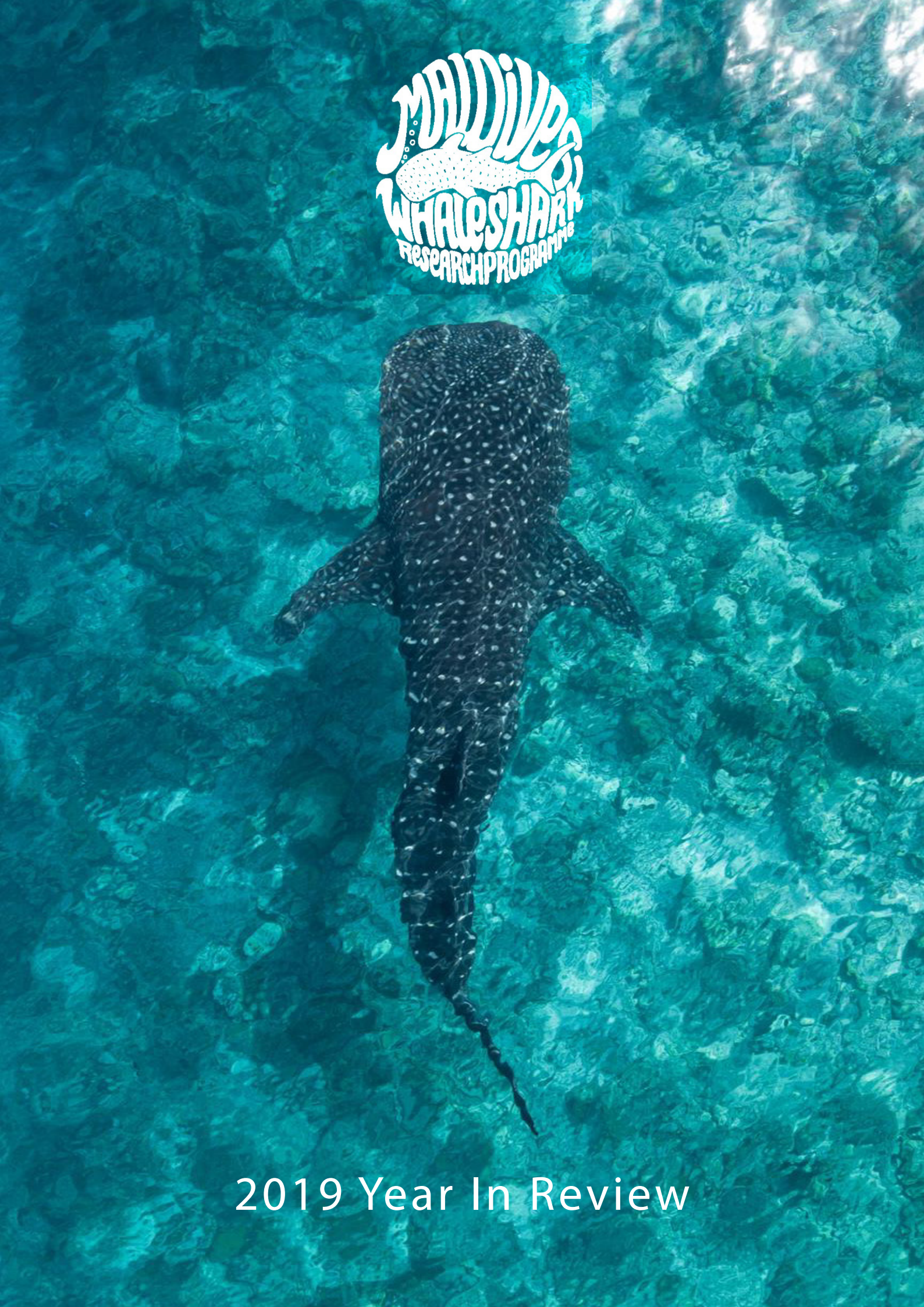
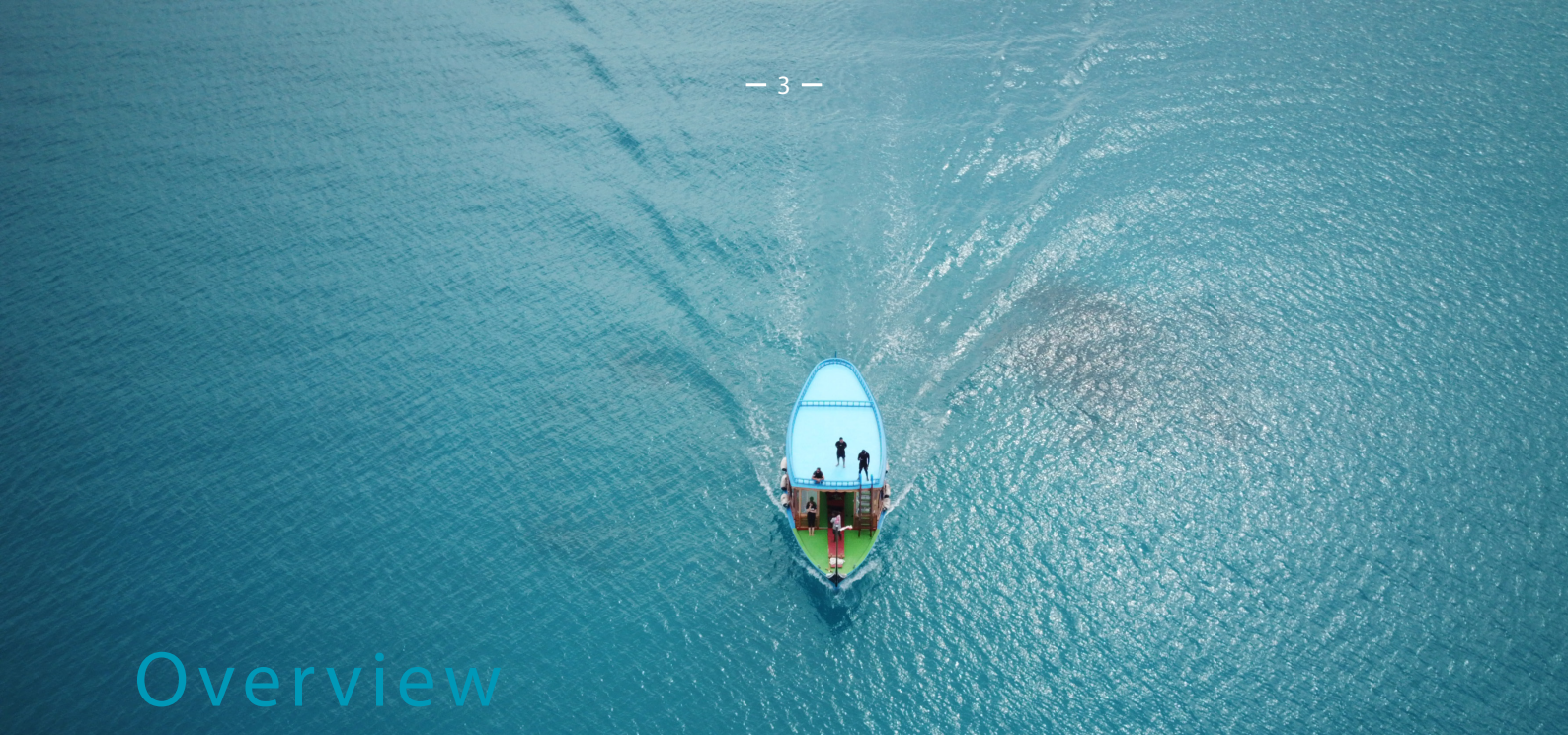


2019 Year In Review

Contents

This report, along with other information about MWSRP, is available online at www.maldiveswhalesharkresearch.org
Maldives Whale Shark Research Programme is a UK Registered Charity (1130369).
Maldives Whale Shark Research is a registered not-for-profit association in the Maldives. T/2013/07/03
Photos by Basith Mohammed, Chloe Winn, Clara Canovas Perez, Kaushiik Subramaniam, Dawid Piotr Szlaga, Lewis Jefferies, Nicki Meharg



Overview

Mission Statement

The charity's objectives are to promote for the benefit of the public the conservation, protection and improvement of the physical and natural environment of whale shark and marine biological diversity by: (a) promoting and carrying out for the public benefit research and publishing or otherwise disseminating the useful results of such research: (b) raising awareness and understanding of marine conservation.

Background

The whale shark *Rhincodon typus* is the largest species of fish on Earth, attaining lengths in excess of 12m. Nonetheless, very little is known about its distribution, habitat requirements, movements or reproduction – all of key importance for conserving and managing this marine mega-vertebrate. The Maldives appears to be unusual, perhaps unique in the Indian Ocean, in supporting a year round aggregation of whale sharks, making the archipelago a superb place to study their behaviour and biology.

Despite these opportunities for research, there were virtually no scientific studies of whale sharks in the Maldives before the MWSRP engaged in a three-month research expedition in 2006. That pilot study documented several dozen sharks and also highlighted the need for further research, conservation and education and provided the seed for the creation of the MWSRP.

The MWSRP has accumulated over 7000 sightings of whale sharks dating back to 1996. The scope for future work in the Maldives is extensive, with questions about spatial distribution, long distance movement and diving behaviour still unanswered. Furthermore, of the 472 individuals identified up to February 2020 only 82 are females, with 236 males and 155 where gender is unidentified. Of those where gender is identified therefore, an 74.2% male bias is recorded, extending the long-held belief that the sub-population in this region principally consists of sub-adult, immature males. The male bias in the Maldives aggregation, as in many other whale shark aggregations in the Indian Ocean (e.g., W. Australia, Mozambique, Seychelles) is an intriguing and pertinent phenomenon and further research is required to account for an apparent lack of female whale sharks.

The MWSRP's research into the characteristics and movements of the whale shark population in the Maldives provides the scientific basis behind the Programme's role as a grassroots conservation charity that acts as a resource for government, industry and community stakeholders. Since 2006 the MWSRP has made numerous school visits, conducted education field trips and facilitated international cultural exchange programmes for local children. Industry stakeholders, fisherman and local-island governing agencies have also been continuously consulted and the Programme has been successful in fostering cooperation between resort and island communities and re-establishing an important bond between the local community and the whale sharks.

The MWSRP has continued to provide key information to the various ministries of the Maldivian government. Two notable achievements to date include the government's adoption of whale shark encounter guidelines for tour operators developed by the MWSRP in stakeholder consultations and more recently in 2009 the gazetting of the Maldives largest collaboratively managed Marine Protected Area (MPA).

The South Ari Atoll Marine Protected Area (SAMPA) encompasses the Maldives primary whale shark aggregation site and by forging partnerships with resorts and local communities, the MWSRP is continuing to assist the government by building the management capacity of the local stakeholder and island communities within the MPA.

MWSRP in 2014 introduced 'The Big Fish Network' (BFN), an online citizen-science platform developed by the founders of MWSRP to establish a regional monitoring network of wildlife tour guides and interested individuals to increase awareness and stewardship of whale sharks in the Maldives.

MWSRP team members hold training workshops all over the Maldives, training guides (name given is contributors) to photo-identify whale sharks and record basic encounter information. The information and photographs collected at each whale shark encounter are submitted by the guide through a web-based portal or via a mobile app to the MWSRP's central database.

A year in summary

Key Stats

- Total number of encounters - 440 Encounters
  MWSRP submitted 140 encounters
  300 encounters were uploaded by Big Fish Network contributors.

- 48 different contributors provided data to us this year. This includes resorts, guesthouses, liveaboards, dive centres, guesthouses and marine conservation organizations.

