



# 2017 Year in review



# Contents

<b>OVERVIEW</b>	<b>3</b>
Mission Statement	3
Background	3
Year in Summary	4
<b>ACHIEVEMENTS AND PERFORMANCE</b>	<b>5</b>
Research Summary	5
Community Outreach Summary	16
Stakeholder Outreach Summary	19
<b>PLANS FOR THE FUTURE</b>	<b>21</b>
Research	21
Stakeholder and Community Outreach	23
<b>ACKNOWLEDGEMENTS</b>	<b>25</b>
<b>TABLES AND FIGURES</b>	<b>26</b>
Tables	26

© Maldives Whale Shark Research Programme, 2018

This report, along with other information about MWSRP, is available online at [www.maldiveswhalesharkresearch.org](http://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 Alex Childs, Ellie Waiwright, Jil Kuhne, Gregor Kervina, MWSRP staff



## 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 4500 photographic sightings of 354 individual sharks dating back to 1996. Over the years a more complete, and increasingly puzzling picture has begun to emerge of whale shark demographics and spatial usage in the Maldives. Early assumptions of whale shark aggregations 'in the Maldives' being juvenile male sharks in the 4-7m range

has transpired to mean only in certain aggregation sites. Neonate sharks, assumedly pregnant females over 11m long and sizes just over and under these extremes are beginning to appear in the Big Fish Network records with increasing frequency. The future understanding of the wider demographics is a key part of MWSRP's plans, with survey trips and technology all in the pipeline to begin exploring this exciting new ground.

The MWSRP's research in to 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. 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 shark.

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 (MPA) 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.

# A year in summary

## Jim's Research Highlights

**Want to know what MWSRP have learned about whale sharks in the Maldives in one easy to read page? MWSRP's Co-founder, Operations Director and research coordinator has listed his top 'take homes' for 2017!**



Big Fish Network; 96 contributors, 354 whale sharks, 6000 encounters, 86.2% male sex bias

Re-encounter rate of individual whale sharks at SAMPA is very high over prolonged periods. For example, WS071 has been seen 238 times in 10 years

SAMPA is likely a 'secondary nursery' location for whale sharks which have grown above the juvenile period. In addition, sharks in this region are not seen again once they grow beyond 8m (and so corresponding to sexual maturity). It therefore appears SAMPA offers a critical habitat for sharks in this post-juvenile-pre-mature stage

Whale sharks in the Maldives may exhibit annual intra-country migrations. Some individuals appear to follow a learned or habitual pattern of movements. Most individuals which have visited different atolls repetitively seem to be in those specific atolls at roughly the same time each year. This is likely tied to seasonal feeding opportunities.

Whale sharks south of Huvadhu Kandu (One and a Half Degree Channel) may exhibit different demographics to the rest of the Maldives. Both neonate sharks and mature sharks exceeding 10m have been recorded. Sex ratio is nearly 50:50 from encounters submitted in this region.

World first study on wild free swimming whale shark growth rates and age conducted. Paper just accepted by Marine & Freshwater Research!

Sea Surface Temperature Anomaly [SSTa] recorded in SAMPA between 2013 and 2016 showed an average rise of 1.1°C. Relates to severe bleaching and coral mortality observed .

Two studies concluded that there is no seasonality through the year for number of individual whale sharks in the SAMPA region. This is a globally significant aggregation.

Coastal areas R. typus aggregate occur with a specific set of bathymetric requirements; shallow areas in close proximity to a reef slope or shelf break with steep gradient, which leads into water in the mesopelagic and bathypelagic zones. SAMPA fits exactly within this prediction. Paper coming!

Why are whale sharks in SAMPA? They are likely feeding at depth and using surface waters for thermoregulation.

Whale sharks in SAMPA show monsoonal movements across the atoll.

