OUR MISSION

DISCOVER
and understand this globally important marine ecosystem through world-class scientific research.

PROTECT
the long-term future of the species which live here by translating knowledge into evidence-based conservation initiatives and legislation.

EDUCATE
our partners - local communities, legislators and visitors - by informing and actively involving them in achieving our goals for the benefit of all.
Dyer Island Conservation Trust in partnership with Marine Dynamics are excited to host the 6th Southern African Shark & Ray Symposium (SASRS). This biennial meeting of the academic community provides opportunity for research updates, collaboration, and inspiration. As we emerge from the pandemic the 6th SASRS will offer the chance for the African shark and ray research community to engage and share information on the status of their different projects. The programme includes presentations on the first two days and workshops on the third day.

Save our Seas Foundation has once again provided sponsorship, which has contributed to some running costs and to travel grants. We are honoured to follow these organisations that have hosted our previous symposia/symposiums: KwaZulu-Natal Sharks Board (2011), Shark Spotters (2013), Oceans Research (2015), South African Shark Conservancy (2017) and Two Oceans Aquarium (2019).

INFORMATION FOR DELEGATES

Pre-registration can be done from 4pm on the afternoon/evening of 16th November at the Great White House, home of Marine Dynamics and the Dyer Island Conservation Trust.

Delegates can do early registration and enjoy dinner at one of the restaurants in Gansbaai. We hope you will secure your reservation at The Great White House as your business will mean a lot to the organisation. Call 028-3843273 to book or 0726573012. (+27 SA code)

The venue is Panorama Farm. Registration will start at 8am on the morning of the 17th. There will be some refreshments every morning, coffee and tea on site, and lunch. Please note that we will have an icebreaker event on the evening of the 17th where canapes will be served. The gala dinner evening on the 18th is an evening we look forward to.

Timings of talks are available on the programme. Please stick to the times so that we can move through what is a very full programme.
COVID PROTOCOLS
Marine Dynamics was proactive in addressing covid protocols across our businesses. You can read more about this and view our Covid Safety documents here. Please do the daily sanitising on entering the venue and wear a mask.

Please note that this venue capacity is 200 and we only plan to have maximum of 100 people in the venue. Most of the time this will be capped at 80 within venue which includes support staff. The workshop on the third day will have an additional 20 invited delegates. Doors can open on one side of the venue for ventilation, but we will of course take the weather into account.

WEATHER
It can still be cool in November and Gansbaai does get a very chilly sea breeze, so we suggest layered clothing and bring a warm jacket.

TRANSPORT
We know most of you will have your own transport. Delegates who need support getting to the venue daily must please advise in advance and provide details of where they are staying. We have a Marine Dynamics 13 seater bus to assist in getting to and from venue. We appreciate delegates working together if staying in the same place.

Cape Town city / Airport shuttle 16 December at 2pm - One-way transport at R400 p/p.
Transport to the city or airport after the symposium can be arranged at the same price.
Please make sure to book in advance: brenda@dict.org.za

ACTIVITIES
We have shared some options of activities in the Gansbaai area on the SASRS website.

Marine Dynamics and Dyer Island Cruises can offer pre and post shark cage diving or whale watching at the discounted rates for delegates. Our reservation teams can assist you: sharks@marinedynamicstravel.com and whales@marinedynamicstravel.com

Please be sure to stop in at the African Penguin and Seabird Sanctuary, one of the Trust's key conservation projects.
CONTENTS

YOUR HOST  Pg  6
WELCOME  Pg  7
DAILY PROGRAMME  Pg  10
ORAL ABSTRACTS  Pg  15
KEYNOTE: DA SILVA  Pg  16
KEYNOTE: MARSHALL  Pg  27
POSTERS  Pg  41
SPONSORS  Pg  43
DYER ISLAND CONSERVATION TRUST
MARINE DYNAMICS SHARK & WHALE TOURS

The Dyer Island Conservation Trust/Marine Dynamics team is involved in critical white shark studies based on daily observational data and tagging and tracking studies. Marine Dynamics is an award-winning shark cage diving company showcasing the white shark and the bronze whaler shark. Dyer Island Conservation Trust is a registered non-profit focusing on marine conservation and community projects.

Dyer Island and the surrounding ocean is a critically important eco-system and home to the Marine Big 5. Known as an Important Bird Area, and managed by CapeNature, Dyer Island is home to breeding colonies of the endangered African penguin and other seabirds. About 60 000 Cape Fur Seals are resident on Geyser Rock opposite the island and they attract the densest population of Great White Sharks in the world. The many sheltered areas of the bay provide the breeding ground for the Southern Right Whales that migrate here from the sub-Antarctic islands between June to December each year. The area is also visited by Bryde’s and Humpback Whales as well as various dolphin species.

WWW.DICT.ORG.ZA  WWW.MARINEDYNAMICS.CO.ZA
Dear delegate

The Dyer Island Conservation Trust and Marine Dynamics are thrilled to be hosting the 2021 Southern African Shark and Ray Symposium from 17 to 19 November and welcome you to Gansbaai. Special thanks to the Save Our Seas Foundation for their continued financial support towards this symposium.

People have many different thoughts on what the ocean means to them. For me it is my LIFE. Since young I have been fascinated with the ocean and explored its depth and breadth. In 2000 I started Dyer Island Cruises doing whale watching as it was whales that first captured my heart. The African penguin was another of my favourite species and why I started the Dyer Island Conservation Trust in 2006 and established the African Penguin and Seabird Sanctuary in 2015. I had bought Marine Dynamics in 2005 and found myself in the world of shark cage diving. I was determined then to change the way this experience was viewed and what it could contribute to science. I was inspired by Michael Scholl's work with white sharks and fin identification, and I knew that having a marine biologist on board these daily trips would be critical. Alison Towner was our first marine biologist and since then we have had many biologists that have worked on board contributing to the dataset on not only white sharks, but now bronze whalers, and the short-tailed stingrays that started visiting the boats. We have seen interesting interactions, wound healing, observed hunting strategies, dramatic ecosystem changes, and without this would not have been able to contribute to critical studies. Alison's tagging and tracking efforts continue and contribute further to this knowledge base. A priority for me has always been that these studies should be meaningful to conservation and influence policy at government level. We also study many of the smaller shark species and will continue to identify any gaps in marine research in our area.

Although our world has changed even more dramatically over the last couple of years, the sea has not had a break, and now more than ever to we need to come together to share our knowledge and discuss the future of species. The latest IUCN report continues to show the pressures that shark and rays are facing in our time, with an estimated 37% in this group under severe threat due to pressures from fishing for meat and fins, climate change and pollution. The research released by Dulvy et al 2021 highlights overfishing as the main risk for all 391 threatened chondrichthyans highlighting bycatch as a major issue. Sustainable fisheries that is informed by science and the management thereof is critical.

We are very pleased to be able to host this year’s 6th Southern African Shark and Ray Symposium and it is my hope that meaningful dialogue will take place that will have an important influence on the future of our sharks and rays.

We welcome all delegates to Gansbaai and hope you will be inspired by this place of infinite beauty.
Dear delegate

Thank you for joining us at the 6th Southern African Shark and Ray Symposium. The team from Dyer Island Conservation Trust and Marine Dynamics have long hoped to have the opportunity to host this incredible gathering of the scientific community. Of course, we didn't expect that it would be under the shadow of the coronavirus, and it has certainly made for many considerations as we brought this symposium together. The scientific community has indicated that the time for dialogue is now, and all have shown a great commitment to be present. While our virtual world has shown us a new way, the interactions, connections, and collaborations that can take place when we meet face to face cannot be underestimated. Thank you to those who have travelled from further afield in these trying times.