- 122 different individual whale sharks were observed from February 2019 until the start of February 2020. 9 of these individual sharks were spotted on 10 or more occasions. 334 of the individuals encountered were already known to MWSRP prior to February 2020

- WS071 'Fernando' was the most seen shark of the database in 2019. He was observed 33 times followed by WS337 'Shaiban' who was seen 30 times.

- WS183 'Kokko' was third in the ranking, encountered 21 times! Last year Shaiban was in first position and Fernando wasn't even on the podium! Out of these three sharks on the 2019 top list, Kokko has been the only one reported visiting another atoll.

- In 2018, sharks WS221 and WS262 were seen more than 24 occasions. This year they were encountered 15 times or fewer.

- This year, (between February 2019 and February 2020) we have added 79 new sharks to the register. An increase on last year when fewer than 40 new individuals were registered! 32 of this year's sharks were female and 15 were male. For the rest sex identification was not possible. 2019 is the second year in a row that we have discovered more new females than males!

- 330 encounters were with 59 different male sharks, remaining the most frequently encountered sex.

- Average estimated length from all the submitted estimations (BFN & MWSRP) was 5.74 m.

- Fuvahmulah was the atoll with the greatest number of new whale sharks submitted, 29, but just two of them were males. This new study site is therefore largely responsible for the influx of female individuals to the register.

- Average length of new sharks on the database for 2019 was 6.19 m. Many new individuals are being reported from the south (Fuvahmulah in particular) and these tend to be larger in size, 8.13 m on average. New female sharks average length was 7.73 m, largest estimated size 10.5 m and smallest individual 3 m long. Again this reflects the Fuvahmulah sites influence where there the whale sharks encountered appear to be predominantly larger females.

- New male sharks averaged 5.40 m which is approximately the average size of the individuals sighted in South Ari.

- Average encounter duration in South Ari MPA was 15.3 minutes, measured from the start (whale shark spotted) to the end (whale shark departs) of the encounter.

- Individuals exhibited feeding behaviour in 14.9% of the encounters. When whale sharks were engaged in 'feeding' behaviour, the average encounter duration was 52.2 minutes.

- Sharks reported as being 'evasive', had the shortest encounter durations, 5.9 minutes on average.

- Whale sharks exhibiting passive 'cruising' behaviour resulted in encounter durations of 13.9 minutes on average. On the other hand, encounters with inquisitive sharks averaged 16.2 minutes.

- Top 3 atolls for encounters by submitted number:
  South Ari with 330 encounters
  Fuvahmulah with 37 encounters
  Baa with 25 encounters

- No shark from the database of the Maldives has ever been sighted elsewhere in the world.

Achievements and Performance

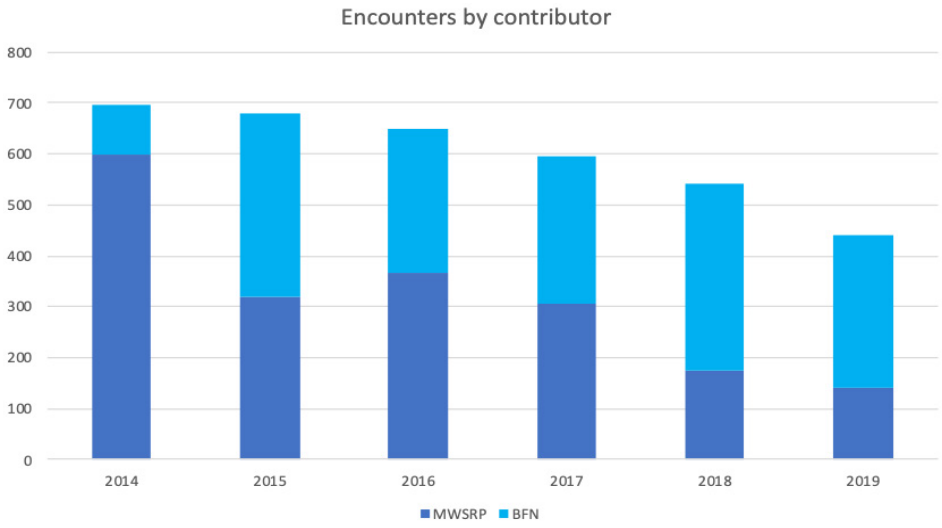
Research Summary

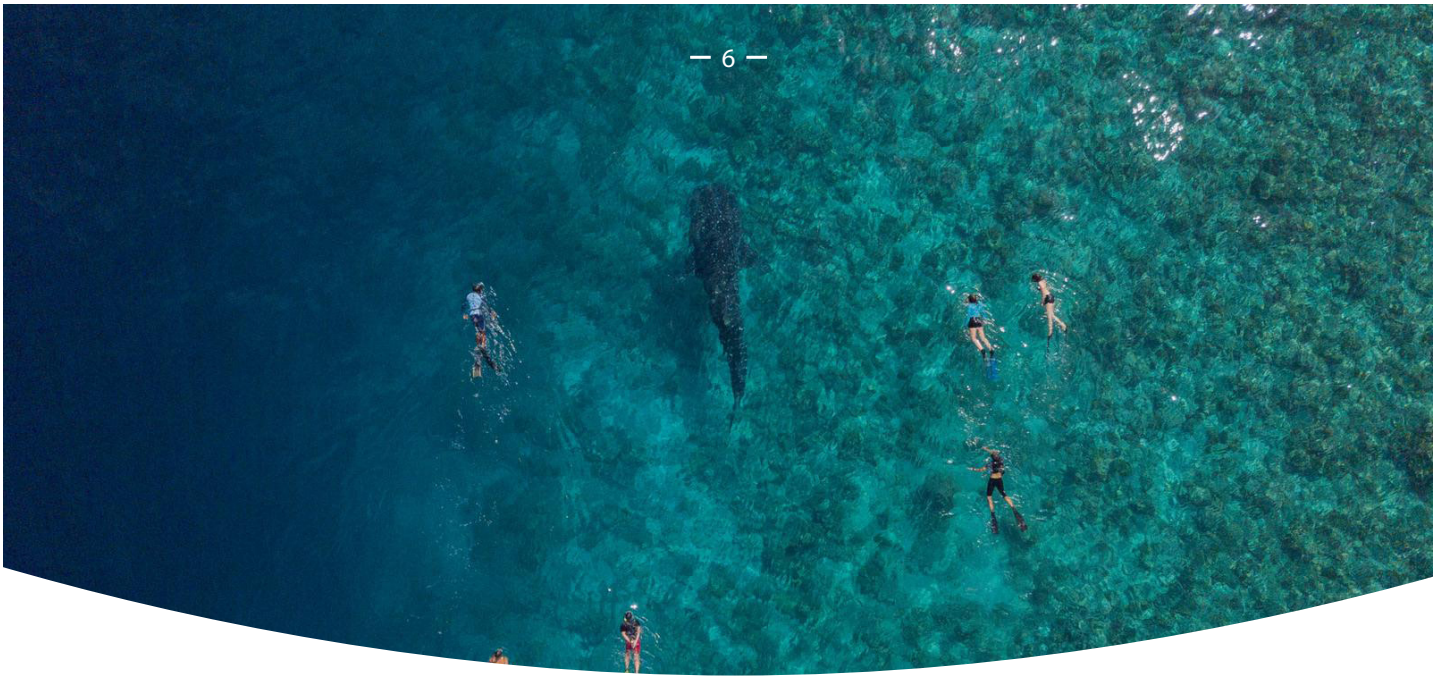
Whale Shark Encounter Log Information

As a reminder, the information provided in this section and for the rest of the report offers a snapshot into the past 12 months only, unless otherwise mentioned. If anyone would like further information on previous seasons or on the holistic understanding of this species in the Maldives or in specific areas, please do reach out to the MWSRP!

Between February 2019 and February 2020 there was a total of 440 whale shark encounters recorded to the Big Fish Network in the Maldives. This comprised of 140 encounters recorded by the MWSRP researchers which also included environmental parameters. The remaining 300 encounters were contributed by citizen science stakeholders of the BFN, predominantly from active members of the tourism sector.

Since 2014 MWSRP has a near year-round presence and BFN is operational for all 12 months. BFN contributions have accounted for more than 50% of the Big Fish Network data for both 2018 and 2019 due to an increase in the number of contributors.





From 2014-2017 encounter numbers had remained constant, throughout those years over 590 encounters were being reported yearly. Unfortunately, the number of sightings is diminishing year after year. There could be various factors behind this decline: fewer sharks visiting the area due to increase in human pressure; global or local environmental factors as well as contributors observing the sharks but not uploading their encounters.

The number of contributors this year totalled 48 including MWSRP. These came from resorts in Thaa, Alifu Alifu, Kaafu, Ari (North and South), Laamu and Baa atoll (17). Guesthouses and dive centres from Fuvahmulah, Ari, Laamu, Baa (11), research organizations & Marine Park Rangers (4) and liveaboards (16) made up the remaining contributors.

A larger number of new individuals (previously unregistered individuals added to the ID database) have been sighted in 2019 compared to 2017 and 2018. The increase in numbers of new individuals coincides with the wider reach of the BFN into other regions of the country and more specifically the southern atolls which are areas of great interest to MWSRP scientifically speaking. Initial findings suggest that it's possible to encounter whale sharks in the southern atolls that have different characteristics and levels of residency to the animals sighted in other atolls in the Maldives. The individual sharks encountered in Fuvahmulah for instance appear to be much less likely to be re-sighted throughout the season (February – April) when compared with other sites in the Maldives. Given this is the first year citizen science data has been available it is too early to say that the sharks appear to be more transient than those in other sites, as there is a possibility that the same individuals return on an annual/seasonal basis. However, it does appear that the chance of one whale shark appearing again in the same area within the same season appears to be very low compared with South Ari. In other words, the whale sharks sighted in Fuvahmulah appear to be passing through rather than staying in the area.

A striking difference is found with the sex ratio of sharks encountered in Fuvahmulah with females making up the vast proportion of encounters. In fact, the Female: Male ratio is the opposite of that in South Ari and elsewhere in the Maldives. 23 out of the 29 new sharks in Fuvahmulah were female. From the encounters registered in South Ari in 2019, 98.1% of the whale sharks encountered were males and in Fuvahmulah, 90% were females.

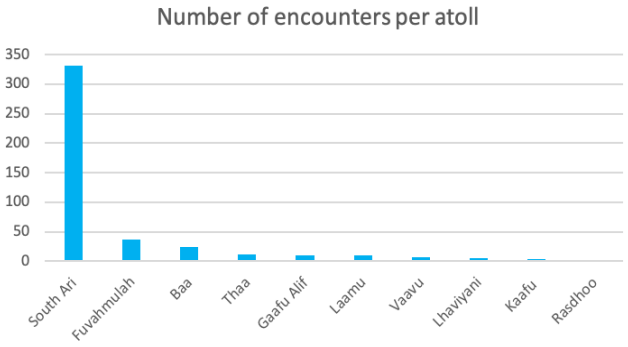
486

At the time of writing, the total number of different individual whale sharks recorded from across the Maldives now stands at 486.