Surface variables do not affect shark abundance on a given day. Likely that currents are a major predictor of whale shark presence or absence in the region;

- In SAMPA, positive correlation between higher chlorophyll a concentration and shark presence at broad temporal scale
- In general, higher Sea Surface Temperatures (SST) collate to a slight increase in the amount of sharks sighted in SAMPA on a broad temporal scale
- Surface feeding behaviour accounts for just 16% of whale shark encounters in SAMPA, but nearly 100% in some other atolls

# Achievements and Performance

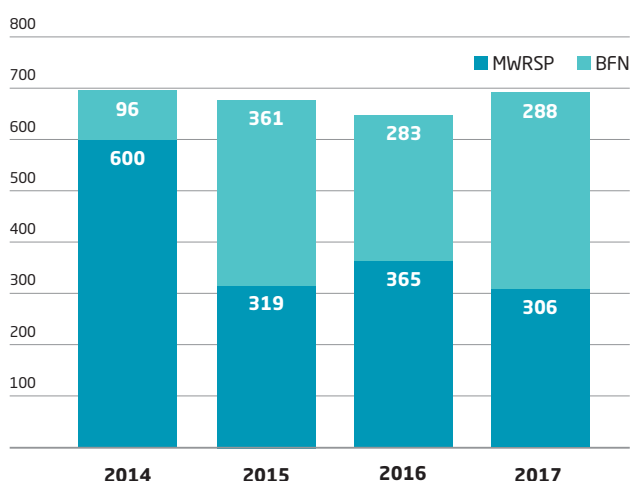
## Research Summary

### Overall Whale Shark Encounter Log Information

For the fourth year in succession, the total number of whale shark encounters recorded over the 12 months has remained near constant. Despite small changes in stakeholder involvement, MWSRP search effort and other variables, there has been strikingly little variance across the last four years.

Between February 2017 and February 2018 there was a total of 694 whale shark encounters recorded to the Big Fish Network in the Maldives. This is against 648 in 2016, 680 in 2015 and 696 in 2014 seasons, all of which were at a time that MWSRP had a near year round presence and BFN was operational. This comprised of 306 encounters recorded by the MWSRP researchers (down from 365 in 2016), which also included environmental parameters. The remaining 388 encounters (way up from 283 in 2016) were contributed by citizen science stakeholders of the Big Fish Network (BFN), predominantly from active members of the tourism sector.

Total Sightings





**354**  
 At the time of writing, the total number of different individual whale sharks recorded from across the Maldives since 2006 now stands at 354.

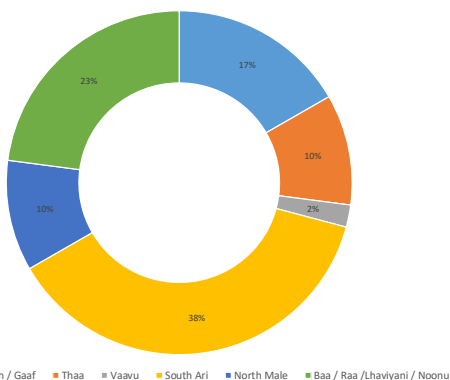
Of the whale sharks encountered, there were 97 different positively identified individuals, with an additional 37 encounters where identification of the individual was not possible. Of the definitively identified sharks, 49 individuals were previously known and were present on the individual whale shark library prior to the 1st February 2017, very close to the 51 individuals known from the previous season. There were a staggering 48 new individuals added to the Maldives individual whale shark database during this period, more than double the 22 new sharks added in 2016 and related to the increasing reach of the BFN into remote parts of the country and the resurgence of sharks returning to Baa atoll after being nearly non-existent in the previous three years. The total number of different individual whale sharks recorded on 1st February 2018 from across the Maldives since 2006 now stands at 354.

produced just 38% of the newly identified whale sharks in this period. While this clearly demonstrates the value of the BFN in shining a light on numbers and demographics on a Maldives wide scale, it does raise interesting questions about the movements between atolls, philopatry to specific atolls and recruitment of individual whale sharks. This will be explored later in this document.

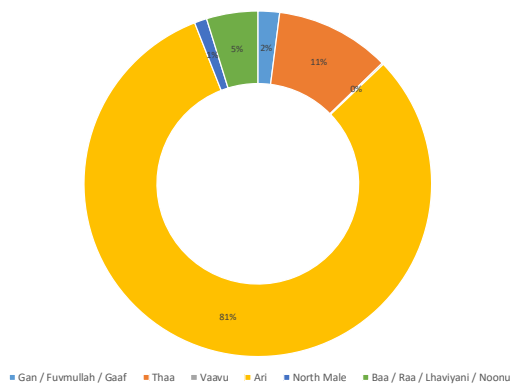
The above observation may well be explained by the very high number of new sharks first seen by BFN contributors. Of the 48 sharks newly added to the database in 2017, 41 of them were first seen by BFN contributors! Only 7 new sharks were first identified by the MWSRP around our home base of South Ari atoll.