The programme includes two full days of presentations and a third day of workshops. We are grateful to our two key speakers and look forward to their sharing of knowledge. We give special thanks to the scientific committee who helped assess all the abstracts and contribute to discussions on the event and who will be chairing the sessions. A very big thank you to Save Our Seas Foundation whose continued financial contribution to the symposium has helped tremendously in these more challenging times. We hope all delegates will enjoy their time with us in Gansbaai, part of the beautiful Cape Whale Coast.
DAILY PROGRAMME
<table>
<thead>
<tr>
<th>TIME</th>
<th>EVENT</th>
<th>SPEAKER(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>08h00 - 09h15</td>
<td>REGISTRATION</td>
<td>PANORAMA</td>
</tr>
<tr>
<td>09h15 - 09h45</td>
<td>OPENING &amp; WELCOME</td>
<td>WILFRED CHIVELL</td>
</tr>
<tr>
<td></td>
<td>HOUSEKEEPING</td>
<td>BRENDA WALTERS</td>
</tr>
<tr>
<td>09h45 - 10h30</td>
<td>KEYNOTE: CHARLENE DA SILVA</td>
<td></td>
</tr>
<tr>
<td>10h40</td>
<td>ENRICO GENNARI</td>
<td>Study Survey: Study release regarding the National Plan of Action for Sharks (NPOA)</td>
</tr>
<tr>
<td>10h55</td>
<td>TARYN MURRAY</td>
<td>Can mobile boat-based acoustic receivers improve data collection of tagged sharks within South Africa’s large-scale passive acoustic telemetry array?</td>
</tr>
<tr>
<td>11h10</td>
<td>ALISON KOCK *</td>
<td>Sex and size influence the spatiotemporal distribution of white sharks, with implications for interactions with fisheries and spatial management in the southwest Indian Ocean.</td>
</tr>
<tr>
<td>11h25</td>
<td>TEA BREAK - 25 MINS</td>
<td></td>
</tr>
<tr>
<td>11h50</td>
<td>RYAN DALY</td>
<td>Bull shark (Carcharhinus leucas) recruitment into St Lucia Estuary after prolonged mouth closure and first observation of a neonate bull shark preyed on by a Nile crocodile (Crocodylus niloticus).</td>
</tr>
<tr>
<td>12h05</td>
<td>GARETH JORDAAN</td>
<td>Movement patterns and growth rate of the whitespotted wedgefish Rhynchobatus djiddensis in southern Africa based on tag-recapture data.</td>
</tr>
<tr>
<td>12h20</td>
<td>STEPHANIE VENEABLES</td>
<td>Robust population assessments require a multi-technique approach: an example of reef manta rays (Mobula alfredi) in southern Mozambique.</td>
</tr>
<tr>
<td>12h35</td>
<td>JENNIFER KEEPING</td>
<td>Stingrays of southern Mozambique.</td>
</tr>
<tr>
<td>12h50</td>
<td>LUNCH</td>
<td></td>
</tr>
<tr>
<td>14h00</td>
<td>CHARLENE DA SILVA</td>
<td>Testing the waters to find the goldilocks zone: fine scale movement of Mustelus mustelus in relation to environmental cues.</td>
</tr>
<tr>
<td>14h15</td>
<td>CHANTEL ELSTON</td>
<td>Site affinity and habitat connectivity of blue stingrays along South Africa’s south coast.</td>
</tr>
<tr>
<td>14h30</td>
<td>VIVIENNE DAMES</td>
<td>The Raggedtooth Gap: A synthesis of global research on C. taurus and what remains unanswered.</td>
</tr>
<tr>
<td>14h45</td>
<td>TOBY ROGERS</td>
<td>Movements and growth rates of the bronze whaler shark (Carcharhinus brachyurus) in southern Africa from a tag-recapture programme.</td>
</tr>
<tr>
<td>15h00</td>
<td>TEA BREAK - 25 MINS</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>Speaker/Topic</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>15h15</td>
<td>SARAH WARIES - Recreationist perceptions of lethal and non-lethal management of sharks in Cape Town and Durban</td>
<td></td>
</tr>
<tr>
<td>15h40</td>
<td>ARNAULT GAUTHIER - Innovative shark mitigation measures tested in Reunion Island towards the reduction of human-shark interactions</td>
<td></td>
</tr>
<tr>
<td>15h55</td>
<td>ARNAULT GAUTHIER - Are shark deterrents an effective protection against human-shark interactions?</td>
<td></td>
</tr>
</tbody>
</table>

**WORKSHOP: ATAP USERS**

16h25 - 18h00

STAKEHOLDER WORKSHOP FOR ALL ATAP USERS. ALL FISH TRACKERS AND INTERESTED PARTIES ARE WELCOME TO ATTEND.

**WORKSHOP:**

ATAP Users
## DAILY PROGRAMME
### THURSDAY 18 NOVEMBER

<table>
<thead>
<tr>
<th>TIME</th>
<th>VENUE</th>
<th>THEME: GENETICS &amp; IDENTIFICATION</th>
<th>CHAIR: NATHALIE VILJOEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>08h00 – 08h30</td>
<td>ARRIVAL</td>
<td>BRENDA WALTERS</td>
<td></td>
</tr>
<tr>
<td>08h30 – 08h45</td>
<td>WELCOME &amp; ANNOUNCEMENTS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>08h45</td>
<td>KEYNOTE: ANDREA MARSHALL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>09h40</td>
<td>DYLAN IRION</td>
<td>The great white shark count: estimating the abundance of the white shark in Southern Africa with a model integrating several long-term datasets - preliminary results</td>
<td></td>
</tr>
<tr>
<td>09h55</td>
<td>JULIANA KLEIN</td>
<td>Population genomics of <em>Carcharhinus brachyurus</em> across Southern Africa</td>
<td></td>
</tr>
<tr>
<td>10h10</td>
<td>STEPHEN LAMBERT</td>
<td>Nice story little data, estimating illegal gillnet catches in SA?</td>
<td></td>
</tr>
<tr>
<td>10h25</td>
<td>DENHAM PARKER</td>
<td>Regulating pelagic shark catches in South Africa.</td>
<td></td>
</tr>
<tr>
<td>10h40</td>
<td>ROXANNE JUBY</td>
<td>Day-night patterns of habitat use by dogfish sharks (<em>Squalus</em>) at photic and subphotic warm-temperate reefs: diel movements, size- and sex-segregation.</td>
<td></td>
</tr>
<tr>
<td>10h55</td>
<td>ISSAH SEIDU</td>
<td>Fishing for survival: importance of shark fisheries for the livelihoods of coastal communities in Western Ghana.</td>
<td></td>
</tr>
<tr>
<td>11h10</td>
<td>TEA BREAK - 20 MINS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11h30</td>
<td>JENNIFER OLBERS</td>
<td>Elasmobranchs at mesophotic depths: baited remote underwater stereo-video system (stereo-BRUVs) surveys in the iSimangaliso Wetland Park World Heritage Site.</td>
<td></td>
</tr>
<tr>
<td>11h45</td>
<td>RHETT BENNETT</td>
<td>A little shark goes a long way: implications of a range extension of the Critically Endangered shorttail nurse shark.</td>
<td></td>
</tr>
<tr>
<td>12h00</td>
<td>DAVE VAN BEUNINGHEN</td>
<td>The curious case of scalloped hammerheads - highly threatened or highly resilient?</td>
<td></td>
</tr>
<tr>
<td>12h15</td>
<td>RYAN DALY</td>
<td>Long-term catch trends and risk assessment of the critically endangered whitespotted wedgefish (<em>Rhynchobatus djiddensis</em>) from South Africa.</td>
<td></td>
</tr>
<tr>
<td>12h45</td>
<td>NAKIA CULLAIN</td>
<td>Sightings trends and population dynamics of the reef manta ray (<em>Mobula alfredi</em>) in Zavora, Mozambique.</td>
<td></td>
</tr>
<tr>
<td>13h00</td>
<td>LUNCH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>Name</td>
<td>Topic</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>14h00</td>
<td>NORTON COSSA</td>
<td>Addressing Destructive Fishing Practices in Inhambane Province, Mozambique.</td>
<td></td>
</tr>
<tr>
<td>14h15</td>
<td>SIMONE LOUW</td>
<td>Identical 3D replica fins of CITES Appendix II listed sharks.</td>
<td></td>
</tr>
<tr>
<td>14h30</td>
<td>MIKE BARRON</td>
<td>Fin Spotter - Citizen science photo identification program for endemic shy shark population estimates.</td>
<td></td>
</tr>
<tr>
<td>14h45</td>
<td>NINA FAURE BEAULIEU</td>
<td>A systematic conservation plan for sharks and rays in South Africa.</td>
<td></td>
</tr>
<tr>
<td>15h00</td>
<td>SANDILE NTULI</td>
<td>A cross-disciplinary approach to the protection of South Africa's threatened sharks and rays.</td>
<td></td>
</tr>
<tr>
<td>15h15</td>
<td></td>
<td><strong>TEA BREAK - 25 MINS</strong></td>
<td></td>
</tr>
<tr>
<td>15h45</td>
<td>EMY COTTRANT</td>
<td>Abundance, distribution and conservation of endemic catsharks (Scyliorhinidae) of Walker Bay.</td>
<td></td>
</tr>
<tr>
<td>16h00</td>
<td>OLIVIA WILSON</td>
<td>Measuring memorable shark diving tourism experiences and conservation attitude among shark divers - Findings from a pilot study.</td>
<td></td>
</tr>
<tr>
<td>18h00</td>
<td></td>
<td><strong>GALA DINNER</strong></td>
<td></td>
</tr>
</tbody>
</table>
Communicating Shark Science
What is science communication and why is it important? African shark and ray populations are under threat and changing public perception is an important step in addressing this. There are many ways that we can engage with the public, including storytelling, technology, informal science groups and citizen science projects. This interactive workshop will give an overview of the principles of science communication, sharing practical tips to deal with the most common challenges.
ORAL ABSTRACTS
The proliferation of conservation programmes and targeted messaging through social media has dramatically transformed the image of charismatic predators such as white sharks Carcharodon carcharias from monster to conservation symbol. Whilst largely a positive development, the overwhelming media on one already protected species has the unintended consequence of deflecting attention and resources away from species that are not. Hundreds of species of smaller sharks, skates and chimaeras receive disproportionately less attention even when there is considerable threat from fisheries. Since 2015, the number of great white sharks observed at several large aggregation sites in the South-Western Cape declined substantially. The cause for decline in sightings at these eco-tourism hotspots has been much debated, particularly regarding the influence of Orca predations versus commercial fishing. The initial media attention and resulting public concern prompted the Department of Forestry, Fisheries and the Environment (DFFE) Minister Ms. Barbara Creecy to appoint an Expert Panel to review the NPOA-Sharks in May 2020. In addition to reviewing the NPOA-Sharks published in 2013, the Expert Panel was tasked with reviewing all available evidence around the decline in observations of white sharks. Literature and data reviewed showed a lack of spatio-temporal overlap between the demersal shark longline fishery and white sharks in areas where the decline in observations occurred. Moreover, no evidence was found that the two main target species smoothhound sharks Mustelus mustelus and soupfins Galeorhinus galeus constitute a significant food source for white sharks. Therefore, it was concluded by the Expert Panel that the shift in distribution of white sharks from west to east was most likely a result of the recent Orca occurrence and predation. The Expert Panel also concluded that the most prevailing concern in terms of shark conservation in South Africa was the stock status of soupfin shark. Despite these findings, media attention continued to focus on the white shark with very little attention to any other shark related conservation matters. In an analysis of all 42 media articles published between May 2020 and June 2021 the word white sharks occurred 545 times. In contrast, soupfins were only mentioned 38 times despite the continuing threat to this species as largely unmonitored bycatch. The approach of focusing on charismatic species is universal across taxa. Whereas there is some utility of using iconic species to highlight conservation challenges in distinct taxa or areas, the approach can become counter-productive by removing the focus from less iconic species and even damaging when the reporting becomes sensational and is not grounded in scientific information.
THEME: Telemetry & Movement
STUDY SURVEY – ENRICO GENNARI: OCEANS RESEARCH INSTITUTE, SOUTH AFRICA