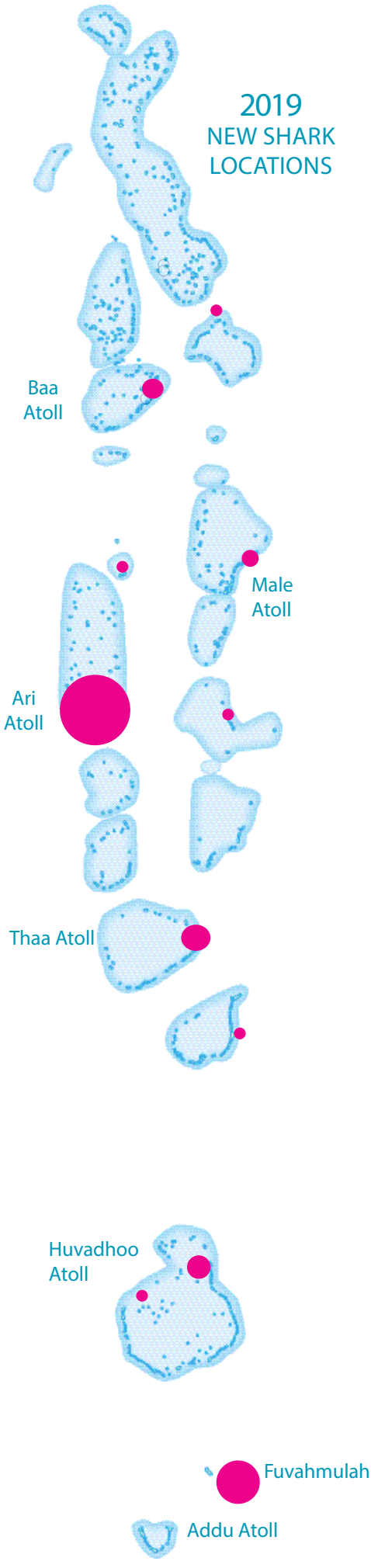
The sharks sighted in Fuvahmulah also appear to be significantly larger than those in South Ari and elsewhere in the Maldives. Average size for 2019 in Fuvahmulah was 8.13 m and in South Ari 5.77 m.

MWSRP would like to thank our friends from this area, as well as visitors, for their dedicated submissions to BFN and look forward to working with them going forward! Special gratitude to Fuvahmulah Dive School, Amis des Maldives, Arknoble, Blueforce Maldives, Manta Trust, MV Carpe Vita, Princess Audrey, Princess Luluka Wildbook for Whale Sharks Princess Rani, Blueforce Maldives, Macana Maldives, Amilla Fushi and Submaldives.

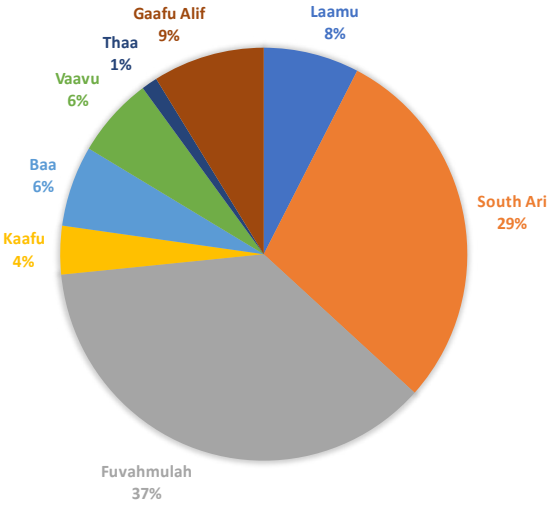
As expected, South Ari accounts for the highest number of encounters. It is the primary site for whale shark tourism due to its year-round aggregation. The MWSRP team is also based in the South Ari island of Dhigurah and most of the contributors belong to South Ari Atoll or visit the area frequently.



Baa atoll continued to see a good return of sharks this year with 25 encounters. However, there has been a decrease in the number of encounters submitted from Thaa. In 2017 there were 74 submitted encounters, in 2018, 31 and this year 11. This reduction in number of encounters could be due to a decrease in sightings and/or, as suggested by contributors in that region a reduced sighting contribution due to staff turnover. Only one encounter was submitted from Rasdhoo.



2019 NEW INDIVIDUALS PER ATOLL



New individuals

In 2017, 48 new sharks were submitted, 37 in 2018 and this year 79. Fuvahmulah for the first time (also the first year we've received reliable data from this region) has been the main location for newly identified sharks, 29 out the 79 sighted new sharks followed by Ari atoll, with 23 new individuals. In comparison, 2018, 7 new sharks were identified in Fuvahmulah and 12 in South Ari.

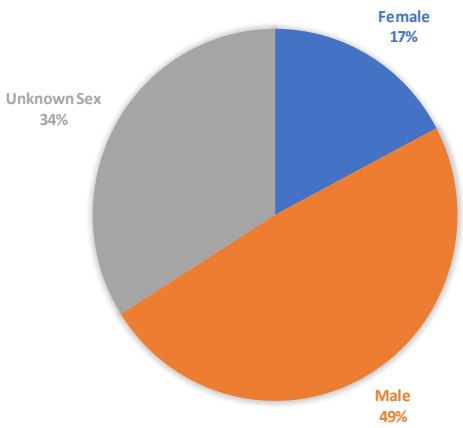
Submissions of whale shark encounters from areas outside of SAMPA were considerably more likely to be of a new individual. For instance, 9 out 10 encounters from Fuvahmulah were new sharks.

As with 2017 and 2018, the established whale shark sites in the southern and northern atolls were the other major contributors to new sharks on the database, with Baa in the north adding 5 and in the south Laamu with 6 new sharks and Gaafu, 7. This year the team has received 5 new sightings from Vaavu atoll out of the 7 submitted encounters from the area. On the contrary in 2018 there were no reports of new individuals from Vaavu.

As of the 1st of February 2020, the database has 471 whale sharks. The sex breakdown is 82 females, 235 males and 154 unsexed individuals. Taking only the data where the sex has been identified this means removing the 'unknown sex' sharks, the sex bias is 74.1%. The trend has decreased since 2017. In 2017 it was 85.5%, 2018, 81.3% and this year below 80%. A key region driving this increase in female whale sharks is the Fuvahmulah site. As the BFN spreads and the search effort and data contributions from different regions begin to become more equal, then it will be fascinating to see how this bias changes (or not!) over time.

This year's number of unidentified individuals in relation to sex, is high. Unfortunately, many of our submissions come without a photograph of the pelvic area to enable us to identify the sex of the shark. It is one of the most challenging images to obtain once you are in the water as you have to dive deeper if you are snorkeling or diving and sometimes the individual is too deep or too close to the seafloor. 31 of the new individuals couldn't be sexed. MWSRP policy states that sex is only assigned where it is affirmed by photographic evidence or has been assuredly noted by a trained guide.

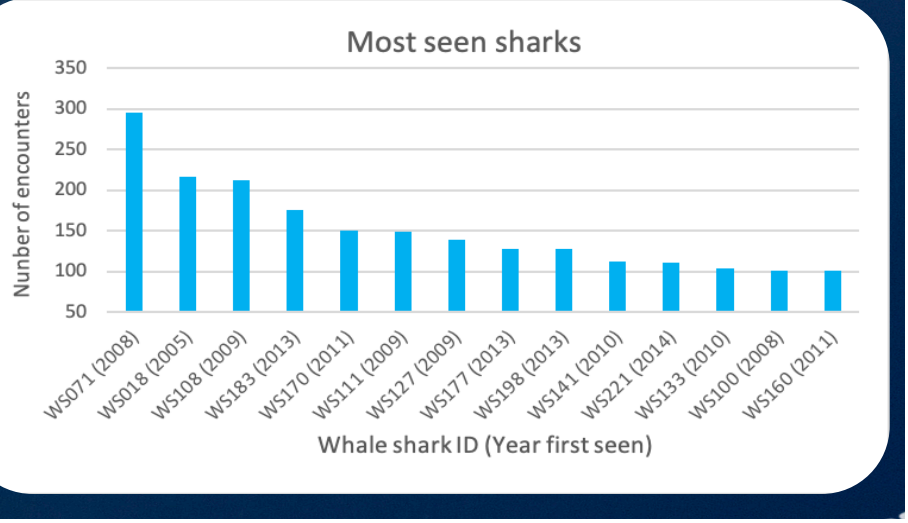
WHALE SHARKS IN DATABASE BY SEX



Which are the most frequently seen sharks?

Since the start of the programme, 14 sharks were encountered on more than 100 occasions. For instance, the most observed shark of the database is Fernando, WS071. It has been sighted 295 times and seen every year since 2008. Encounters with Fernando have always taken place in Ari atoll. The second most sighted shark in the list is WS018 'Adam', encountered 216 times since 2005. The third shark on the list is WS108 'Andy', recorded 212 times since 2009.

These three sharks are male sharks and measure in excess of 7 m. WS018 Adam has been observed in South Ari since 2005. Peak sightings were from 2014-2018, it was encountered over 30 times. In 2018 and 2019 it was only accounted for twice. Our data suggests that once individuals start reaching the possible age range of sexual maturity (circa 8 m in length) their visits to the shallow reefs of South Ari Marine Protected Area, tend to decrease.



Size

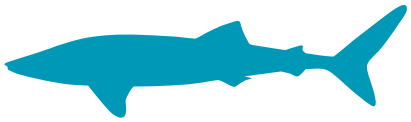
Average whale shark size per year has remained between 5 and 6 meters for the last 5 years. From the 337 (BFN& MWSRP) submitted estimations for the period taken into account for this report, average whale shark length is 5.78 m. 75% of the submitted estimations came from South Ari which is a known aggregation for immature whale sharks and from where there is a higher number of contributors due to the proximity to SAMPA.

The MWSRP provided 127 estimations on length in SAMPA and the average was 5.77m, last year being 5.61m. The smallest shark was 3.5 and the largest was 7.5 m.

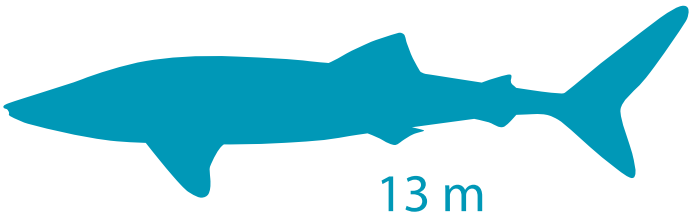
As a comparison there were 30 size estimations from Fuvahmulah, the average length was 8.12 m. Over 1/3 of those encounters reported sharks above 8 meters in size. It should be noted that this is based on citizen scientist visual estimates. In South Ari visual estimates are regularly different to measurements using laser photogrammetry or tape.

Taking into account the whole database, the maximum estimated length of a whale shark was 13 m (estimated by a contributor), minimum 2 m and average length for the Maldives 5.65 m.