What is striking about the high rate of new sharks to the individual database is the relative number of new sharks coming from locations outside of the MWSRP's South Ari atoll base. Despite accounting for 81% of the overall encounters, South Ari

Locations of newly identified WS in 2017



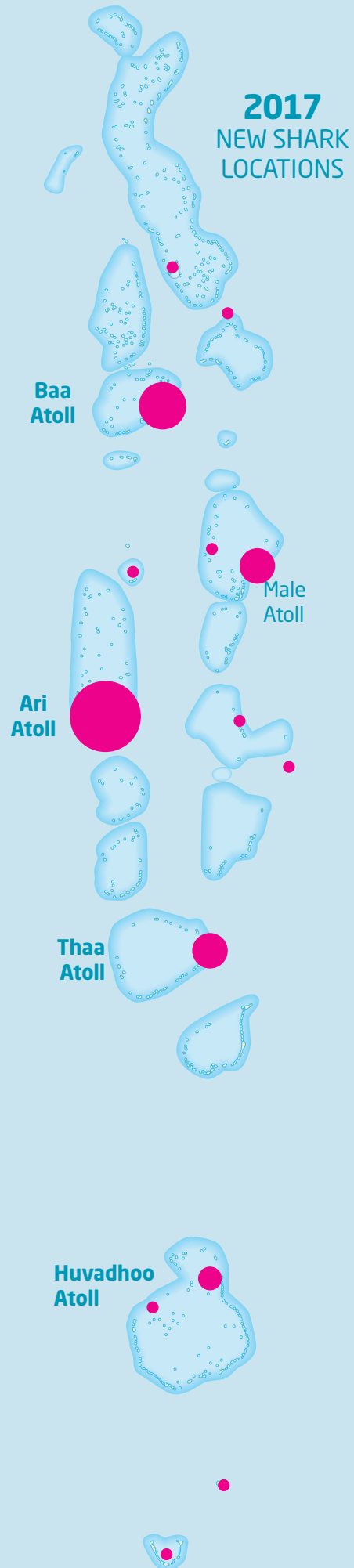
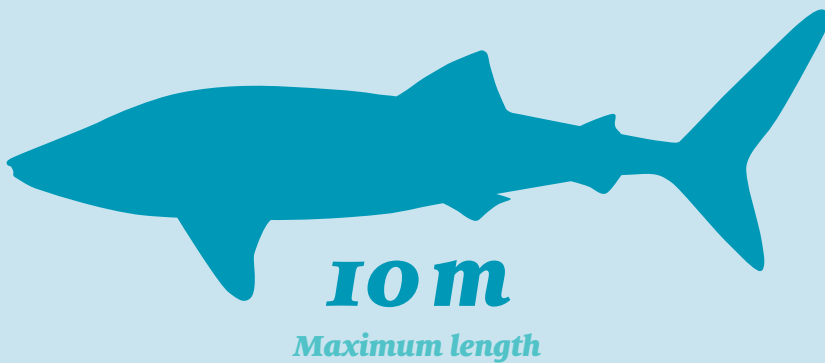
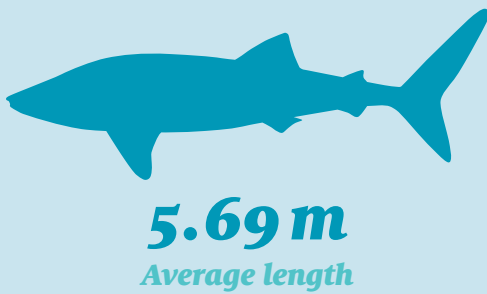
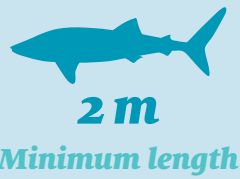
Whale Shark Sightings by Location 2017



This map represents the sightings locations of the new sharks on the MWSRP database in 2017.

Once again, the MWSRP would like to take a moment to thank those BFN contributors for such valuable contributions to our understanding of this species in the Maldives.

Average length of the whale shark was estimated by BFN or MWSRP members for 479 encounters during this period, with an average estimated length of 5.69m over all regions. Once again, this is very close to the findings for both the 2016 (486 encounters, 5.58m average estimated) and the 2015 season (680 encounters, 5.55m average estimated). Minimum estimated length was 2m, while maximum was 10m.