Study release regarding the National Plan of Action for Sharks (NPOA)

You are invited to participate in a survey on the National Plan Of Action for Sharks (NPOA-Sharks). Ethical clearance for this study has been obtained under the ethics number NWU-00935-21-A4. Please read the following information carefully and ask the researcher if there is anything that is not clear or if you need more information.

The reviewed NPOA-Sharks is intended to implement harvesting strategies that are biologically sustainable and consistent with a precautionary approach, as well as a rationale for long-term economic use. The Panel, appointed in 2020 by the Minister Barbara Creecy, “highlighted that better communication and coordination is needed within the Department, and between the Department and external stakeholders”.

The main purpose of this study is to understand stakeholders’ perceptions of the revised NPOA-Sharks so as to guide strategies for its implementation that will consider the opinion of experts as well as other members of the public.

The delegates attending the 6th Southern African Shark and Ray Symposium will be asked to complete this survey, as well as other stakeholders (recreational and commercial fishers, NGOs, tourism operators etc...) outside this symposium. It will take approximately 15 minutes to complete the survey. Your participation in this study is completely voluntary. There are no foreseeable risks associated with this project. Data from this research will be reported only in the aggregate and you will in no way be identifiable. However, if you feel uncomfortable answering any questions, you can withdraw from the survey at any point.

The survey will act as a poll, with Dr Gennari presenting some of the findings at the Symposium. The overall findings will be used to create a scientific publication and will also be communicated to the Department of Forestry, Fisheries and the Environment.

TARYN MURRAY: SOUTH AFRICAN INSTITUTE FOR AQUATIC BIODIVERSITY, SOUTH AFRICA

Can mobile boat-based acoustic receivers improve data collection of tagged sharks within South Africa’s large-scale passive acoustic telemetry array?

The development of large-scale passive acoustic telemetry arrays, such as South Africa’s Acoustic Tracking Array Platform (ATAP),have greatly advanced our understanding of the movements and migrations of aquatic animals across the globe. However, acoustic receivers moored at fixed sites within these arrays are often unevenly spaced along a stretch of coastline and thereby create gaps in the collection of spatial data. The aim of this study was to assess the efficacy of a mobile boat-based receiver to improve data collection within the ATAP array. A receiver was secured to a research vessel in Mossel Bay, which allowed for the comparison of data collected by the existing ATAP receivers (n = 13) in the bay and the boat-based receiver. Between the period January 2017 and May 2018 the ATAP array recorded 17177 detections from 14 species and 74 different individuals, while the boat-based receiver recorded 10504 detections from seven species and 46 individuals. The findings of this study suggest that there is tremendous potential for the deployment of boat-based receivers to enhance data collection within the ATAP array. This can be facilitated by vessels involved with eco-tourism activities such as shark cage diving at key hotspots around the South African coastline.
Sex and size influence the spatiotemporal distribution of white sharks, with implications for interactions with fisheries and spatial management in the southwest Indian Ocean

Human activities in the oceans, specifically fisheries, increase the extinction risk of marine megafauna populations. Given that fisheries management measures and spatial zonation may be required to reduce the extinction risk of a species, we analysed the movement patterns of 33 white sharks (*Carcharodon carcharias*) satellite-tagged in South Africa. We investigated the influence of size, sex and season on movement patterns and the spatial and temporal overlap with longline and gillnet fisheries and marine protected areas (MPAs) between 2012 and 2015. Transboundary movements between South Africa and Mozambique were frequent. A hidden Markov model identified two movement states (‘resident’ and ‘transient’) and investigated the effect of individual and temporal covariates on the transition probabilities between states. The model with sex, total length and a periodic function of day of the year had the most support (70%). Males and females were more likely to adopt resident movement behaviour near the coast. Sub-adult and adult females were the only ones to travel extensively away from the coast. White sharks overlapped with longline and gillnet fisheries within 25% of South Africa’s Exclusive Economic Zone (EEZ) and spent 26% of their time exposed to these fisheries during the study period. The demersal shark longline fishery had the highest relative spatial and temporal overlap, 14% and 20%, respectively, followed by the pelagic longline fishery, 11% and 5%, and the KwaZulu-Natal (KZN) shark nets and drumlines, 1% and 1%. However, the KZN shark nets and drumlines reported the highest white shark catches, emphasising the need to combine spatiotemporal shark movement and fishing effort with reliable catch records to assess risks to shark populations more accurately. White shark exposure by movement state, sex and maturity status to shark nets and drumlines corresponded with the catch composition of that fishery, providing support for a meaningful exposure risk estimate. White sharks spent significantly more time in MPAs than expected by chance, likely due to increased prey abundance or less disturbance. Improved conservation and management of white sharks in South Africa could be achieved by reducing the number of nets and drumlines in KZN, finding alternative non-lethal solutions to beach safety, increasing the observer coverage in longline fisheries, a centralised database of white shark mortality and continued monitoring of movement patterns with existing and emerging threats.

Bull shark (*Carcharhinus leucas*) recruitment into St Lucia Estuary after prolonged mouth closure and first observation of a neonate bull shark preayed on by a Nile crocodile (*Crocodylus niloticus*).

Estuaries provide critical nursery habitat for juvenile bull sharks that have the ability to withstand a wide range of salinities. St Lucia is the largest estuarine lake in Africa and was once a key nursery for bull sharks until a prolonged period of mouth closure and drought between 2002 and 2021. The estuary mouth was opened for the first time in 13 years on January 6th, 2021 and within 10 days, bull shark pups recruited into the estuary. On January 16th, an adult Nile crocodile was observed preying on a live neonate bull shark which it swallowed whole. This observation provided the first photographic evidence in Africa and highlighted a unique interaction between these top freshwater and coastal predators, respectively. Estuaries remain important nursery habitats for bull sharks and we confirmed the current records of bull shark occurrence in all South African estuaries. In summary, the rapid recruitment of bull shark pups into St Lucia Estuary was notable for the management and conservation implications of the estuarine system, as well as for regional bull shark populations.
GARETH JORDAAN: OCEANOGRAPHIC RESEARCH INSTITUTE (ORI), SOUTH AFRICA

Movement patterns and growth rate of the whitespotted wedgefish *Rhynchobatus* 

Information on the movement ecology of endangered species is critical for the implementation of effective conservation measures. This study made use of a long-term dart tagging dataset to reveal the movement patterns and growth rates of two size classes of the Critically Endangered whitespotted wedgefish *Rhynchobatus djiddensis* within its southern African distribution, which can have important implications for fisheries management. A total of 4 768 individuals were tagged with 340 recaptures recorded, ranging from 1 to 2 639 days (7.2 years) at liberty. Most of the tag releases and recaptures occurred within the KwaZulu-Natal central region in South Africa, with catches increasing significantly during summer (October to March). Most recaptures (43%) were recorded within 5 km of the tagging (release) site. Tagged adults recorded significantly greater distances moved than juveniles (p < 0.002) but there was no significant difference between juveniles or adults in terms of their direction of movement (p > 0.30). A Francis growth model showed that smaller individuals had a substantially faster growth rate (198.69 [SE 21.75] mm year−1) compared with larger individuals (57.41 [SE 27.83] mm year−1) confirming that the species is relatively slow-growing. Ultimately, this study identified important knowledge gaps in the broadscale movement patterns of *R. djiddensis* and provided new information on the growth rate of this Critically Endangered species. Filling in these knowledge gaps will aid in conservation measures for two important size classes of the *R. djiddensis* population as the species faces increasing targeted fishing pressure.