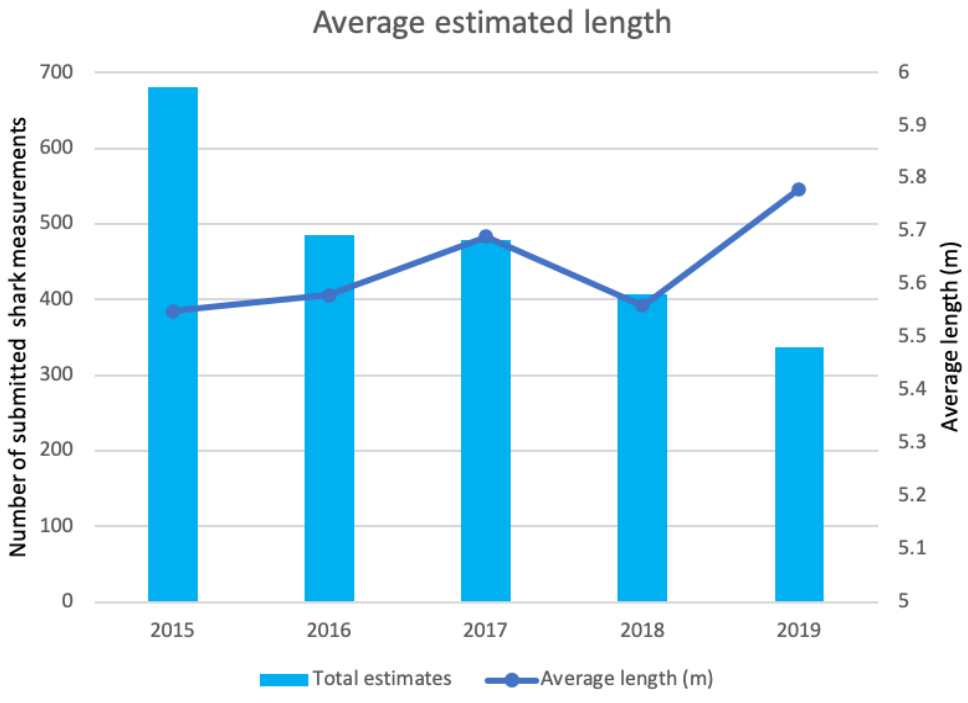
2 m



5.65 m



13 m

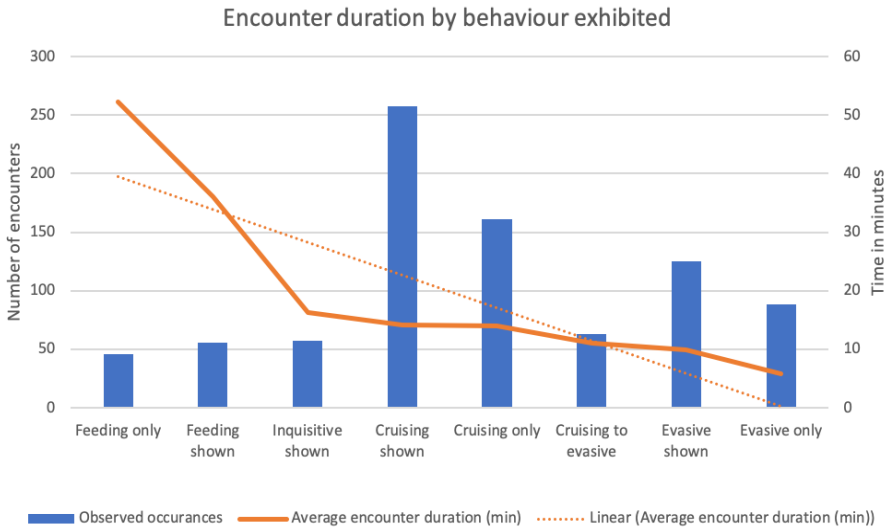


Shark behaviours in encounters

The MWSRP also observe and categorise the behaviour of a whale shark during an encounter. Each shark is assigned one or more of up to five behavioural categories; 'Cruising', 'Evasive', 'Inquisitive', 'Interacting' and 'Feeding'. By recording these details, the MWSRP are able to compare against other factors – either environmental or human influenced – to see what affect they have on a shark's behaviour.

When relating behaviour to stress levels, 'Evasive' is considered the most stressed as sharks exhibiting an evasive response are likely to be being negatively influenced by a stimuli in their environment and are taking evasive action to remove themselves from the negative stimuli. The typical response is to change direction abruptly and dive into deeper water, this means that for human snorkelers visual contact is lost. 'Cruising' is a passive state, not associated with stress in the sharks and is recorded when the shark is not engaged in a particular activity, such as feeding or being inquisitive, whilst also not reacting to avoid a stimuli. When sharks are 'feeding', they are showing natural behaviour and are often largely unresponsive to all but severe external stimuli. 'Inquisitive' sharks are actively engaged in approaching objects or humans in the water and are not considered to be under stress, as they do not appear to avoid or evade the stimuli. 'Interacting' sharks exhibit a natural (generally quite brief) engagement with other sharks that come into close proximity during an encounter.

The most observed behaviour reported in 2019 was 'cruising'. Encounters were shorter when the shark was observed displaying 'evasive' behaviours.



Normally 'evasive' behaviour takes place when vessels get too close to the shark or when the in-water code of conduct is broken for instance, when a shark is touched, obstructed, flash photography is used or when a person gets closer than three meters to the shark. If snorkelers/ divers jump into the water instead of sliding in gently from the boat the sharks tend to exhibit avoidance behaviour. 39.9% of the encounters submitted, lasted 5 or less minutes.
During February 2019 - February 2020, 377 records of behaviour have been annotated, last year only 167! During the same period 388 records of encounter duration time were logged. On a positive note, this year ´cruising´behavior was the primary behaviour. Last year 'evasive' behaviour was the most frequently observed.

'Cruising' behaviour as a sole reaction was registered on 161 of the encounters, 42.7%, for an encounter duration of 13.94 minutes. In comparison ´evasive´behaviour as the sole reaction, accounted for 23.3% of the encounters and resulted in shorter encounters, 5.86 minutes. On 33.2% of the encounters some evasive behaviour (´evasive shown´) behavior was exhibited. 'Feeding' was seen during 14.85% of the encounters. 5.4% of the encounters where feeding behaviour was exhibited lasted an hour or more.

Inter-atoll movements

During the 2019 season, 14 individual whale sharks were encountered in more than one atoll. Four of the sharks in the table below, have been sighted in 3 different atolls. In fact, two sharks displayed inter-atoll movements within a 15-day period. WS183 Kokko was sighted near Velassaru Reef in Kaafu Atoll on the 5th of December and was encountered in South Ari 10 days later. WS214 travelled to another atoll during the same month, it was seen in Thaa on the 8th of April and observed 13 days later in South Ari. Baa atoll sightings coincides with the peak season which takes place during the SW monsoon bringing an abundance in plankton into the Hanifaru bay area.

	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan
WS111								Baa				S.Ari
WS175				Baa							S.Ari	S.Ari
WS183			S.Ari		S.Ari	S.Ari	S.Ari	S.Ari	S.Ari		Kaafu	
WS206			S.Ari			S.Ari	Baa		Lhaviyani			S.Ari
WS209	S.Ari		S.Ari		S.Ari		Baa		Baa		Thaa	S.Ari
WS214		Thaa	Thaa								S.Ari	S.Ari
WS262	S.Ari						S.Ari	Rasdhoo	S.Ari	S.Ari	S.Ari	
WS276			S.Ari						S.Ari			S.Ari
WS286		Thaa				S.Ari	S.Ari		Lhaviyani			
WS288		S.Ari		S.Ari	S.Ari				Lhaviyani			
WS304						S.Ari	Baa				Thaa	Thaa
WS321				S.Ari				Baa				
WS341							Baa	Baa				S.Ari
WS345			S.Ari		S.Ari	S.Ari	S.Ari				Vaavu	S.Ari
	North East Monsoon			South West Monsoon						North East Monsoon		

Anthropogenic impact

Unfortunately whale sharks in the Maldives are no stranger to anthropogenic injuries, largely due to the fact that they dwell near the surface to thermoregulate their bodies and, to a lesser extent to feed. 26 of the 122 individual sharks encountered in 2019 exhibited new injuries.

WS337, Shaiban has was seen in January 2020 with a new major laceration to his left side, the nature of which is consistent with a boat propeller. The injury is healing rapidly. We urge boats operating in high whale shark density areas like South Ari MPA to reduce their speed to below 10 knots at all times as specified in the guidelines, so as to minimize the risk of collisions. You can see the comparison of Shaiban's injury between the 12th of January 2020 and the 5th of March 2020.

The left photograph was taken by Hassan, excursion guide from Centara Grand and the right photograph is from Ahmed Hayyan from Omadhoo.

On a happy note, pictured here is WS382 Mendhan who had a hook stuck in the underside of its mouth. This photo is taken the first time the presence of the hook was recorded. In a subsequent encounter the hook was removed by Dhigurah Divers Maldives.

At the end of the year, Macana Maldives, a liveaboard company, rescued a previously unidentified female whale shark which was found entangled in a fishing net in Fuvahmulah. Unfortunately, this whale shark presented various injuries, but it is hoped in the absence of the net the whale shark will make a full recovery. Thank you Macana Maldives for the footage and your quick actions which will allow this shark to swim freely from now on!

Species	Number of Encounters	Number of Individuals
Hawksbill turtle	469	477
Green turtle	159	162
Olive Ridley turtle	1	1
Undefined turtle	256	258
Marlin	9	9
Sailfish	16	18
Undefined whale	2	3
False Killer whale	3	68
Short fin pilot whale	1	9
Indo-Pacific bottlenose dolphin	150	2064
Risso's dolphin	1	20
Undefined dolphin	27	202
Spinner dolphin	41	831
Eagle ray	54	90
Reef Manta Ray	54	59
Mobula rays sp's	34	90
Stingray sp's	43	55
Whitetip reef shark	1	1
Blacktip reef shark	10	11
Zebra shark	2	2
Nurse shark	2	2
Leopard Shark	1	1

Megafauna surveys

2019 represented the ninth year that MWSRP has collected data on incidental megafauna sightings during the daily whale shark search transects.

This year MWSRP added an additional 1399 records of marine megafauna, comprising of 4510 individuals across all species to the overall database. In total 29,218 individuals (rays, turtles, dolphins, whales, billfish…) have been logged since we started collecting megafauna data!

If you are a marine biologist with an interest in one of the megafauna species listed in the table below, hit us up! The MWSRP would be happy to share the data with a good project!

Of course, recording data is what MWSRP does, but it's not to say that megafauna is simply noted and ignored. A chance to swim with a manta ray or watch dolphins play is an incredible opportunity in itself, so MWSRP are now focusing on getting more detailed and quality data on each megafauna encounter by investing a bit more time in these special sightings. This may mean stopping our search for whale sharks to get in with a manta ray and obtain a ventral ID photo, or spending time getting dorsal or scale pattern photos from cetaceans or turtles. This information is then shared with other NGO's operating in the Maldives who monitor and research these species. With Maldives NGO's invariably having limited time or space resources, mutual assistance by other organisations operating in an area where the dedicated charity does not have a presence is a valuable assistance – just look at the BFN for how MWSRP benefits!

In 2019, MWSRP contributed information on 84 different turtle encounters to the Olive Ridley Project (ORP). The of number of hawksbill turtles *(Eretmochelys imbricata)* sightings recorded was 469. Again, this made the hawksbill turtle the most frequently encountered species, by number of separate instances (NB; not necessarily individual turtles, hawksbill turtles are highly resident, so we probably saw the same individuals multiple times!).

Reef manta ray *(Mobula alfredi)* sightings were significantly lower than last year, 59 individuals compared to 109 in 2018 and 80 in 2017.

Spinner dolphin *(Stenella longirostris)* sightings continued this year, with records of this species increasing to 41 encounters with 831 individuals compared to 2018's 36 encounters with 598 individuals.

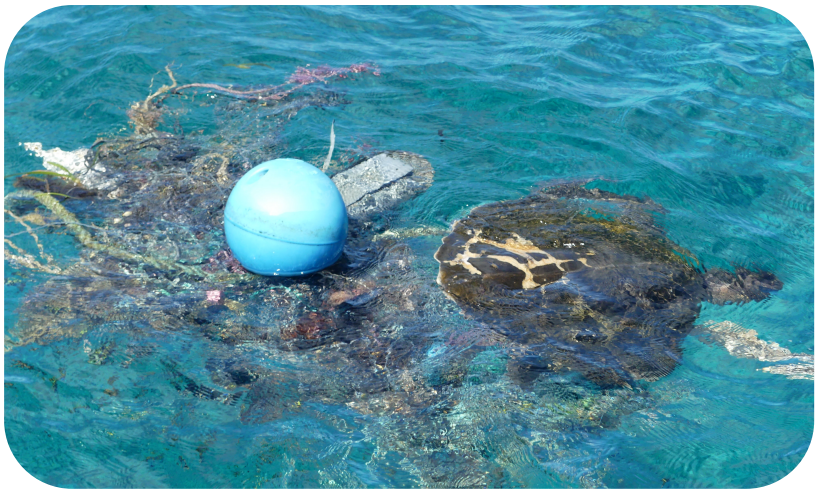
Indo-Pacific bottlenose dolphin *(Tursiops aduncus)* sightings increased again. In 2017 we had 67 encounters totalling 727 animals. 2018 we had 116 encounters with 1961 individuals and in 2019 we had 150 encounters with 2064 individuals. Average pod size for bottlenose dolphin was 13.9 and for spinner dolphins 20.3. No mating events were recorded this year unfortunately.