# SIZE

*It matters*

Sharks around the South Ari atoll Marine Protected Area (S.A.MPA) were estimated to be almost exactly the same as the average for the whole country at 5.70m, with 2.5m to 8m being the range. Interestingly, when purely MWSRP tape measured sharks are considered, the average goes up to 6.11m, though the range is much smaller, between 4.2m and 7.6m.

Of all the new information uncovered in 2017, arguably the most interesting is the variance of size and therefore life cycle of whale sharks that are in or that transit through the Maldives. This has been hinted at now for several years, with a neonate shark found off the west coast of North Ari atoll in 2014 that famously found its way into a swimming pool. At the other end of the scale, fishermen have long told stories of using “very large whale sharks” as impromptu fish aggregation devices in One and a Half Degree Channel!

The 2017 season was the break through where photographic evidence and BFN encounter submissions started to quantify some of these sightings.

A tiny whale shark, estimated to be just over 1 metre long was encountered at the surface off Huvadho. It is unknown what distance a whale shark of that size would be able to cover, so unfortunately it is not possible to guess at any potential pup-



Star-Divers on Horizon 3 saw this little shark off Huvadho atoll on 7th February 2017

**Authors note: Just outside the period that this report is framed in, MV Leo and the Emperor Divers Maldives shared incredible footage (see image above) of a female shark estimated at over 11m and with a very disgorged belly. The location – a couple of miles away from where the juvenile shark pictured below (bottom left) was found at the same time of year in 2017. Just sayin’....!**

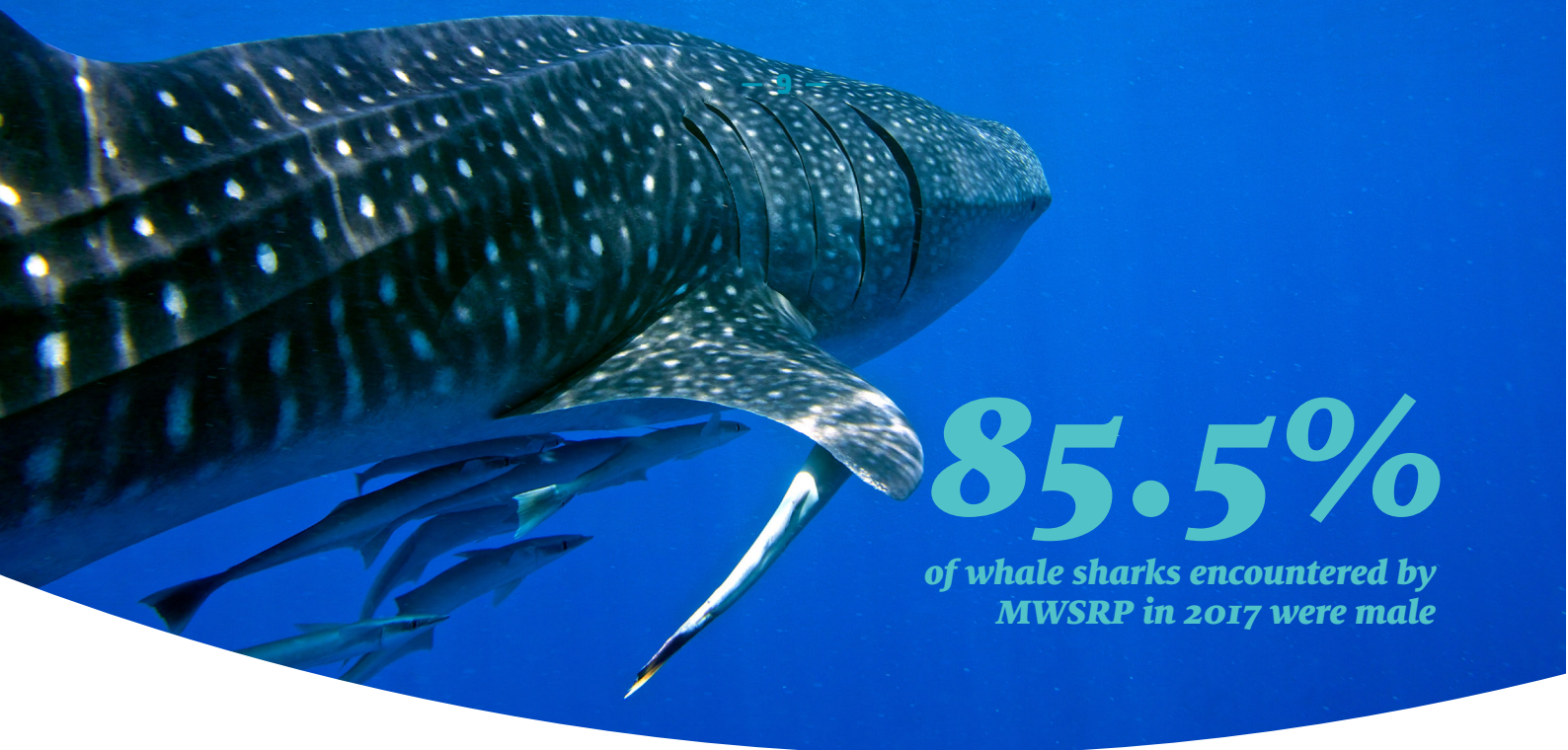
ping locations. It is nonetheless potentially the beginning of a very exciting period of discovery for large and small whale sharks in the central Indian Ocean and is an area MWSRP will be focussing on in 2018 and 2019.