STEPHANIE VENEABLES: MARINE MEGAFAUNA FOUNDATION, MOZAMBIQUE

Robust population assessments require a multi-technique approach: an example of reef manta rays (*Mobula alfredi*) in southern Mozambique.

Manta ray populations are declining globally, largely due to targeted fishing and indirect anthropogenic threats. Important aggregation sites for reef manta rays (*Mobula alfredi*) have been identified along the coast of southern Mozambique. While previous studies identified regional decline, further understanding of this population is required to guide effective management. We examined the demographics, habitat use and population connectivity of reef manta rays in Mozambique’s Inhambane Province, using data from 4473 photo identification surveys, 42 acoustic tags and 120 genetic samples. Photo-ID of 1209 individuals characterized a transient population (38% re-sighting rate) comprising mostly adults. Minimal interchange was detected between study sites (up to 300 km), despite the large movement capacity of *M. alfredi*. Abundance modelling of sightings from Praia do Tofo revealed a declining trend, from a peak of N=836 in 2004/2005 to N=<100 from 2013 onwards. We examined habitat use and movements using passive acoustic telemetry, identifying site affinity and diel visitation patterns to inshore reefs. Tagged individuals were typically present during daylight hours at cleaning station reefs, whilst detections peaked at night for a known feeding site. Although we observed frequent movements between Praia do Tofo and Zàvora, we detected no movements between these regions and the Bazaruto Archipelago, corroborating photo-ID findings. To assess whether apparent ecological segregation was indicative of genetic sub-division, we examined 3057 nuclear-marker sites (SNPs) across the genome, finding no evidence of population structure (FST=−0.003-0.006) and confirming that sampled *M. alfredi* belong to a single interbreeding population. At a broader spatial scale, we detected strong genetic differentiation between Mozambique and Western Australia (FST=0.406), suggesting the Indian Ocean basin represents a dispersal barrier. Our holistic approach achieved broad spatial and temporal coverage, setting a standard for *M. alfredi* population assessments globally, whilst providing valuable population insights to inform local conservation and management.
This presentation intends to showcase the works completed during my MSc by research projects concerning the stingrays of southern Mozambique, the research gaps I have identified therein and the preliminary results of my forthcoming PhD projects. I intend to summarise the findings of the two published manuscripts from my MSc studies; the first detailing the validation of the computer-aided, photo-identification of the smalleye stingray, *Megatrygon microps*, which is among the largest and most unique species of stingrays in the world. The second manuscript describes the trends in the sightings of stingray in southern Mozambique, using citizen-science collected data to determine seasonality and small-scale habitat movement of stingrays in the diving region of Tofo, Mozambique.

I am now undergoing PhD research to continue to work on filling the many research gaps that I have identified during the MSc work. My PhD topics include the use of biochemical analysis to determine feeding ecology, habitat use and movements of multiple stingray species in the Inhambane provincial region. These data will compliment the photo-ID and diver observations already completed, whilst increasing our knowledge surrounding the differing trophic roles of each stingray species, their importance to the ecosystem and, most notably, reveal more about their movements to the ocean zones that are unavailable with the satellite and pinger tags traditionally used in movement telemetry studies.
Testing the waters to find the goldilocks zone: fine scale movement of *Mustelus mustelus* in relation to environmental cues.

The fine-scale movement of *Mustelus mustelus* in relation to environmental conditions was investigated at various temporal scales with acoustic telemetry and temperature-depth transmitters inside a coastal Marine Protected Area in South Africa. Twenty-four sharks were equipped with acoustic tags and logged by an array of 28 acoustic receivers from Nov. 2006 to Nov.2008. Generalised additive and generalised additive mixed models (GAMMs) were used to explain patterns of movement in terms of the environmental conditions related to temperature and changes the rate of change of temperature, tidal flow, diel cycle and moon phase. The most important environmental parameters affecting movement and direction of movement were related to absolute temperature and changes in temperature at the position of the shark. The movement of *M. mustelus* was not affected by tide and only minimally affected by the diel cycle, suggesting behavioural thermoregulation as the ultimate cause of the movements. The thermal preference for *M. mustelus* was from 18 to 22°C as determined by GAMMs for environmental conditions experienced in summer. The combination of the thermal environment, rich feeding grounds and protective effect of the LMPA may explain the high abundance and regular occurrence of *M. mustelus* within this Marine Protected Area.

Site affinity and habitat connectivity of blue stingrays along South Africa's south coast.

Blue stingrays *Dasyatis chrysonota* are common benthic stingrays endemic to southern Africa. They are known to occur in shallow inshore habitats during summer and are hypothesized to move to deeper offshore waters during winter. However, it is unknown whether individuals display fidelity (i.e. return to the same summer location) or dispersal (i.e. do not return to same summer location) and to what extent they may connect coastal habitats. This information is vital to inform population dynamics, ecological roles and best management practices for this declining Near Threatened species. Twenty-seven individuals were monitored using the Acoustic Tracking Array Platform (ATAP – a nation-wide collaborative network of acoustic receivers) for up to 4.5 years. Individuals were found to display site affinity to defined regions of the coast, with the majority of detections for most individuals being recorded in the shallow bay/coastal shelf they were tagged in. However, important movement corridors linking different habitats were also identified (inshore vs offshore and coastal bay vs coastal shelf habitats). This habitat use was influenced by month and temperature, with individuals displaying restricted movements to the shallow bay habitat in summer when deeper waters were much colder. The large collaborative nature of the ATAP allowed for the monitoring of a benthic ray across large spatial scales for the first time, challenging preconceived notions that small undulatory batoids cannot travel large distances (many individuals were found to travel up to 200 km). Insights can also assist in local management of this species, and highlights that current Marine Protected Area zonation may not be sufficient to protect blue stingrays from further population declines.
VIVIENNE DAMES: DEPARTMENT OF FORESTRY AND FISHERIES AND THE ENVIRONMENT, SOUTH AFRICA

The Raggedtooth Gap: A synthesis of global research on *C. taurus* and what remains unanswered.

The raggedtooth shark, *Carcharias taurus*, is a common littoral shark with a wide global distribution. Internationally it is among the most popular shark species to be displayed in public aquaria, contributing immense value towards public perceptions. In South Africa, the species is also very important to the diving tourism and recreational angling sectors. Due to a combination of exploitative factors, commercial fishing being the most prominent, this species was put in dire straits internationally. It is listed as critically endangered and is now protected in most of its range. Populations remain collapsed in regions of South America, the Mediterranean and Western Australia. A synthesis of all research done on the species internationally and within South Africa has identified numerous research gaps at a national and international level which will be discussed in this presentation. Processing over 1000 literary results, a review identified a total of 146 peer-reviewed publications and dissertations that had *C. taurus* as a study species. Some of the research gaps that will be discussed include; how this species utilises estuarine habitats, how aquarium released individuals integrate back into the wild, how populations utilise complex social networks and the effect of changing ocean variables. Due to the collective efforts of researchers across South Africa an acoustic telemetry dataset exists for this species, which has gone relatively unmined. A total of 95 raggedtooth sharks have been acoustically tagged between March 2007 and January 2021. Of these, 81 individuals have been detected on the ATAP nationwide receiver network, with many tags presently still active. From a perspective of post-pandemic research this begged the question, how can we use this existing dataset to address the gaps in our knowledge for this species?