Bottlenose dolphins were recorded throughout the year as well as spinner dolphins. There were many re-sighted individuals. The team is now processing hundreds of bottlenose dorsal fin ID footage and hopefully by next year we will have a clearer idea as to the number of individual bottlenose dolphins that visit SAMPA. Some of the dolphin species we observe during our surveys, are most likely coming to rest during the day in the shallow reefs and travel to the outer reefs during the sunset to forage, hence the added importance to slow down within SAMPA and follow the dolphin watching regulations.

As a possible consequence of vessels travelling at high speed (dolphins are more than capable of avoiding slow moving vessels), 4 individuals of the bottlenose database have major dorsal amputations and lacerations which are consistent with propeller strikes.

Marine life rescues

4 olive ridley turtles (*Lepidochelys olivacea*) have been rescued throughout 2019 but sadly, one of them died.

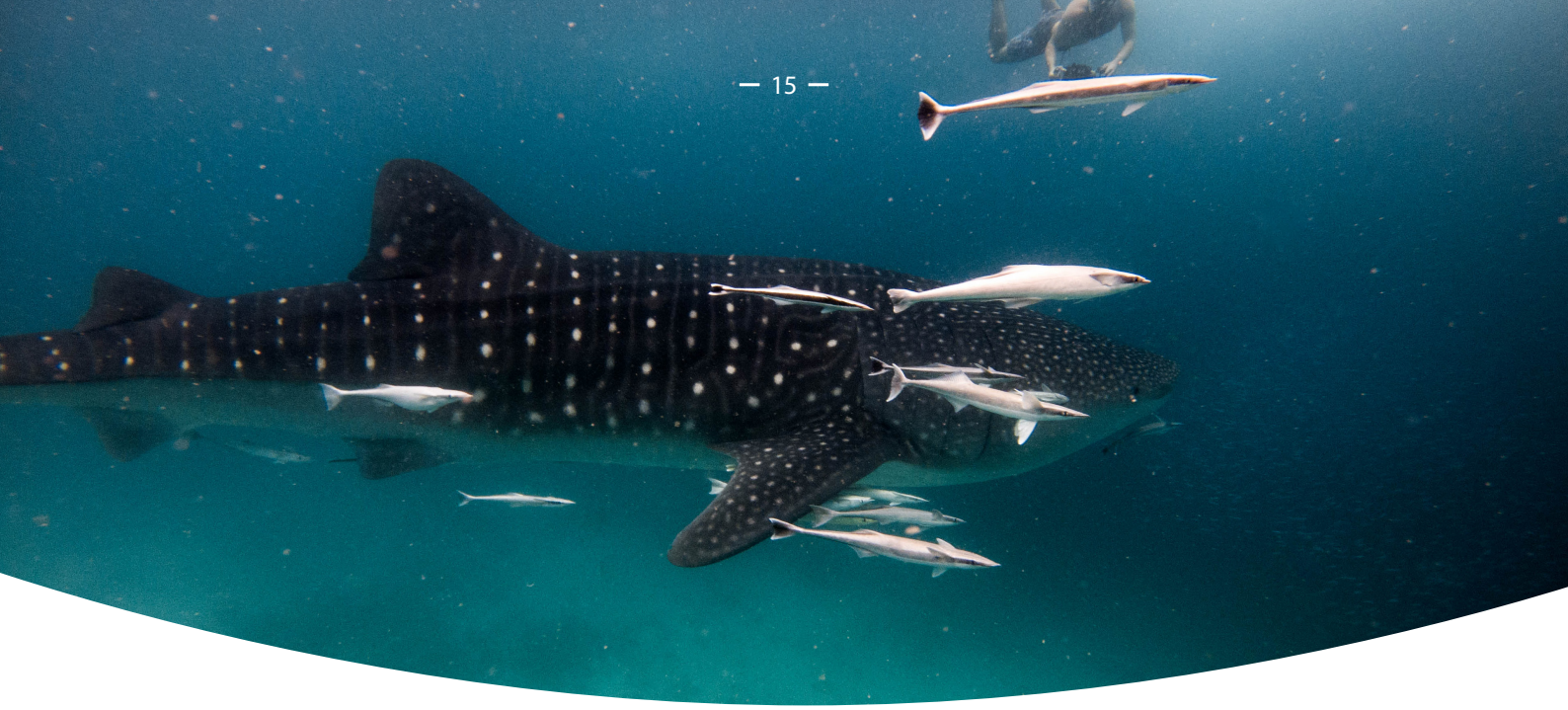


A previous MWSRP research volunteer, Nick Holton https://www.saltyseadog.sydney/ put together a wonderful account of an Olive Ridley turtle that we recovered from a net during one of our whale shark surveys in February. 'Thomas' the turtle (named and adopted by Thomas' School Battersea in London) went on to be released back into the wild after surgery and several months of rehab with the amazing Olive Ridley Project. She's minus a flipper, but strong and healthy. We hope her reintroduction to her habitat makes your day, certainly made ours! Of course, it's also a stark reminder as to the impact of discarded fishing gear. 'Ghost gear' is a real menace to marine wildlife, continuing to snare and kill creatures for as long as it remains in the ocean. Thomas was incredibly fortunate to survive. Countless others won't.

Thank you so much to LUX* Resort, Marine Savers and Transmaldivian Airways for their generous and rapid response in helping during their rescue.

Another olive ridley turtle was rescued in November infront of LUX* Resort in SAMPA. This turtle species is the most seen entangled species in ghost nets. It is an offshore species so when we do see them unfortunately, they are always entangled in a ghost net. There is a higher percentage of entangled olive ridleys during the months of January and April, our northeast Monsoon. "Talia" as this turtle was named, was taken to the Rescue Centre.

This was all possible thanks to LUX* Resort, Trans Maldivian Airways and the 'Olive Ridley Project'. Talia was released a few weeks later when she recovered from her injuries. During its first two and a half years of operation, the Rescue Centre treated 101 injured turtles. Thank you to the wonderful veterinary team of the ORP!



Other Research

Thesis outputs in 2019

The MWSRP this year has collaborated with the University of York, Università degli Studi di Milano – Bicocca, University of Plymouth, and University of Edinburgh.
All of the below will be available in full on the MWSRP website once permission periods are finished. Should you wish for the full document, please contact MWSRP at

info@maldiveswhalesharkresearch.org.

1

How submarine geomorphology and oceanographic parameters can influence the presence of large pelagic filter feeders: the case of whale sharks *(Rhincodon typus)* at South Ari Atoll (Maldives)
Silvia Valsecchi
MSc Marine Sciences at the Università degli Studi di Milano – Bicocca

Abstract

The whale shark *(Rhincodon typus)* forms coastal aggregations in response to seasonal increases in productivity. Recently, the proximity to shallow areas, such as reefs, has also been indicated as another important aggregation factor.
South Ari Marine Protected Area (SAMPA) (Maldives) has been indicated as a *R. typus* aggregation site since years. This study aims to analyse the SAMPA aggregation point combining submarine morphologies and available environmental data to define the main features driving the aggregation of R. typus.
Sightings of *R. typus* and relative oceanographic parameters have been derived by available dataset (2014-2018, Big Fish Network); temperature and chlorophyll-a data have been derived by satellite data (MODIS). Submarine morphologies data have been collected during fieldwork in 2018.

The total sightings are 2640, for a total number of 116 individuals. Most of them are immature male (90%). Temperature (min=27.8 °C, max=30.6 °C, mean=29.4°C, σ=0.70 °C) and chlorophyll-a concentration (min = 0.10 mg/m3, max = 0.79 mg/m3, mean = 0.68 mg/m3, σ=0.16 mg/m3) show positive correlation with the occurrence of *R. typus.*

Considering the morphology of the reef, SAMPA has been divided in three zones (A, B, C) from E to W. Zone A (NE-SW) is characterized by a narrow and steep fore reef, whereas zone C (E-W) shows a larger and a gentler morphology interrupted in front of Nalaguraidhoo Island, from an abrupt reef slope which leads to 240 m of water depth. Zone B is the pass area to the lagoon and the channel between Ari Atoll and North Nilandhe Atoll (Ariadhoo kandu). Density analyses along the three zones highlight a high concentration of encounters in the C area close to the changing of reef inclination.

This study confirms the presence of a year-round aggregation in the SAMPA, following temperature and chlorophyll-a concentration, but locally driven by sea bottom morphology that likely contribute in creating optimal conditions for the whale shark aggregation.

2

Achieving "ecological sustainable" status in whale shark tourism: the need for regulation and stronger management in the South Ari Marine Protected Area
Bernadette Butfield
MSc Marine Systems and Policies at the University of Edinburgh

Abstract

Whale sharks *(Rhincodon typus)* are listed as "Endangered" (IUCN Red List, 2019), and as a result, whale shark tourism is an important income generating alternative to fishing in many countries (E. Cagua, 2014). First established in Western Australia, the current codes of conduct regulating the industry in the Ningaloo Marine Park has been referred to as a 'gold standard'. Although the success of marine wildlife tourism is often evaluated by its "ecological sustainability", the term has not been commonly defined (Trave, 2017).

Trave (2017) defines "ecologically sustainable" activity as one that "does not result in chronic or irreversible detrimental changes" including, changes in behaviour, population dynamics and alteration of habitat and ecosystem functions (Trave, 2017).

The South Ari Marine Protected Area (SAMPA) is home to a significant global aggregation of whale sharks. However, the area lacks strict regulation and enforcement of the codes of conduct for whale shark interaction, leaving the area at risk of becoming another "paper park" (Mulder, 2016).

This paper uses the criteria set out in Trave (2017) to evaluate the impacts of human presence in the South Ari Marine Protected Area (SAMPA) and discuss the current "ecologically sustainable" success of the codes of conduct, using that applied in the Ningaloo Marine Park (NMP) as a 'gold standard' comparison. Common hinderances to the development of an "ecologically sustainable" industry are identified within the current SAMPA framework, and suggested codes of conduct are developed to mitigate against the presence of human impacts on the local whale shark population.

3

Assessing Codes of Conduct for Human Interactions with Whale Sharks *(Rhincodon typus)*

Hannah Rudd
MSc Marine Environmental Management at the University of York

Abstract

Whale sharks *(Rhincodon typus)* are a flagship species for marine ecotourism experiences in locations where they form near-shore aggregations. South Ari Atoll Marine Protected Area (SAMPA) is a unique swim-with whale shark location as it possesses a year-round aggregation of whale sharks. However, this marine protected area currently lacks a management plan and there is no enforcement regarding whale shark interactions. Many unknowns remain regarding the life histories of whale sharks and the influence of tourism excursions on whale shark short-term and long-term behaviour is relatively understudied.

This study has assessed the codes of conduct for human-whale shark interactions in five locations – South Ari Atoll Marine Protected Area (Republic of Maldives), Ningaloo Reef (Australia), Tofo Beach (Mozambique), Donsol (The Philippines) and Bahia de los Angeles (Mexico) – in accordance with current scientific research on the influence of swim-with whale shark excursions on whale shark behaviour. From this systematic literature review a revised code of conduct has been created alongside recommendations for implementation, with a focus on the SAMPA, and avenues for future research have also been highlighted.