MWSRP will be publishing an ‘observation paper’ on neonate and mature female shark sightings by the end of 2018.



At the other end of the scale, giants like the 10m estimated shark from Fuvahmulah (courtesy Princess Audrey 15.02.2017).





**85.5%**  
of whale sharks encountered by  
MWSRP in 2017 were male

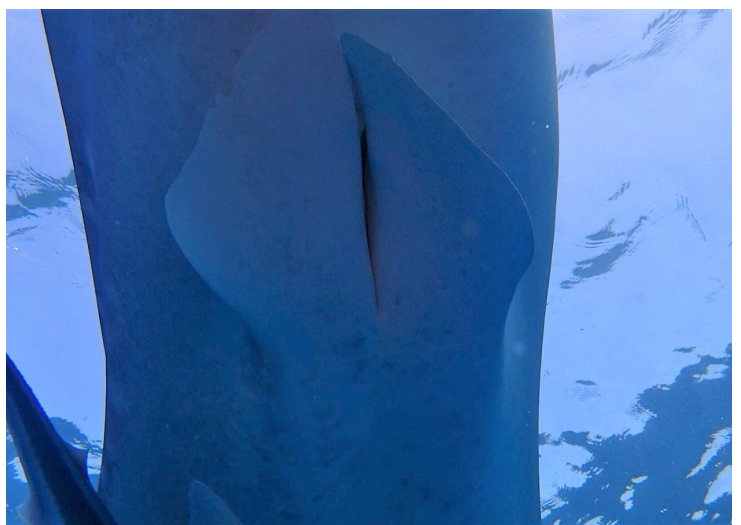
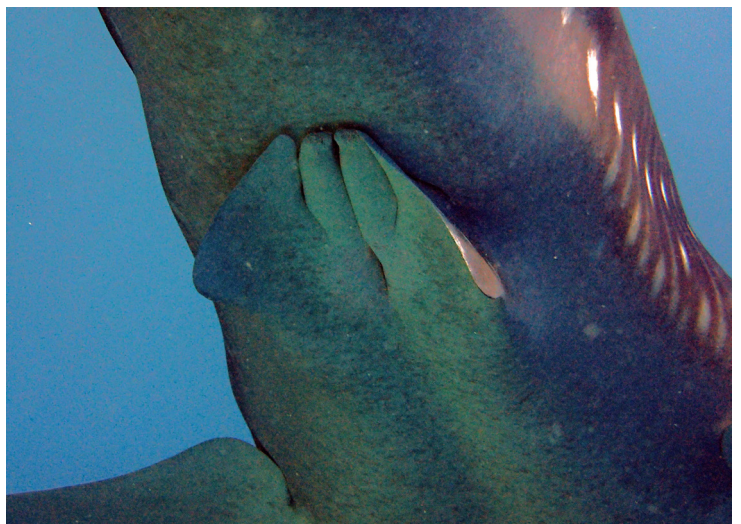
Sex makeup for the 354 sharks on record breaks down as follows; 35 females, 206 males and 113 unknown. Taking only that data where the sex has been positively identified, that results in a sex bias of 85.5% male, which is just a percentage point down on last year's total. For the newly identified sharks, the breakdown is 9 male, 3 females and 36 unknown, so just 66.6% male where sex has been verified.