TOBY ROGERS: INSTITUTE FOR COMMUNITIES AND WILDLIFE IN AFRICA, DEPARTMENT OF BIOLOGICAL SCIENCES, UNIVERSITY OF CAPE TOWN, CAPE TOWN, SOUTH AFRICA

Movements and growth rates of the bronze whaler shark (*Carcharhinus brachyurus*) in southern Africa from a tag-recapture programme

The bronze whaler shark (*Carcharhinus brachyurus*) is found in coastal temperate latitudes worldwide. Due to low reproductive potential, being targeted in several fisheries and caught as bycatch in others, *C. brachyurus* is classified as Near Threatened on the IUCN Red List. We used tag-recapture data from the Oceanographic Research Institute’s Cooperative Fish Tagging Project to investigate *C. brachyurus* movement and growth patterns in southern African coastal waters. From 1984 – 2020, 10 069 *C. brachyurus* were tagged by citizen anglers between Cape Vidal (east coast South Africa) to Namibe (southern Angola), with 331 (3.3%) recaptured. Large-scale inter-regional movement was evident (6% of recaptures, n = 21), which supports previous genetic studies demonstrating connectivity within the southern African *C. brachyurus* population from Namibia to South Africa. However, most recaptured sharks showed strong site fidelity and were often recaptured <100 km (70%, n = 230) from the tagging location. Adult sharks demonstrated significantly higher site fidelity compared to juveniles and subadults. However, time at liberty between tag and recapture was significantly lower for juveniles, indicating greater catchability of this vulnerable stage. A maximum-likelihood growth model predicted slow annual growth rates of 7.61 cm year⁻¹ - 2.14 cm year⁻¹ for reference lengths 70 cm and 200 cm (PCL) respectively, based on 107 individuals. As a commercially and recreationally important target species with a slow growth rate and high site fidelity, means that the southern African *C. brachyurus* population is vulnerable to over-exploitation. These findings can be used to identify focus areas for research and management, and in stock assessments of the species.
THEME:
Sharks & Humans
Despite growing public pressure to use non-lethal strategies for managing predators (e.g., sharks) in marine ecosystems, the response of many governments remains largely lethal. This article examined recreationist support and understanding of approaches for managing sharks in two of South Africa’s marine areas. Questionnaires completed by 575 ocean recreationists at beaches near Cape Town and Durban showed they strongly disagreed with lethal management of sharks. The non-lethal Shark Spotters program was the most strongly supported strategy, followed by heat sensor cameras to detect sharks. Other non-lethal strategies (exclusion nets, personal repellent devices, deterrent cables, camouflage wetsuits) were supported by fewer than 50% of respondents, but were still more strongly supported than specific lethal strategies (shark hunts, drumlines, shark nets). Shark Spotters was more strongly supported near Cape Town, whereas the lethal strategies and a few of the other non-lethal approaches (personal electric repellent devices, electric deterrent cables, exclusion nets) were more strongly supported near Durban. Few respondents understood that shark nets and drumlines are designed to catch and kill large sharks. Understanding the function of shark nets correlated negatively with support for their use and positively with support for temporary exclusion nets. Implications of these results were discussed within the framework of a global transition from lethal to non-lethal management.

Since 2011, the intensity of unprovoked human-shark interaction has dramatically increased on the coast of Reunion Island, with a total of 30 human-shark interactions including 11 fatal shark bites. Most of these interactions occurred within the most popular beaches of the island. The main shark species responsible for these interactions is the bull shark (*Carcharhinus leucas*). Faced with this unprecedented situation, the French government instituted a ban on all nautical activities around the island and decided to implement a comprehensive strategy to mitigate the risk of human-shark interactions. To ensure the implementation of this strategy, the Reunion Shark Security Centre was officially created in April 2016 and became since June 2020 a French governmental agency. The main objectives of this institution are to coordinate and implement operational mitigation measures contributing to reduce the shark risk in Reunion, as well as to promote mitigation measures reconciling ocean users’ safety and the conservation of marine biodiversity using technological innovations.

For the past four years, many innovative mitigation measures have been tested in Reunion waters and other parts of the world. These measures include a highly regulated shark control program using smart drumlines, the creation of new tools to detect potentially dangerous sharks, as well as testing commercially available shark deterrent devices. Thanks to all of these measures, the ban on nautical activities has now been partially lifted in specific areas of the island, with further development to come in the near future.
Over the past few years, the number of human-shark interactions has been on the rise globally. A range of measures meant to mitigate the risk of an interaction has been deployed worldwide, such as preventive fishing or exclusion nets. More recently, the use of a personal shark deterrent has become a popular option for ocean users. Several types of these shark deterrents exist and typically rely on optical, olfactive, magnetic, or electrical stimuli to repel sharks that get too close to the wearer. Until recently, these devices were rarely tested independently and in a robust manner. However, this has now changed and through these recent studies, we learned that not all of these devices were effective in repelling sharks, and that electric shark deterrents are generally the most effective type. However, not all of these deterrents are as effective as the others, but their effectiveness may also vary between shark species. The Shark Security Centre from Reunion Island has recently tested several electric shark deterrents on bull sharks and is planning to test other commercially available devices in the near future. Throughout this presentation, we will go over the existing types of personal shark deterrents to identify their advantages and drawbacks, the results of recent investigations on their effectiveness, but also potential future development for this technology.
The Inhambane Province of Mozambique is a globally significant area for iconic marine megafauna, particularly manta rays, whale sharks, and dugong. This coastline is also an important seasonal habitat for large predatory sharks and cetaceans, and is a major aggregation area for sea turtles and billfish. It is also home to rare or poorly studied species of elasmobranchs. The northern section of the province is protected as Mozambique's first marine protected area, the Bazaruto Archipelago National Park (BANP), and together with the adjacent unprotected southern coastline has been mooted as a future World Heritage site by UNESCO and a Hope Spot by Mission Blue.

Over the last two decades, the Marine Megafauna Foundation (MMF), has demonstrated the critical importance of Inhambane Seascape. Our researchers have pioneered the first studies on smalleye stingrays in the wild, and have begun first formal studies of wedgefish, leopard sharks and devil rays in the country and have compiled some of the longest running datasets on manta rays and whale sharks in the world. We have also contributed to long-term studies on sea turtles, bull sharks, and dugong in the region.

MMF’s main objective is to help safeguard threatened and economically important marine megafauna in southern Mozambique by reducing their primary threats in the region and helping to protect critical habitats and important aggregation areas. We are helping to use science to underpin the development of adaptive management plans for endangered or at-risk species, to ensure that they are being protected and monitored properly by local management authorities. Perhaps most importantly, we are using our results and focused media campaigns to build on the refuge provided by Bazaruto Archipelago National Park and encourage formal protection for a significant migratory corridor for marine species to the south of this protected area.
THEME:
Genetics & Identification
The great white shark count: estimating the abundance of the white shark in Southern Africa with a model integrating several long-term datasets - preliminary results

Paramount to the success of any regulatory action is a basis in sound scientific knowledge and a regular assessment of progress. This project aims to assess the status and trend of the white shark (Carcharodon carcharias) assemblage in southern Africa by deriving the first robust regional estimates of past and present shark abundance that accounts for movement within and outside of the study area. An accurate estimate of abundance is a vital index for the management of the white shark in the region. This work aims to unify previous estimates of abundance by integrating several independent photographic identification and telemetry datasets. Preliminary results of movement models combining acoustic, satellite telemetry and visual encounter datasets are presented. 38 individuals were fitted with SPOT transmitters, 35 of which, plus an additional, 5 were surgically implanted with RCODE acoustic transmitters. Over 1 terabyte of photographic encounter records will be processed to identify individuals using a novel automated computer vision system. The model then aims to account for biases introduced by animals that are in the study site but not sampled photographically, particularly when bait is used for attraction, by developing a hierarchical state space model that links the underlying movement of individuals with the observation process that results in successful photographic identification, and ultimately, the mark-recapture model. Drivers of movement between aggregation sites, the influence of this movement on seasonal relative abundance and temporal and spatial trends reflecting the health of the population will be explored.

Population genomics of Carcharhinus brachyurus across Southern Africa

The bronze whaler or copper shark (Carcharhinus brachyurus) is a large coastal shark with cosmopolitan distribution and one of the most commercially exploited elasmobranchs in South Africa. The species is considered highly vulnerable to overexploitation due to its life history traits characterized by low fecundity and late maturity. Moreover, a lack of accurate species-specific catch data complicate assessments of stock structure and population trends, increasing the risk of negative population trends going unnoticed. Here we aimed to comprehensively assess the population genomics of this vulnerable species throughout the South-East Atlantic and South-West Indian Ocean region using a novel genotyping approach. Samples were collected across a representative distribution range from the east coast of South Africa to Angola and prepared for massively parallel sequencing on an Illumina platform using the Adapterama III (3RAD) library preparation protocol. Generated raw reads were processed with an optimized bioinformatic pipeline and resulted in thousands of genome-wide single nucleotide polymorphisms (SNPs) genotyped in 88 individuals. The distribution of genomic diversity and patterns of gene flow were explored with different methods to define stock structure on a local and regional scale. Additionally, demographic analyses provided first estimates of the species’ effective population size and trends over time. Ultimately, these data are expected to inform conservation, management strategies and policy at the national and regional level.
THEME:
Fisheries
Gillnets were introduced to South Africa in 1885 for the targeting of large nomadic, migratory fish such as geelbek *Atractoscion aequidens* on the West Coast. Shark directed gillnetting only took off in the 1940s driven by the demand for shark liver oil and Vitamin A and disruption of established markets in WW II. Thereafter, management of the gillnet fisheries became more formal and the only legal shark gillnet fishery for St Joseph *Callorhynchus capensis* (& limited bycatch) was confined to St Helena Bay. This fishery’s market for dried product to the DRC collapsed in the 1990s. Since then, illicit targeting of sharks has increased on the West and South coasts driven by a lucrative market, no restrictions on net ownership and cheap availability of 178 mm “St Joseph” mesh and other large-mesh gillnets imported from elsewhere.