4

Monitoring and Enforcing the South Ari Atoll Marine Protected Area in the Maldives

Nastazia Femmami
MSc Marine Environmental Management at the University of York

Abstract

The South Ari atoll Marine Protected Area (SAMPA) in the Maldives, is a long strip of water spanning 42km, designated in 2009 as a measure to protect its year-round aggregation of whale sharks *(Rhincodon typus)* and ensure the sustainability of the local ecotourism that offers the opportunity to swim with this iconic species.

However, since its creation neither management plan nor enforcement measures have been implemented. Likely as a consequence, 79% of SAMPA resident whale sharks show signs of injuries mainly due to boat strikes, while unregulated activities and overcrowding at encounters threaten the safety of swimmers and negatively affect visitors' satisfaction. A management plan is therefore urgently needed for regulating whale shark activities in SAMPA. This study explored existing regulations and new technologies that could be implemented to manage, monitor and enforce SAMPA. In this context, combining a zonation system with an alternate access day system and a licensing system of tour operators would enable a limit on the number of vessels visiting the MPA at the same time, and subsequently reduce the risk of injuries for both whale sharks and swimmers. Mandatory 10-knot vessel speed limits also appear essential for significantly reducing the risk of boat strikes on whale sharks. Furthermore, modern technologies such as GPS tracker devices and drones could be used by rangers to monitor vessel speed compliance and perform aerial surveillance respectively. Finally, close cooperation between all stakeholders, as well as education of operators and visitors, is crucial to foster self-enforcement. The present study primarily focused on informing managers and stakeholders of potential measures to be defined in the future management plan for SAMPA. However, measures outlined are also replicable in any other MPA facing similar issues in the

5

Seasonal distribution of whale sharks in the Maldives

Aleef Naseem
BSc Marine Biology and Coastal Ecology at the Plymouth University

Abstract

Whale shark, *Rhincodon typus* (Smith, 1928) is the largest fish in our oceans. Yet very little is known about this gentle giant and the movements on regional and intra-regional scales. In the Maldives, whale shark population dynamics is for the most part unknown and as a year-round aggregation, the drivers for this are not know. Whale shark seasonal movement patterns in relation to the monsoon weather which effects the Indian ocean currents and productivity have not been previously explored. This study analyses data since 2012-2018 from all around the Maldives, to see if whale shark exhibits seasonal distributional patterns in the Maldives. Analysis of the data revealed that whale sharks were mostly found in the central west region of the Maldives, and no seasonal patterns were found in their distribution. More detailed studies on this area is key to identifying the drivers to their distribution patterns in the Maldives. This is essential to creating a more well-rounded local conservation strategy for whale sharks.

Other outputs

WSX2019 Whale Shark Expedition-Dedicated Liveaboard Charters

On the 31st of October our team departed on the WSX Expedition onboard MV Ecoblue for 10 days. Basith (In-field Coordinator), Clara (Operations Manager) and Kaushiik (Research Assistant) went on the Whale Shark Expedition (WSX2019) together with a group of volunteers onboard MV ECO BLUE (Ecoprodivers).

In November environmental changes start to be noticed due to the shift of the SW-NE monsoon affecting in the distribution of megafauna species. The WSX team visits different atolls and catalogues the species of megafauna they encounter along their way. All the data collected related to other megafauna species is provided to the relevant marine research organizations. Throughout the Expedition, the volunteers and the staff went on multiple dives and snorkels to register megafauna. We visited various atolls: Malé, Vaavu, Meemu, Thaa, Dhaalu, Faafu and Alif Dhaalu. Interesting megafauna was sighted such as spinner dolphins, bottlenose dolphins, beaked whales, reef manta rays, whale sharks, many reef sharks and two unidentified whale species. 18 turtles were identified as new, both hawksbills and green turtles. We encountered 11 manta rays although some were already in the Manta Trust database. Good old Fernando, the most seen whale shark of the Maldives was encountered during the trip.

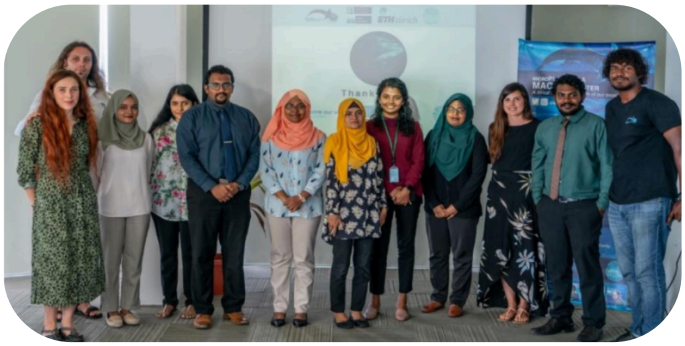
We travelled a distance of 850 km!

Microplastics a macro-disaster

Our previous in-field coordinator Giulia Donati (ETH Zürich) is leading a project together with Alina Wieczorek (University of NUI Galway) related to microplastics in the Maldives. This project "Microplastics a macro-disaster" is funded by Save Our Seas Foundation in collaboration with MSWRP. Alina, Giulia, Shameel (Volunteer Coordinator) and Iru (Community Outreach Coordinator) have been investigating how these sharks are scooping up microplastics as they feed and trying to find out where these plastics might be coming from. In April a 10-day field trip around the Southern Atolls of the Maldives took place. Overall, 73 Particulate Organic Matter (POM) samples and 36 plankton samples were collected during the trip.

This will enable the identification of zooplankton and microplastics within the samples and give insight of their depth distribution. Furthermore the team will be able to evaluate whether zooplankton may act as a vector for microplastics.

Microplastics extraction was possible from 5 of the 10 samples. From five faeces, 10-20 microplastics were extracted from each faecal sample. (90%) were fibrous in shape which is in agreement with recent findings reporting fibers to be the most common shape ingested by other marine organisms (e.g. Wieczorek et al. 2018). Possibles sources are ghost gear and clothing. Polyethylene terephthalate (PET) was also found, used for bottles and canisters. Stakeholder workshops took place with local scientists, tourism sector, policy makers and local communities. Around 150 people participated in the workshops.



Community Outreach Summary

Paid Maldivian internship scheme

In early January 2019, MWSRP secured a funding commitment from the start up clothing company 'In Sharks We Trust' for a three month internship, which began in June 2019. Humaam Nihad, aged 19 and from Malé was selected for the internship by "In Sharks We Trust".

"As a Maldivian I am proud of the connection we have to the environment, as it is what drove this country to grow from a fishing village to the tourism. And what I would like to change the most is the amount of young adults who are interested in the conservation. Most of them gravitate towards the fun side of the ocean and not yet aware or involved in protecting the environment and the marine animals."

After the completion of his internship with us he joined the Six Senses Laamu marine research team. This shows how important it is to provide this opportunity to young passionate conservationists for them to start building a career in marine science and bring a positive change to the country.

IN SHARKS WE TRUST

As part of a second internship in collaboration with Conrad Maldives Rangali Resort, a new female Maldivian intern Isha Afeef joined the MWSRP team in December. She stayed with us for 3 months and then joined Conrad Maldives Rangali Island Resort for an additional work placement of 3 months.

CONRAD MALDIVES RANGALI ISLAND

Conrad Maldives Rangali Resort is situated on the other side of SAMPA. Thanks to this initiative, Isha has learned about megafauna research, participated in community outreach programmes and helped the University of Edinburgh during their Marine Systems and Policies MSc course field trip in the Maldives in collaboration with MWSRP and the MaRHE (Marine Research and Education Centre). We asked her to reflect on her experience:

"The days start early – carrying our packed lunch, GPSs, and data logs onto the boat, we get ready for the long trip with sunscreen and water. Then we hop onto the deck on the dhoani searching the changing waves for whale sharks. In my first weeks, we didn't spot any. It was only after the first whale shark sighting that I realised the adrenaline pumping excitement of swimming with the largest sharks in our ocean.

The whale shark is a gentle creature, coming upto the shallows to thermoregulate after long dives. It is happy when feeding on plankton, tired when parabola diving, stressed when evasive, and curious if it comes to check you out. I learnt all this in my three months with the MWSRP as an intern. I learnt more – what megafauna constitutes, what it means for health of the reefs, and how we can find patterns into whale shark behaviour with the data we collect.

The learning experience isn't confined just to the boat – I spent hours listening to the field team give presentations to volunteers and guests, finding out something new every time, trying my best to remember all the amazing facts. Some news are heartbreaking – seeing and documenting the injuries of whale sharks has been the most difficult and understanding the lengths we have yet to go to raise awareness to avoid future injuries.

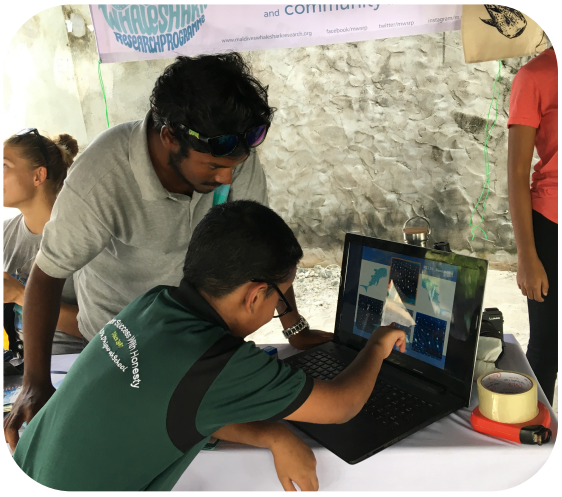
I also learnt by listening to the Dhigurah community as they share about what whale sharks mean to them, how the relationship with whale sharks has changed from hunting them to a source of pride in the tourism industry, and the enthusiasm to spot and swim with these creatures when they can be found.

When we're lucky enough to swim with a whale shark, I am always humbled that they allow us the privilege. I've also learnt of patience – we can't always expect whale sharks to show up, wild creatures as they are. South Ari means something to them – a secondary nursery, their home, a safe haven. I am grateful for the opportunity to learn about them and safeguard them with MWSRP and Conrad Maldives.

The thing I'll miss the most – waking up for work hoping to see a whale shark in the wild, and swim alongside with ocean conservationists working for their survival. I hope to keep learning about our marine environments and how to protect our ocean, because we owe it to the lovely creatures of the ocean."

The Maldives is blessed with a massive amount of people working in the dive and recreation industry who are immensely knowledgeable about the marine environment. This industry fuels a lot of employment for people with a love of the underwater world. But the concept behind the internship with MWSRP is to provide an opportunity for someone passionate and enthusiastic about starting in the world of marine sciences, but who is perhaps in another role outside of this specialisation or who has yet to start their first ever job and to whom exploring this new career possibility would not be viable without financial reassurance to cover living costs.

An MWSRP internship is seen as a springboard. It provides an opportunity to learn and be seen, but also offers a great chance to meet the network of organisations and individuals in the marine sciences in the country. MWSRP make every effort to ensure that interns have an opportunity going forward and are extremely proud that at the time of writing the entire field team are ex-interns themselves!



Festivals

Laamafaru Festival

In September, MWSRP had the opportunity to join the Laamafaru Marine Conservation Festival in Laamu Atoll. Iru, joined the event and shared her knowledge with the youth of Laamu! Most of the students have never seen a whale shark or a manta ray before. Whale shark sightings there are rarer, therefore students didn't have as much awareness about the biology and ecology of the species.

Baa Atoll Manta Festival

Humaam (intern) and Basith (Lead In-Field Coordinator), headed to Baa Atoll in September to participate in the Baa Atoll Manta Festival a community festival organized by Manta Trust. They took with them some of the tools used for whale shark research and carried out educational sessions.