Unfortunately, the number of new sharks where the sex has not been recorded raised significantly this season. This can be explained by the relative abundance of BFN contributions. Of the 7 sharks identified for the first time by MWSRP, in only one case was the sex not noted. The proportion of new sharks where sex is not recorded contributed by BFN members is significantly higher. The MWSRP respectfully requests that where possible photographic evidence of the claspers / cloaca be obtained every time a whale shark is encountered, as this will help to both identify sex for new sharks but also help verify or fill in the blanks of known individuals where that information is unknown. The MWSRP will use 2018 to highlight this with new and current BFN members.

As was the case last season, two of the three new female sharks were recorded from the southern atolls.

The overall bias for all whale sharks recorded by the BFN from all parts of the Maldives during this 2017 season was 91.4% male, almost exactly the same as the previous season (58 whale sharks where sex was confirmed; 53 were male, 5 female). Breaking that down over region, we see that sharks seen in the South Ari atoll area are again significantly biased toward being male. Of 48 different sharks seen there, 38 were positively sexed of which 36 were male and just 2 were female – a 94.7% bias.

**Image top right: pelvic area of juvenile male whale shark. Bottom right: pelvic area of female whale shark**



# Creatures of habit ?

For the first time in a few seasons, the most frequently encountered individual whale shark over the 2017 season was not WS071 'Fernando'. While he was encountered almost as many times this season as last (33 vs 36) and retains the title of the most encountered whale shark on the MWSRP database (238), it is WS183 'Kokko' who claims the title this season with 50 encounters. First seen by MWSRP in May 2013, he has racked up 137 sightings in the intervening years, making him a real regular on the reef. He's a slightly larger than average S.A.MPA shark, being measured recently at 6.2m, but he should be around for many more years yet if he follows the trend of leaving the area at around 7.5-8m.

Second place is WS221 'Igmale' with 43 sightings and WS108 'Andy' rounds out the top 3 with 40 encounters.

Only one of the 'originals' from the very first 2006 expedition was seen this year. WS018 'Adam' was again frequently seen, with 30 sightings this season taking his total up to 208 overall.



**Top 5 Contributors**  
during this period

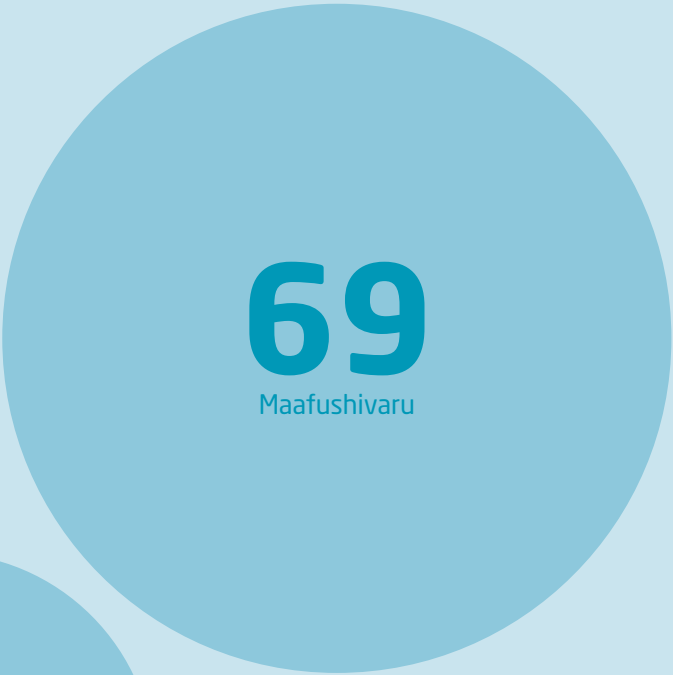


**Top Guest House Contributor**

Boutique Beach



**Top 5 Liveaboard Contributors**



**Data Contributed by Big Fish Network Stakeholders**

Where would MWSRP be today without the wonderful contributors to the BFN?! Contributions rose from 25 in 2016 to 45 for this season, with a total of 358 direct encounters submitted! MWSRP were especially pleased to see 12 active safari vessel contributors, with the large and small sharks all being submitted by these adventurous floating hotels! This represents an enormous addition of valuable data to the BFN and is a very positive example of cooperative working increasing our understanding.