Catch data are limited by the illicit nature of the fishery so comprise mostly that from confiscated nets and catches. Catch estimates are bolstered by extrapolating known cpue from comparable research gillnetting to lengths (& mesh) of nets confiscated. Shark bycatch in the illegal nearshore and estuarine gillnet fishery is largely a function of bioregion and the mesh size used. For example, > 90 % of the nets confiscated in Richards Bay are > 80 mm stretched-mesh, mean length of 110 m with an estimated four nets deployed in the system at any one time. Shark bycatch ranges from 0 – 50 per 100 m of net, dominated by hammerhead *Sphyrna zygaena* and milkshark *Rhizoprionodon acutus*. In comparison, 75 – 145 mm gillnets targeting galjoen *Dichistius capensis* and other linefish on the West Coast catch smooth-hound *Mustelus mustelus* and seven-gill *Notorynchus cepedianus*, those on the Cape south coast, the latter two but also gully-shark *Triakis megalopterus* and juvenile ragged tooth *Carcharias taurus*.

Shark directed gillnetting is an increasing threat on the Cape south coast, predominantly targeting smooth-hound, soupfin *Galeorhinus galeus* but with substantial catches of gully, seven-gill and bronze whaler *Carcharhinus brachyurus*. Nets are deployed permanently as well as stored at sea to avoid detection, dislodged and lost nets are responsible for ghost-fishing. Each operation may work more than 2 km or more of nets and confiscated catches suggest a total of up to 200 t per annum. Hearsay has at least one regular operation in each of four coastal areas False Bay to Mossel Bay.

Pelagic fishing for tuna dates back to the 1960s, when South African longline vessels targeted southern bluefin tuna and albacore around the Cape. Only in 1997 were thirty experimental large pelagic longline permits issued to revive the local tuna fishery, which was eventually formalised as the large pelagic (tuna and swordfish) longline fishery in 2005. At the time, the Department stipulated in its policy for the allocation of long term rights in the large pelagic fishery that it would phase out targeting of sharks (DAFF, 2005). Subsequently, in 2011, a decision was taken to close the pelagic component of the shark longline fishery and to incorporate the pelagic shark specialist vessels into the large pelagic longline fishery. To allow for transition from sharks to the primary target species (tuna and swordfish), a 2 000 ton Precautionary Upper Catch Limit (PUCL) was implemented for pelagic sharks. The 2015 large pelagic longline policy prohibited any directed targeting of sharks and the permit conditions prohibited the discarding of dead sharks, the retention of thresher, hammerhead, oceanic whitetip, porbeagle, dusky and silky sharks, the use of stainless steel hooks and wire traces, as well as stipulating sharks must be landed with fins attached and setting a minimum observer coverage threshold. Yet, the practice of shark targeting persisted, with catches of blue sharks (*Prionace glauca*) and shortfin mako (*Isurus oxyrinchus*) adding up to ~ 1 400 tons, or 52% of the total landings by the large pelagic longline fishery (2 650 tons), in 2016. In response, the Department reviewed the National Plan of Action (NPOA) for sharks, consulted with stakeholders and implemented new permit conditions to reduce pelagic shark catches. In 2020 South Africa’s total pelagic shark catch was just 204 tons; an 85% reduction in just 4 years. Furthermore, sharks only contributed to 12% of the total pelagic longline catch. In this talk we discuss the challenges of effecting behavioural change in fishers through regulation.
**Day-night patterns of habitat use by dogfish sharks (*Squalus*) at photic and subphotic warm-temperate reefs: diel movements, size- and sex-segregation**

Dogfish sharks (genus *Squalus*) demonstrate complex distribution patterns that may increase their vulnerability to selective overfishing. This study investigated the day and night reef-use patterns of dogfish in South Africa on shallow photic (13–35 m) and deep subphotic (51–99 m) nearshore rocky reefs. Using baited remote underwater stereo-video systems, immature male dogfish were commonly recorded at subphotic deep reefs. At shallow photic reefs, dogfish were essentially absent during the day; however, a significant increase in the abundance of large male dogfish was observed at night. The size class of dogfish that moved onto photic reefs at night was not recorded at deep subphotic reefs, suggesting that they make use of a different day-time habitat. The observed differences in depth use by cohorts of small and large male dogfish, and the absence of females, provided strong evidence for size- and sex-segregation within the surveyed population. While the potential biotic and abiotic drivers were not directly tested, the results suggest that reef-use patterns may be linked to photic or temperature preferences and/or competition- and mating-avoidance strategies. This new information about the use by dogfish of nearshore rocky reefs in South Africa has raised important questions relating to the distribution and habitat use of females and the day-time habitats of mature male dogfish. With dogfish extensively caught in longline and trawl fisheries in South Africa, further research is needed to address the current knowledge gaps.

**Fishing for survival: importance of shark fisheries for the livelihoods of coastal communities in Western Ghana.**

Small-scale shark fisheries support a large number of coastal community livelihoods in developing countries. Shark meat comprises a cheap source of protein and is traded locally in many parts in developing countries, while the skins, oil, fins and gill rakers are exported to the international market. This study addresses a gap in literature regarding the importance of elasmobranchs to key shark-fishing communities and the degree to which trade in shark products (meat and fins) vary in time and among fishing communities in Ghana. We interviewed 85 fishers and traders involved in shark fisheries in Axim, Dixcove, and Shama communities in Ghana using semi-structured questionnaires. Fishing was the primary source of income and accounted for 58.5% of the total household income of respondents. Other important economic activities were fish processing (16.0%), fish retailing (13.3%), and small businesses (2.5%). One-third and often two-thirds of respondents generated between 80-100% of their income from shark fisheries: Axim (n = 65%), Dixcove (68%), and Shama (35%). Shark meat consumption was common among fishers and traders and represents a substantial source of protein in the diet of the study communities. Overexploitation of these species may compromise food security. Hammerhead sharks (*Sphyrna spp*) and Bull Shark (*Carcharhinus leucas*) have the most valuable fins and meat. Further, 75% and 95% of fishers and traders respectively see fishing and trading of shark meat as their last safety-net and, therefore, tend to be satisfied with their jobs. Non-fishing related livelihood streams including small businesses and transportation were the major fallback activities both fishers and traders preferred to rely on if there is a ban on the exploitation of sharks in Ghana. Thus, any shark management strategy must take into consideration the preferred livelihood fallback options outlined by fishers and traders, and implement them to ensure the success of the intervention.
THEME: Conservation
Globally, the emphasis for baited remote underwater stereo-video (stereo-BRUVs) surveys of coral reefs and their associated elasmobranch communities has been on photic waters (0 – 30 m). Studies have shown that long-term monitoring of elasmobranchs, especially coral-reef associated sharks and rays, is warranted, given the status of many species and the pressures they face in coastal waters. Similar attention in deeper waters is only emerging, as remote camera technology facilitates repeatable work at increasing depths. The ecological importance and conservation imperative of the mesophotic depth zone is also becoming increasingly apparent. For effective management, the iSimangaliso marine protected area (MPA) and World Heritage Site (iSimangaliso), situated in the KwaZulu-Natal (KZN) province of South Africa, requires additional biodiversity information for mesophotic benthic ecosystems and submarine canyon habitats, including assessments of elasmobranch diversity, relative abundance and size frequencies to assess what is being protected by the MPA’s current designation. This project conducted stereo-BRUVs surveys in the previously un-surveyed reaches of northern and central iSimangaliso in 2017, 2018 and 2020, with the aim to cover a representative proportion of the Park’s mesophotic reefs (45 - 240m depth) and provide baseline information on soft sediments. Key species of conservation concern for the region, including Rhynchobatus djiddensis and Sphyrna lewini, and species of management interest, including Carcharius taurus, were detected. Twenty four elasmobranch species were recorded with the following top six species having the greatest number of observations: Carcharhinus limbatus (n=12), Bathytoshia lata (n=10), Carcharhinus albimarginatus (n=9), Carcharhinus humani (n=8), Rhynchobatus djiddensis (n=8), and Acroteriobatus leucospilus (n=6). The deepest record of an elasmobranch (Heptranchias perlo) recorded during the survey was at a depth of 235 m. The preliminary results show that stereo-BRUVs can access greater depths and more habitats than previously surveyed in the recently-expanded iSimangaliso MPA – a promising tool for monitoring management effectiveness.