Moodhu Maakan'du Festival

The Moodhu Maakan'du Festival was organized on the 3 of August at Dhigurah. Students from various schools of South Ari Atoll attended the event. Organizations such as Manta Trust, Olive Ridley Project, IDEAS Maldives, Reef Check, Live and Learn joined too and we all shared our experience in the conservation and educational field.

Basith, gave a presentation about the whale sharks of South Ari Atoll and chatted about his personal experience in the marine science field. A perfect way to inspire the youth of Baa atoll! The rest of the team worked alongside the students and showed them the different research tools we use and taught them about whale shark conservation. This event was brought by Project REGENERATE a Government of Maldives project implemented by IUCN (International Union for the Conservation of Nature) and funded by USAID (United States Agency for International Development).

International Whale Shark Day

On the 30th of August the International the 'Whale Shark Day' was celebrated in Dhigurah!

Participants learned about the different surveying techniques and the importance of whale shark conservation. It is very important for locals to know that they have the largest Marine Protected Area just outside their harbor and to appreciate the value of it.

On this year's event Gayoombe a prior whale shark fisherman from Dhigurah joined us. He shared all his knowledge and stories of what he remembered from when he used to hunt whale sharks before fishing was banned in the Maldives in 1995. Did you know that whale sharks were hunted in the Maldives in the past? Fishermen used their liver oil to waterproof their boats.

Fishing gear marine toolkit education session

MWSRP joined forces with "The Green Teen Team" to develop a supplementary series of hands on, outdoor activities that complement and bolster the teaching beyond the Marine Science syllabus for the students in the Maldives.

As part of this Educational Toolkit, Iru and the team went to Dhidhoo island and spoke about fisheries and conservation. The students completed a survey with people from the island regarding the subject and then discussed some of the potential impacts.

Passport to Fishing Programme

Iru, helped in the "Passport to Fishing Programme" hosted by the International Game Fishing Association in Dhigurah. The aim of this programme is to teach 100,000 students how to fish while keeping personal safety, sustainability and ethical measures in mind. Most of the students go fishing with their families on a weekly basis and some of their parents are professional fishermen so the earlier they learn about sustainable fishing the better! Fish is a staple of the Maldivian cuisine. Some of the most used species are yellowfin tuna, mahi-mahi, frigate tuna, bigeye scad, wahoo and mackerel scad.
European Rolex Scholar

European Rolex Scholar of the Our World-Underwater Scholarship

In August 2019, European Rolex Scholar of the Our World-Underwater Scholarship, Kim Hildebrandt joined us and helped us with our research work onboard. Kim will be working side by side with current leaders of underwater fields for a year. The range of experiences include: “active participation in field studies, underwater research, scientific expeditions, laboratory assignments, equipment testing and design, photographic instruction, and other specialized assignments”.

Dhigurah pre-school mural

Chloe from our in-field team, has designed a beautiful mural for the pre-school wall of Dhigurah school. With the help of the volunteers and locals the wall has slowly turned into an ocean! We would like to extend our sincere gratitude to the artist Hammad and the filmmaker/photographer Lewis Jefferies.

Beach clean-ups

Beach clean-ups took place on a regular basis in Dhigurah. It is an essential activity in order to ensure healthier ocean ecosystem. The highest percentage of trash collected was plastic although in some occasions ghost nets were found too!

Remarkable beach clean-up days:

In September together with members of the community and guesthouses we cleaned 900 metres of beach, filled 5 jumbo bags and one buggy full of metal! 2 of the 5 jumbo bags were all recyclable plastics and sent to Parley Maldives.

For the International Coastal Clean-Up Day a reef clean-up took place also in September. This was conducted with a snorkel team and scuba dive team cleaning up two sites in Dhigurah. Despite big waves and dark skies, everyone was able to collect a large amount of trash, showing admirable levels of enthusiasm and persistence.

It was wonderful to have the opportunity to collaborate with the Secretariat of the Dhigurah Council for the beach clean-ups which would not have been possible without their valued support, as well as the help of many amazing people of the community. We had support from the guesthouses, dive centres, several organizations of Dhigurah and Parley Maldives.

Schools and Universities

This year students of the American School of Doha and the UWSCEA Singapore school spent a short period in-field learning about marine conservation as well as community outreach. Students from the MSc Marine Systems and Policies joined for a field trip to the Maldives in collaboration with MWSRP and the MaRHE (Marine Research and Education Centre).

Moodhu Kudhin

In 2017 the MWSRP launched the 'Moodhu Kudhin' or 'Children of the Sea' initiative. Moodhu Kudhin is a community outreach project initiated by MWSRP. The project, meaning 'Children of the Sea' in English, is designed to take place over a series of consecutive days and nights where participants from local schools are immersed in all things whale shark and ocean conservation. Students are given the opportunity to join us on our research dhoni (boat) and learn first-hand what it takes to collect scientific data. On-water activities and learning will also be supported by a series of lessons in the evening. Through this initiative the MWSRP hopes to develop the growing awareness for the beauty and fragility of the unique environment here in the Maldives, and perhaps the next generation of scientists.

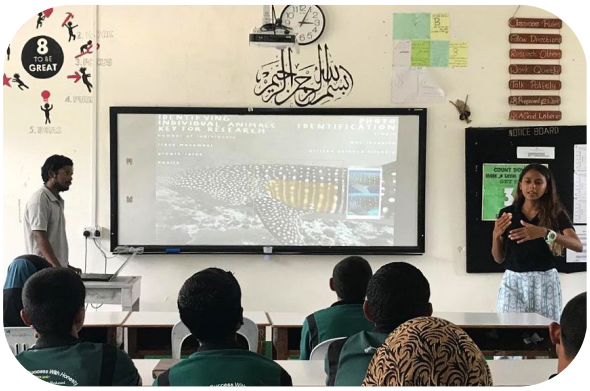
Throughout 2019, we organized Moodhu Kudhin sessions 'Children of the Sea' with students from Mandhoo, Dhangethi and Dhigurah from South Ari Atoll.

The first school to participate in the activity was Mandhoo. Students were very lucky as they spotted pilot whales and false killer whales from the boat. Once in the water they were able to observe manta rays. A special thank you to Nappe from Dhiguveli Guesthouse Dhigurah who joined and helped us during the activity. A beach clean-up took place too!

August was the month Moodhu Kudhin was carried out with Adh. Dhigurah School. Two boat surveys were conducted as well as two beach clean ups. Prior to the field trip a whale shark presentation was given to the students and parents. Unfortunately, there was no luck with the whale sharks! Both the students and the teacher were very engaged!

In December we had the Moodhu Kudhin event with the school of the neighbouring island Dhangethi. Manta Trust and Eurodivers team members from Vilamendhoo Resort joined us in some of the sessions and provided their knowledge to us and the students. Their presence was greatly appreciated!

We were very lucky because Fernando the whale shark, showed up for our snorkel which was already very eventful with camouflaging octopus and two green turtles checking each other out! The teachers, students and parents were very excited about this encounter as they had heard about Fernando before.



Top Resort Contributors during this period

41 LUX* Maldives

23 Conrad Maldives

23 SubAqua Angaga

13 Vilamendhoo

Top Guest House/ Local Dive Centre Contributors

25 Fuvahmulah Dive School

Honourable mention to Fuvahmulah Dive School, they have submitted the greatest number of new sharks!

Top 3 Liveaboard Contributors

18 MV Emperor Explorer

7 MV Emperor Serenity

5 Amis des Maldives

Stakeholder Outreach Summary

Big Fish Network updates and other additions

There are now 136 people, organisations or operators that contribute their sightings information to MWSRP. Some are not quite so active but many have given a great deal of their time, are passionate and very committed! Here we take a minute to salute the top contributors from each area;

The top three resort contributors during this period were;

1) LUX* Maldives Resort (41)
2) Conrad Maldives & Subaqua Angaga (23)
3) Vilamendhoo (13)

Last year both Conrad and Subaqua Angaga were on the list too!
Thanks a bunch to Marc McMillan, marine biologist from LUX* Resort for all his contributions!

These three resorts are located in South Ari atoll.

Top 3 Liveaboard Contributors were;

1) MV Emperor Explorer (18)
2) MV Emperor Serenity (7)
3) Amis des Maldives (5)

Top Guest House/local Dive Center Contributor
Fuvahmulah Dive School

Top Guest House/Dive Center Contributor from Dhigurah
*Bliss Dhigurah

We really appreciate the time dedicated by all of you by submitting these encounters. We will be in contact through the year to work on what else we can do for you despite the current situation the world is facing. A heartfelt thank you!

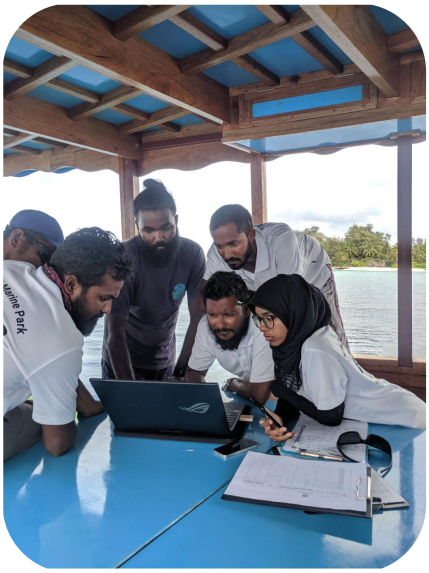
Big Fish Network Training Sessions

This year we have 33 new members on the Big Fish Network. MWSRP offers training to the new members and welcomes them onboard to learn about the research techniques and the work the team carries out. Support materials are also sent for members to aid them in delivering an informative and enjoyable whale shark encounter experience for guests including providing correct boat briefings and educational tools.

The team would like to highlight two training sessions from 2019:

In October staff members from Vilamendhoo resort (situated in South Ari Atoll) joined us onboard for a training session. Members from the dive centre r as well as the new Manta Trust project manager of the Resort participated. Vilamendhoo Eurodivers Dive Centre as well as Manta Trust are both active members in the Big Fish Network. Vilamendhoo offers daily excursions to South Ari Marine Protected Area for their guests to observe the whale sharks therefore this training sessions provides the guides with better knowledge and skills enabling a richer experience for their guests as well provides them skills to be able to collect whale shark data and contribute to our research.

A big welcome to Suju Gasim our a new contributor to the Big Fish Network. Suju has always been very passionate about the ocean and has been informing us about whale shark and marine mammal sightings in SAMPA. He was born in Fenfushi and has a vast knowledge about megafauna and marine conservation. He joined us for a workshop and learned about the work we do both in-field and back on land. Suju, will be reporting the whale shark encounters on behalf of the Excursion team on Sun Island Resort and Spa. He has a lot of experience working in SAMPA. We had a wonderful time chatting to him about marine science and the future of our oceans.



In October we hosted the SAMPA South Ari Marine Park Rangers-IUCN Maldives-Environmental Protection Agency of Maldives for two days. They had the opportunity to join us onboard and participated in a series of workshops as part of their training as new rangers to the area. Our latest findings were shared, and they gained hands-on experience of our research methods.

Presentations

Maldives

On the 10th of August a workshop was organized together with Manta Trust at LUX* Resort in South Ari Atoll. Representatives from different dive centres and excursion guide centres from South Ari Atoll joined the event and participated in several training sessions to ensure megafauna conservation and sustainable tourism in the Maldives.

Iru (Outreach Coordinator) and Clara (Operations Manager) were invited to participate on the 10 to 10 DIVE event which took place on the 31st of August at the Angsana Ihuru Resort. They presented MWSRPs work to commemorate the 20th Anniversary of the Rannamaari Wreck and joined the 24 hour dive!

In order to increase our outreach, the team has given presentations on a weekly basis. Presentations took place in 2 guesthouses and 9 different safari boats.