BFN members contributed data on 91 different sharks – out of the 97 different individuals encountered over the whole year! There was an additional 24 encounters submitted where the photograph could not allow for a positive identification or where an ID was missing completely.

As previously mentioned, the value of BFN contributors is often in identifying new individuals from areas outside of the MWSRP’s operational area.

***"BFN members contributed data on 91 different sharks – out of the 97 different individuals encountered over the whole year".***

The MWSRP is aware that taking photos and uploading data takes time. While we work to make it easier with our new 2 way app, we would like to take this opportunity to sincerely thank all contributors for their efforts in citizen science and hope that reading the results of their graft here inspires them to continue helping the cause!



### Other Research

The 2017 season was one of the first where MWSRP's structured approach of building on previous seasons work and expanding on directions as new findings are uncovered really started to highlight key points. The large number and long term nature of encounters and individual whale sharks on record now is really allowing for interesting work to be done. Some things – such as growth rates – simply cannot be rushed and the dataset needs to be consistently accrued over time. Seemingly mundane measurements, such as water temperature at each encounter, begins to tell a story when done for long enough and was starkly highlighted in one study in this period which coincided with the mass coral bleaching events seen in recent years.

The dedicated work of the researchers and volunteers of the MWSRP for nearly a decade continues. If you or someone you know would like to use the datasets we have, please contact us as we are proponents of open data for the greater good and would love to be listing your work in a future MWSRP Annual Report!

1

#### **Age and growth of whale sharks near South Ari atoll, Maldives**

This flagship study aimed to expand on the knowledge of age and growth of whale sharks in the Maldives by calculating growth parameters and rates from encounters during the time period of April 2006 to May 2016. Total length estimates were taken via three different measurement methods (visual, tape, and laser) and linear regression was utilized to investigate how the different methods were related to one another. This study showed that visual estimates tended to underestimate large sharks and tape and laser measurements yielded similar results to one another. New sharks to the South Ari Atoll were significantly smaller than returning sharks. This provides evidence that small sharks may be recruited to the South Ari Atoll, where they stay and grow until they reach maturity and then they leave the area.

This study was the first of its kind to produce growth parameters and rates from measurements of free-swimming whale sharks.

2

#### **Seasonal hotspots of mega-fauna and vessel activity in South Ari Marine Protected Area**

The aim of this study was to identify hotspots where mega-fauna and vessel distributions are most concentrated, whether they overlap, and if these hotspots shift between seasons. This information is needed by managers to develop appropriate regulations for the core areas. The distribution of *R. typus*, other mega-fauna, vessels and recently injured *R. typus* was mapped, during both the North East and the South West monsoon seasons. It was found that concentrations of all mega-fauna, vessels and recently injured *R. typus* occur in the south of SAMPA during the NE monsoon and appear to shift to the east during the SW monsoon with the south retaining relatively high densities all year round. The concentration of wildlife and vessels in such a small area highlights the importance of wildlife to the local tourism industry but also the threats facing mega-fauna, which need to be regulated.

3

#### **Planning for a Future on Dynamic Islands in the Maldives. A Description and Analysis of Key Nearshore Processes on Dhigurah Island**

This study examined two key nearshore processes on Dhigurah Island, the Maldives – sediment supply and seagrass. It finds that there is an active sediment supply of Halimeda and coralline red algae from the inner reef flat to the oceanward shoreline. It also concludes that seagrass beds are significantly higher than surrounding substrates and they provide important coastal protection. With understanding of these processes, island planners will be able to protect and incorporate them in any future development of coastal infrastructure.

4

#### **The influence of environmental and anthropogenic variables on whale shark abundance in the South Ari atoll**

This study assessed the environmental and biological variables driving whale shark aggregations at SAMPA in order to



improve whale shark conservation strategies. A mean of whale sharks per day (shark encounters/search effort) and 12 environmental variables were calculated to allow for accurate comparisons between data using a Gaussian Generalised Linear Model (GLM). Of these variables, chlorophyll a and current strength were found to have a significant relationship with mean whale sharks per day. The environmental and biological variables analysed were found to affect the year round aggregation of whale sharks at SAMPA, but the primary drivers of site fidelity remain unknown.