The shorttail nurse shark Pseudoginglymostoma brevicaudatum (Ginglymostomatidae) is a very small shark with a very big name, and an even bigger conservation problem. A poorly known species, this Western Indian Ocean endemic has all but slipped under the radar of conservation assessments. However, owing to severe population declines, the species was uplisted from Vulnerable to Critically Endangered on the IUCN Red List of Threatened Species, in 2019. This makes it the only Critically Endangered (and thus the single most threatened) shark species that is endemic to sub-equatorial Africa; and worthy of conservation intervention. We present a revised distribution range for the species, following a >2000-km extension of its known range, into Mozambique (as evidenced through ecological surveys and citizen science), whilst refuting its Seychelles distribution as a species identification error (calling on museum archives). We also present the first dental description of the species. We discuss the potential mechanisms for, and the implications of, this range extension and question the role of climate change in driving this pattern. The study highlights the value of broad, multi-national and multi-disciplinary collaboration, digging deeper to gain more from existing datasets, and engaging with fisheries sectors and citizen scientists to enhance data collection potential, which are likely key considerations for post-pandemic research on southern African Chondrichthyans.
Scalloped hammerhead sharks *Sphyrna lewini* are circumglobally distributed in coastal warm-temperate and tropical seas. Extensive capture in fisheries throughout their range, both targeted and bycatch, has led to their recent uplisting from Endangered to Critically Endangered on the IUCN Red List of Threatened Species. Their listing on CITES Appendix II in 2013 has done little to reduce international trade in this species, as scalloped hammerhead fins are among the main shark species in Hong Kong fin markets. In the Western Indian Ocean, *S. lewini* are caught in considerable numbers by industrial and artisanal fisheries, and are considered a valuable food resource for many coastal communities. In artisanal fisheries in East Africa, pregnant *S. lewini* are caught in Tanzania and juveniles comprise the majority of the catch in Mozambique, while in northeast Madagascar the species is known to be caught in the only designated shark sanctuary in the Western Indian Ocean. Significant under-reporting in the trade of this species is likely, as no CITES export records exist for *S. lewini* from Madagascar, Mozambique or the United Republic of Tanzania, yet fins belonging to *S. lewini* were confirmed in an illegal confiscation in Mozambique. If *S. lewini* populations are connected in East Africa, socio-economic implications of their depletion include decreased food and income security and negative impacts on ecotourism at known aggregation sites, such as Aliwal Shoal, South Africa. A population genetics study for this species in the Indian Ocean is currently underway to resolve this query. The situation raises the question of how such high numbers of a Critically Endangered species can still be caught and traded? Is this species really on the cusp of extinction in the wild, or is it more resilient than its conservation assessments suggest? Research priorities and the need for a regional conservation assessment are discussed.

The whitespotted wedgefish (*Rhynchobatus djiddensis*) is a Critically Endangered shark-like ray in the family Rhinidae. Throughout its Western Indian Ocean distribution, it is targeted for its valuable meat and fins and is reported to have undergone major population declines. However, there remains a need for species specific time-series data to accurately assess localised population declines. This study used two independent long-term (37 to 40 years) time-series catch data from competitive shore angling and shark nets to investigate the size composition and catch per unit effort (CPUE) and conduct a risk assessment for the population on the east coast of South Africa. From 1977 to 2017 the competitive shore fishery captured 7703 individual *R. djiddensis*, whilst shark nets in the same region captured 2856 individuals from 1981 to 2017. The net catches, with a sex ratio of 1.8:1 females to males, were larger than those of the anglers. Although the mean annual sizes of net-caught individuals were above the size of reported sexual maturity, there was little evidence to suggest that any individuals captured were reproductively active. Both the competitive shore fishery and shark net catches exhibited strong seasonal trends with the majority of *R. djiddensis* catches occurring from October to May peaking in austral summer. CPUE from the competitive shore fishery declined substantially between 1977 and 2017 and shark net catches exhibited a significant ($p < 0.05$) fourfold decline in annual CPUE from 1981 to 2017. Ultimately, a risk assessment showed a 65.1% decline in abundance over a period of three generation lengths which indicates that the sampled population of *R. djiddensis* should be classified as Endangered according to the IUCN Red List using criterion A2b. The conservation implications of this are discussed.
**MICHELLE CARPENTER: DEPARTMENT OF BIOLOGICAL SCIENCES, THE UNIVERSITY OF CAPE TOWN, SOUTH AFRICA**


Very little is known about the Endangered shortfin devil ray, *Mobula kuhlii*. This research documents critical sites, cleaning stations, for this ray species in Southern Africa. Most shark and ray species exhibit strong site preferences, thus making certain locations crucial for their survival. Many of these preferred sites are cleaning stations: areas on rocky or coral reef where symbiotic cleaner fish remove parasites and clean wounds of a variety of hosts, from small fish to large sharks or rays. These sites also function as social gatherings or resting points, as well as for reproduction where courtship and mating occurs. Since the discovery of this cleaning station at the Aliwal Shoal Marine Protected Area, 535 sightings of shortfin devil rays over 3379 minutes of sampling effort (average of 0.15 devil rays per every minute sampling time) have been recorded. These data were collected across 89 SCUBA dives, making an average of 6.01 devil rays per dive. Unexpected findings also included first-time footage of shortfin devil ray mating behaviour at the study site. We collected one hour of total visual data on the rays cleaning utilising manned and five hours of Remote Underwater Video footage. We captured maximum numbers of 23 and 30 devil ray individuals using the cleaning station at the same time, by the remote cameras and me manning an underwater camera respectively. Much longer cleaning durations were observed in the remote cameras, in the absence of human divers, compared to when divers were present. This is the first scientific report of shortfin devil ray cleaning station use and results will prove critical in increasing data to assess threats to this species, and influence policy and conservation management decision for them.

**NAKIA CULLAIN: DALHOUSIE UNIVERSITY, DEPARTMENT OF BIOLOGY, CANADA. MARINE MEGAFAUNA FOUNDATION, USA**

**Sightings trends and population dynamics of the reef manta ray (*Mobula alfredi*) in Zavora, Mozambique.**

Mozambique is a hotspot for threatened and data deficient species of sharks and rays, yet a lack of site-specific information hinders the development of local and national species management plans. The largest identified populations of both the giant manta ray (*Mobula birostris*) and reef manta ray (*Mobula alfredi*) in southern Africa aggregate within a 350 km upwelling zone that extends from the Bazaruto Archipelago to Zavora. Research in Praia do Tofo (100 km north of Zavora) revealed a 90% and 98% decline in sightings for giant manta rays and reef mantas, respectively. Zavora is remote and poorly explored, however, consistent and frequent sightings of both manta ray species indicate that it may be a critical visitation site for remaining individuals, or, may indicate a habitat-shift in recent years. Using sightings and photo-ID data from dive surveys conducted during 2009-2021, we investigate sightings trends, movement patterns, and habitat preference of *M. alfredi* in Zavora Bay. Further, we expand on previous research to assess whether there is evidence for temporal and spatial shifts of aggregation sites along the Inhambane coastline, using a suite of modelling techniques. Observational and anecdotal evidence from Zavora suggests a shift from consistent year-round sightings to a seasonal aggregation from July-November, with complete abandonment of a previously favoured cleaning station. Our findings provide a detailed understanding of manta ray occurrence, abundance, and movement patterns, which are crucial to defining critical habitats and informing policy and management decisions.
Identical 3D replica fins of CITES Appendix II listed sharks have been developed through a collaboration between TRAFFIC and the Department of Forestry, Fisheries and the Environment. This is the first initiative of its kind in the World. The entire process from scanning, printing and painting has been documented and is now available online in English, French and Spanish with all scan files freely available so that replica fins can be made anywhere in the World. The development of the 3D printed fins accompanied by QR codes, which link to dedicated webpages providing additional guidance on identification, will facilitate the traceability and enforcement of dried shark fins in trade and allow for rapid and confident decision-making by relevant law enforcement officials. The presentation will focus on the context and need for these new tools, the development process, a demonstration of the QR code functionality, and use of the fins by compliance officials.

Mozambique is one of the poorest countries in the world, yet its ocean is home to precious marine biodiversity and Inhambane province is one of few places where you can find whale sharks and manta rays year-round. Artisanal fisheries and tourism are critical to the economy, yet both are under immediate threat from ongoing, destructive fishing practices. To address this threat, MMF tackles the root causes by educating and empowering local communities to manage their marine resources sustainably through innovative education, pioneering research and community empowerment. MMF promotes sustainable fishing activity throughout the most bio-diverse waters. Improved scientific knowledge of keystone species and fisheries, combined with responsible marine resource management and alternative livelihoods will mitigate threats to vulnerable species, helping communities to protect their valuable natural resources for future generations.

The informative poster and oral presentation will highlight Marine Megafauna’s conservation based engagement within the fishing village communities of Inhambane Province, with focus on our successes and challenges in our efforts to decrease destructive fishing practices by working within the community to increase locally taught conservation based education through our Ocean Ambassador’s program, increase local livelihoods through job training, apprenticeships, and VSLA loan savings programs, and increase local fishermen visibility and representation by revitalizing local fishing groups and assisting them in their efforts to create locally managed marine areas (LMMAs), as well as highlight community socio-economic data collected in fishing villages such as number of people per households, income levels, occupations, fishing methods, bycatch data, etc; understanding the community is a vital step in improving the harmony between people and marine life.
MIKE BARRON: CAPE RESEARCH AND DIVER DEVELOPMENT, SOUTH AFRICA

Fin Spotter - Citizen science photo identification program for endemic shy shark population estimates.

Fin Spotter is a long-term citizen science project that aims to estimate demographic parameters for several endemic and endangered shark species in Southern Africa using photographic identification, whilst engaging the public in shark conservation and education.