Liveaboards: Secret Paradise, Blue Shark II, Honors Legacy, Scubaspa Ying and Yang, Ensis Felicity, MV Eco Blue and Carpe Novo
Guesthouses: TME Retreats Dhigurah, Bliss Dhigurah.

UK

On the 7th of January, Chloe and Basith our infield coordinators visited the National Marine Aquarium in Plymouth (UK) together with Ocean Conservation Trust. They gave a talk about their work in South Ari Atoll with the whale sharks! The public was very interested in the latest research findings and conservation efforts.

As part of the microplastics project, the MPWhalesharks team presented preliminary results in the following conferences:

1) 5th International Whale Shark Conference
Ningaloo Australia
May 2019
Presented by Ibrahim Shameel

2) IMBeR Future Oceans2
June 2019
Presented by Alina Wieczorek and Giulia Donati

3) 54th European Marine Biology Symposium
August 2020
Presented By: Alina Wieczorek

4) European Elasmobranch Association 23th Annual Conference, Rende, Italy
October 2020
Presented By: Katie Hindle

Other notable activities

Television Appearances & Media Outputs

The Reef commissioned by Apple, directed by Sven Dreesbach

An 8 minute video was recorded featuring how scientific research can be carried out with the use of technology. The film crew joined the in-field team for a week and filmed the day-to-day work of the MWSRP. This recording was part of the of the #shotoniphone campaign by Apple. The short-film was also shared on the Maldivan TV and was mentioned on several magazines and websites in the Maldives and from the rest of the world (Canada, Germany, Italy, US, Japan, Brazil, Austria, Spain, etc...).

Winner The Telly Awards 40th Annual 4x Silver | Winner, W3 Awards 2019 2x Silver | Winner, Summit Creative Award, 2019 | Winner, Global Trend Awards- Social Video Shortlist, Shots-Awards The Americas 2020 | Shortlist-Cresta International Advertising Awards, 2019 | Winner New York Mobile Film Festival-Best Short Film Category | Shorlist-The Love Awards, 2019 | Winner Cinephone-Festival Internacional de Cine con Smartphone, Barcelona 2019 | Winner-Smartphone Flick Fest, Sydney 2019 | Shorty Social Good Awards-Finalist | Winner-Muse Creative Awards, 2019 3x Platinum 1 x Gold | Winner-Worldfest Houston, 2020 | Official Selection American Documentary and Animation Film Festival | Official Selection Wildlife Conservation Film Festival | Official Selection Docs Without Borders, 2019 | Official Selection Eugene Environmental Film Fest, 2019 | Finalist-Mozi Motion Film Fest, 2019 | Finalist-Momi Milano Mobile Fest, 2019 | Official Selection Am Docs 2020 | Official Selection Rural Film Fest | Official Selection Save The Waves Film Festival 2019 | Honourable Mention Toronto Smartphone Film Festival 2019 | Official Selection Four Seasons Film Festival, London | Official Selection Lookout Film Festival LWFF 2020 | Winner Tulum World Environmental Film Festival, 2019 | Winner 2020 One Screen Short Film Festival, New York 2020 | Winner, Mobile Motion Film Festival, Zürich 2020 2x

21 days of the ocean

The White Shark Projects from South Africa, featured a video about our work for their 21 days for the Ocean Campaign in September. This wouldn´t have been possible without the help of Hannah Rudd, Since 2014, they have celebrated the start of Spring in South Africa with this initiative. This campaign is used to educate the communities of the Cape Whale Coast. Educational talks at schools, radio interviews, social media drives, beach clean-ups, competitions, fundraisers and are organized throughout these 21 exciting days.

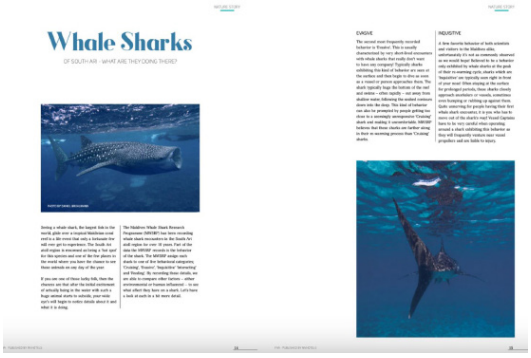
The Natural Code

This year the in-field team had the pleasure of working with the wildlife film maker Kriss Ceuca and the scientific researcher Natasha Ellison, specialised in mathematical ecology. They collaborated together to make a film about patterns in nature following Alan Turing's theory, with a focus on the whale shark! They visited Dhigurah in June for the filming. So far, the film has been chosen as an official selection at 9 festivals. All this thanks to the support from the University of West of England Bristol as part of the Wildlife Filmmaking Master Course. It is now available on YouTube.

Magazines

FlyMe

FlyMe, domestic airline of the Maldives has featured MWSRPs work on one of their magazine issues!



Oceanographic Magazine

Chloe one of our in-field coordinators, has been preparing an article for ´´Oceanographic Magazine´ although we will be able to share it on the 2020 Report!

Vogue Arabia

Iru our Outreach Coordinator, was interviewed for Vogue Arabia as an 'everyday hero' together with other talented Maldivians.

"I think there's a lot of opportunity in marine conservation, regardless of gender," she says. "Sadly,[in the Maldives] it's not a career path most people jump tow ards, especially women. But I'm hopeful. Even though it was definitely not common a couple of years back, the amount of women who are now seen within this field is definitely increasing, slowly, but surely."

Plans for the future

Continuation of observational research

We aim to increase understanding of;
a) The physical characteristics, distribution and behavioural ecology of whale sharks in the Maldives and
b) Further explore the significance of the primary aggregation site, South Ari atoll.

Significance of South Ari Marine Protected Area

The abundance of surface swimming whale sharks in South Ari might suggest the presence of a reliable food source. However, the apparent lack of feeding behaviour exhibited by the individuals encountered near the surface has led MWSRP to hypothesise that the South Ari area may provide the optimum combination of habitats for these juvenile whale sharks. It is thought that the proximity of a deep water channel may offer opportunities for whale sharks to seek food at depth or facilitate long range movements, whilst also remaining in close proximity to a warm shallow water habitat for post-dive recuperation and thermoregulation. It is a key objective of the MWSRP to further understand why whale sharks are encountered in South Ari so consistently compared to other areas of the Maldives. We would like to establish what physical parameters make South Ari such an important aggregation site and which environmental conditions may affect the frequency of whale shark sightings in this area.

The MWSRP aims to:

- Continue to build a central register of whale shark individuals identified using photo-identification
- Keep an encounter log of observational data including shark characteristics, shark behaviour and environmental parameters
- Establish and maintain a national citizen-science monitoring network, through which tour operators from across the Maldives can submit encounter information and photographs via an online portal
- Identify key environmental and oceanographic parameters within the South Ari area and compare these with other sites in the Maldives.
- Opportunistically collect whale shark fecal samples for genetic testing
- Use empirical data to explore the potential seasonal movements of whale sharks between regions in the Maldives
- Deduce whether any differences exist in terms of population demographics between South Ari and the other regions of the Maldives.
- Establish whether injuries may affect residency and or apparent survivability of individual whale sharks in South Ari atoll.

Acknowledgements

The MWSRP would like to sincerely thank the Marine Research Centre, the Environmental Protection Agency of Maldives and the Ministry of Fisheries and Agriculture for their continued support of our work.

To the people and island councillors of Dhigurah and the islands of South Ari atoll and the South Ari atoll councillors, we appreciate so much you allowing us to spend time in your islands over these years and thank you for your hospitality and for sharing your wealth of knowledge with us.

Our Dhigurah island hosts TME Retreats Maldives for their logistical support, especially Fayaz Mansoor.

Dhigurah school principle other teachers – with special mention to Jackson – of Dhigurah school who so enthusiastically engage with our programme are offered special mention, we really appreciate you giving your time to work with us.

We also thank Hogan & Lovells for their legal assistance and Bryan Kemsley for his accountancy service.

To our volunteer partners, Natucate and The Great Projects, thank you for your continued support.

To our fellow conservation NGO's Manta Trust, Olive Ridley Project and IUCN thank you for sharing a vision and working with us to realise this.

To Critter Earth for their support in the continued innovation in developing the Big Fish Network platform.

To the Shark Trust, In Sharks We Trust, EcoProDivers, Secret Paradise Maldives and Conrad Rangali Maldives for their fundraising support of crucial initiatives such as our Paid-Internship Programme.

The volunteers of MWSRP, visiting teachers and school students who share their time and knowledge with us on the ground and who's donations allow us to continue our work we say a big 'shukuriyaa'!

Thank you to the American School of Doha and United World College South East Asia for your steadfast support of our charity.

To our wonderful, enthusiastic in-field staff and research assistants who's efforts are the beating heart of this programme.

Tables and Figures

Tables

Table 1; Summary of the whale shark encounter information collected by MWSRP

From	May 2011	Nov 2011	May 2012	Oct 2012	Feb 2013	Feb 2014	Feb 2015	Feb 2016	Feb 2017	Feb 2018	Feb 2019
To	May 2011	Feb 2012	June 2012	Feb 2013	Feb 2014	Feb 2015	Feb 2016	Feb 2017	Feb 2018	Feb 2019	Feb 2020
No. of Whale Shark Encounters	6	171	51	155	352	308	319	365	306	175	140
No. of different Individual Sharks	4	36	20	33	44	50	45	49	43	35	40
Known Sharks	3	34	20	28	14	45	39	40	34	30	28
of which Male	3	32	19	28	13	40	35	47	32	30	27
of which Female	0	2	1	0	1	3	3	1	1	0	0
of which Sex Unknown	0	0	0	0	0	2	1	1	1	0	1
New Sharks	1	2	0	5	30	5	2	9	7	5	9
of which Male	1	0	0	5	26	4	1	8	4	5	4
of which Female	0	2	0	0	1	0	0	0	1	0	2
of which Sex Unknown	0	0	0	0	3	1	1	1	2	0	3
Average Shark Length (Metres)	4.5	6.08	5.64	5.58	5.82	5.92	6.2	5.46	6.11	5.61	5.75
Total Individual Whale Sharks in MWSRP Database	161	168	172	181	206	226	275	302	354	391	472

Table 2; Summary of the whale shark encounter information collected over the whole research period by members of the tourist sector

From	May 2011	Nov 2011	Mar 2012	May 2012	Jul 2012	Feb 2013	Feb 2014	Feb 2015	Feb 2016	Feb 2017	Feb 2018	Feb 2019
To	Oct 2011	Feb 2012	Apr 2012	Jun 2012	Feb 2013	Feb 2014	Feb 2015	Feb 2016	Feb 2017	Feb 2018	Feb 2019	Feb 2020
No. of Whale Shark Encounters	32	55	38	10	122	493	388	361	283	388	366	330
No. of Different Individual Sharks	24	25	23	7	33	U/Av	63	91	60	91	85	109
Known Sharks	19	25	19	6	27	U/Av	48	47	42	50	48	39
of which Male	17	23	18	5	26	U/Av	44	35	37	43	43	36
of which Female	2	2	1	1	1	U/Av	2	2	2	2	3	0
of which Sex Unknown	0	0	0	0	0	U/Av	2	10	3	5	2	3
New Sharks	5	0	4	1	7	U/Av	15	44	18	41	37	70
of which Male	5	0	3	1	7	U/Av	6	11	11	5	10	11
of which Female	0	0	1	0	0	U/Av	2	12	3	2	14	30
of which Sex Unknown	0	0	0	0	0	U/Av	7	21	4	34	13	29
Average Shark Length (Metres)	5.26	6.07	5.54	5.65	5.39	U/Av	5.17	5.59	5.71	5.53	5.36	5.78
Total Individual Whale Sharks in Database	161	168	172	173	181	206	226	275	302	354	391	472