seabed. The beach is a mix of sand and small rocks. The vegetation is dense and green. The sky is a clear, pale blue.

“

Mozambique and South Africa share manta rays along their contiguous coast. A joint management plan will benefit both countries.



INTERNATIONAL CONSERVATION

The resulting study was the first population-level genomics study on reef manta rays to be published in the scientific literature, and was also my favorite chapter from my PhD thesis! The implications of our findings are particularly important here in the Inhambane Province of Mozambique, where we have witnessed a decline in reef manta ray sightings of over 90%.

Andrea and the MMF team worked hard to get reef manta rays listed on the UN Convention for Migratory Species in 2014. This treaty provides a global platform for the conservation of migratory animals, on land or underwater, and provides a foundation for internationally coordinated conservation measures throughout a species’ migratory range. This study provides evidence that confirms Mozambique and South Africa share manta rays along their contiguous coast. A joint management plan will benefit both countries.

HOW FAR DO MANTAS SWIM?

The major decline of reef manta rays in Mozambique presents the scary scenario that the species could go completely extinct in the near future. Of course, that is far less likely if the manta rays can repopulate from other areas. To understand just how far these highly mobile rays might travel, we extended the study out to Western Australian reef manta rays, collaborating with our friends at Project Manta in Australia to analyze more manta genomes.

Turns out, the African mantas aren’t traveling Down Under – or vice versa. We found a high level of genetic differentiation between the two locations. Manta rays are not crossing the deep Indian Ocean basin. However, this non-result is useful information too.

Understanding broad-scale connectivity in the Indian Ocean gives us some insight into how reef manta rays are likely to be connected in other areas. In southeast Africa, mantas show high genetic connectivity along a continuous coastline, but limited gene flow across a large, deep body of water. In locations where genetic studies are yet to be completed, these results provide a useful starting point to guide protection measures. We can’t assume that local populations can be saved by mantas moving in from other areas, particularly where they are separated geographically.

Studies like this help us define what is known as management units – essentially drawing a line around distinct breeding populations, so they can each be treated separately. Like we do for electoral districts... but hopefully with fewer arguments. There’s a lot more work to do before we can allocate mantas to different populations within the Indian Ocean, but it’s great to have this paper out as a start towards that goal.



DR. STEPHANIE VENABLES

Senior Scientist



Join us in the field!

MMF EXPEDITIONS

TUBBATAHA REEFS, PHILIPPINES

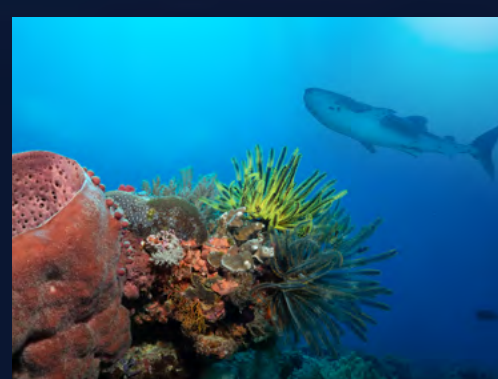
04 – 11 MARCH 2023

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