Photographs, taken by field scientists, recreational divers and tourists are an abundant source of valuable data. These submissions of catsharks to our Fin Spotter database are processed through autonomous visual recognition software (wildbook) to identify individuals from their unique patterns, spots and stripes, enabling quality scientific data through engaging and educational citizen science experiences.

Encounter histories generated from resighting the same individual over time allows researchers to estimate critically important parameters like abundance and probability of survival, which can be used to help identify priority areas for conservation.

In this presentation we will present the concept and methodology as well as preliminary results from our database thus far as well as discuss the impact, benefits and challenges of citizen science as a source of data and financial funding for local conservation projects.

NINA FAURE BEAULIEU: WILDLANDS CONSERVATION TRUST, SOUTH AFRICA

A systematic conservation plan for sharks and rays in South Africa.

South Africa is a global hotspot for shark and ray (elasmobranch) diversity, with high endemism, and it provides essential habitats for many wide-ranging endangered species. Recent and emerging threats within South Africa, and in the African region have resulted in dramatic declines in the abundance of elasmobranchs over the past several decades. Their role as top predators, and their life-history characteristics (low fecundity, slow growth, late reproductive maturity) make them extremely vulnerable to exploitation and other anthropogenic pressures that degrade marine ecosystems. Both fisheries and spatial management measures are required to address these declines, however, owing to their wide-ranging spatial distributions and movement characteristics, they have been overlooked as focal species in the designation of Marine Protected Areas (MPAs). We propose that many species can benefit from spatial protection when they congregate in mating areas and nursery habitats. To identify essential habitats for elasmobranchs, a systematic conservation plan (SCP) is being developed for South Africa. We first compiled distribution data from elasmobranch species within the continental Exclusive Economic Zone (EEZ). Data were sourced from research institutions, online repositories, the scientific literature, and expert workshops. We then produced spatial distribution models for each species to map their distribution within the EEZ. Seasonal distribution models were also created when possible. The last step (currently underway) will collate the distribution maps, define spatial conservation targets for each species (with a focus on areas important for critical life-history stages), and will assess the representation of these targets in existing MPAs. Conservation planning software (Marxan and prioritizr R) will identify focal areas for protection. The outcome of the SCP will be to identify at least 10 new areas of essential habitat for elasmobranch species. The extent of data collection, as well as distribution maps and preliminary results from the planning phase will be presented.
A cross-disciplinary approach to the protection of South Africa's threatened sharks and rays

South Africa is a global hotspot for chondrichthyan diversity, with a relatively high degree of endemism, while providing important habitats for many threatened species. Despite a rich history of shark research and management in South Africa there are substantial knowledge gaps, inadequate statutory interventions to ensure adequate protection for sustainable use and lack of capacity to effectively implement and enforce current legal provisions. Furthermore, public perceptions about sharks are in general, negative, and based on incorrect information. In an effort to improve the protection of threatened (Vulnerable, Endangered and Critically Endangered) species, prioritizing South African endemics the WILDTRUST through their marine programme, WILDOCEANS, together with the Shark Conservation Fund and other partners, has implemented a 3-year Shark and Ray Protection Project.

A campaign called Shark Attack was launched in March 2020, highlighting the plight of South Africa’s chondrichthyan species and actively trying to shift negative perceptions and inspire positive action through its website (www.sharkattackcampaign.co.za), traditional media and various social media platforms, and to date has reached 12.9 million people. Furthermore, the project has compiled a database and annotated checklist comprising all known chondrichthyan species found in South African waters, detailed status reports on 70 threatened and/or endemic species, a catalogue of all chondrichthyan literature relevant to South Africa and a detailed report on the use of drones for fishing. Before the end of the project in July 2022, the following deliverables are expected to be produced: field guide highlighting threatened and endemic species for law enforcement officers, species ID workshops, shark and ray best practice guidelines for commercial fisheries, recreational handling guidelines, recommendations for improved statutory modifications, shark and ray conservation plan, criteria for shark and ray MPA’s or shark sanctuaries, trade toolkit for law enforcement in numerous ports of entry and various information pack and policy brief for decision-makers.

Abundance, distribution and conservation of endemic catsharks (Scylliorhinidae) of Walker Bay.

This study is based on analysis of tagging data collected by the South African Shark Conservancy (SASC) since 2014 as well as using Baited Remote Underwater Video (BRUV) data focusing specifically on endemic catshark species of Walker Bay (pyjama catshark Poroderma africanum, dark shyshark Haploblepharus pictus, puffadder shyshark Haploblepharus edwardsii and leopard catshark Poroderma pantherinum). Tagging data comprises total length, pre-caudal length, inter-dorsal length, sex, maturity, date and location. Species abundance and distribution are described for different areas within Walker Bay to provide an estimate of the total population. Vertebral analysis is used to estimate age at length of individuals. The importance of small sharks in the identification of critical habitats is discussed. Over the next three years, I will collect data on neonates and juveniles held in captivity, and I plan to continue adding to the tagging data set. The BRUV database comprises more than 200 hours of videos and data collection is ongoing. Analysis of BRUV data will include teleosts, linking habitat use to community structures. The study will describe population trends over the past eight years and aims to relate these to anthropogenic and climatic threats.
Managing memorable tourism experiences poses desirable benefits to destinations and tourism organisations. In nature-based environments, for example, memorable tourism experiences contribute to tourists’ pro-conservation behaviour. Shark diving tourism emphasises the socio-economic value of live sharks in their natural habitats and demonstrates the feasibility of sustainable tourism in natural environments.

Previous studies have researched the relationship between conservation behaviour and wildlife tourists’ experiences. This pilot study evaluated the industry’s demand and supply side to support the sustainable management and development of shark diving tourism and shark conservation at four case studies in Southern Africa (Mozambique and South Africa). The findings presented in this pilot study will contribute to the large-scale study answering the research question: what influence do memorable shark diving tourism experiences (MSDTEs) have on shark conservation?

After reviewing previous literature on memorable tourism experiences, shark diving and shark conservation behaviour, a semi-structured interview was created to interview randomly selected shark divers (n = 55) in 2019. Upon transcribing the interviews and conducting a deductive thematic analysis with inductive open coding on the outputs, six (6) key themes emerged. These themes confirmed the participants’ awareness of threats that sharks face and highlighted the solutions participants deem appropriate to mitigate human threats to sharks conservation.

Based on the findings of the pilot study, participants had personal experiences that foster a conservation attitude. These included research and education, monitoring differences in shark behaviour in natural environments, and witnessing other stakeholders’ unethical behaviour toward sharks.

Finally, the results from the pilot study better contextualised the significance of MSDTEs (from both the demand and supply side) and their relationship with marine and shark conservation. This pilot study aids in creating a measuring instrument for a larger study that will better quantify the impact of MSDTEs on shark conservation.
The presence of pollutants in the marine ecosystems have been known to bioaccumulate and biomagnify in top marine predators such as iconic species of sharks. The conservation of critically endangered shark species such as the scalloped hammerhead, *Sphyrna lewini*, is now more important than ever for the survival of the species. Pollution is not just a threat for these species, but overharvesting, illegal trade and bycatch also puts pressure on the species. Metals, semi-metals, and polychlorinated biphenyls have been found in the tissues of top marine predators which could have possibly led to histopathological alterations in liver tissue. The aim of the study was to identify pollutants in the liver of *S. lewini* of the eastern coast of South Africa and to determine any histopathology was present in the liver. Six male sharks were used for this study and standard necropsy was performed to identify any macroscopic abnormalities present. Liver samples were removed from assigned areas and fixated. The tissues were then dehydrated and embedded into paraffin wax and sectioned. The sections were stained with heamatoxylin and eosin (H&E) as well as periodic acid Schiff (PAS) and Mallory Trichrome. ICP-MS 66 metal scan was used to detect the presence of metals in the liver as well as the presence of PCB's. Histopathology that was identified in the liver was necrosis, hypertrophy, hyperplasia, vacuolation and inflammation. Cadmium, arsenic, lead and mercury were detected in the liver of *S. lewini*. All of these metals were above the maximum regulatory limit (MRL) but the PCBs's (isomers; 153; 138 and 180) weren’t above the MRL. PCB's were present in the shark livers with PCB 153 the highest (114 µg/kg) and PCB 138 the lowest (30.4 µg/kg). It could be that the presence of the metals and PCBs contributed to histopathology present in the liver of *S. lewini* due to the high lipid content of shark’s liver and the liver being the main route for detoxification. Due to the stress that this species is already under it is important to develop better pollution management solutions for the conservation of the species.

Could the exposure of metal, semi-metal and polychlorinated biphenyls (PCB's) have a possible effect on the health status of the liver of the critically endangered scalloped hammerhead (*Sphyrna lewini*)?

Mozambique is rich in marine biodiversity and Inhambane is one of the few spots where whale sharks and manta rays are present year round. Barra beach in Inhambane is one of those potential zones that has been under intensive fishing pressure. To support these fishermen, Marine Megafauna Foundation carried out a series of consultations with fishermen and stakeholders to bring about sustainable solutions.