### 5 Characteristics of whale shark *Rhincodon typus* around the island of St Helena, South Atlantic & the comparative impact of ecotourism

This study examined the demographic make up of whale sharks in St Helena island and the Maldives. Worldwide, aggregations of whale sharks tend to consist of majority juvenile males, as is the case in the Maldives. In St Helena, a combination of mature male and female whale sharks were found and courtship behaviour has been observed. It is possible that the waters around St Helena are of global importance for whale shark mating. The St Helena aggregation was compared to an aggregation in the Maldives for injury rates. Whale sharks in the Maldives bore a significantly higher injury rate than those in the St Helena aggregation, with anthropogenic injuries in Maldives being significantly higher than in St Helena. This may be a consequence of the greater number of ecotourism boats targeting the Maldives aggregation compared to the tightly regulated and limited ecotourism for whale sharks around St Helena.

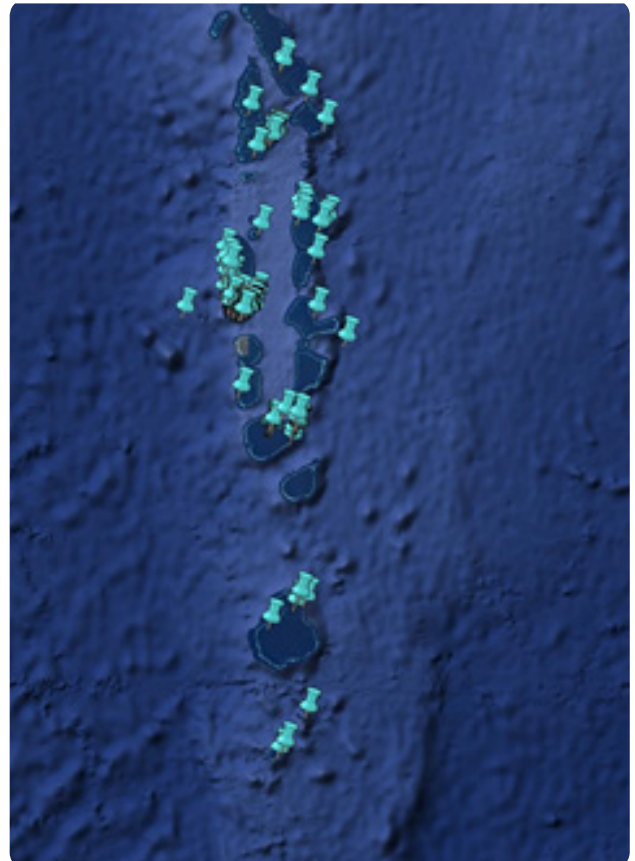
### 6 The influence of environmental and anthropogenic variables on whale shark abundance in the South Ari Atoll

It was discovered that there was no seasonality between months in the years from 2013 to 2016. Whale shark abundance for all

years increases with Sea Surface Temperature anomaly (SSTa) most likely due to the optimal functioning of the shark's metabolism being within this temperature causing them to remain within a specific range. Average maximum number of people present on the day had a negative effect on abundance for all years, most likely due to prolonged exposure to humans leading to avoidance behaviour by local whale sharks.

### Location Map of Whale Shark Encounters

The map of encounters for 2017 season submitted to the MWSRP shows a fantastic spread from north to south of the country! Some of these locations are the first records on the database. If you travel to or work in the Maldives and see a whale shark – please remember we would love to hear about it! This is especially true if you take a liveaboard. It all helps connect the dots!



**43**  
whale sharks have  
been recorded making  
inter atoll movements

# Highly Mobile

## Inter-atoll movements by individual whale sharks

The movements of individual whale sharks around the atolls of the Maldives is perhaps the research aspect that challenges the discovery of neonate sharks and very large females, to the title of being the most interesting and potentially most significant. Data coming in from the BFN is now at a volume where movements between atolls are starting to be noticed. At least 43 individual sharks have, at the time of writing, been seen in more than one atoll. These sharks have made a collective 89 recorded individual inter atoll movements.

The most commonly seen movements are between South Ari and Baa and vice versa, with 18 individuals completing 42 journeys between these locations.

Movements between Thaa and South Ari are also common, with 11 individuals making 19 journeys and Baa to Thaa and back again being recorded on 8 occasions.

When plotting the movements of the sharks by simply stringing them together in colourful cells in Excel, it appeared patterns were emerging. Not just in the back and fore or cyclical nature of the locations, but crucially in the timings of those movements.

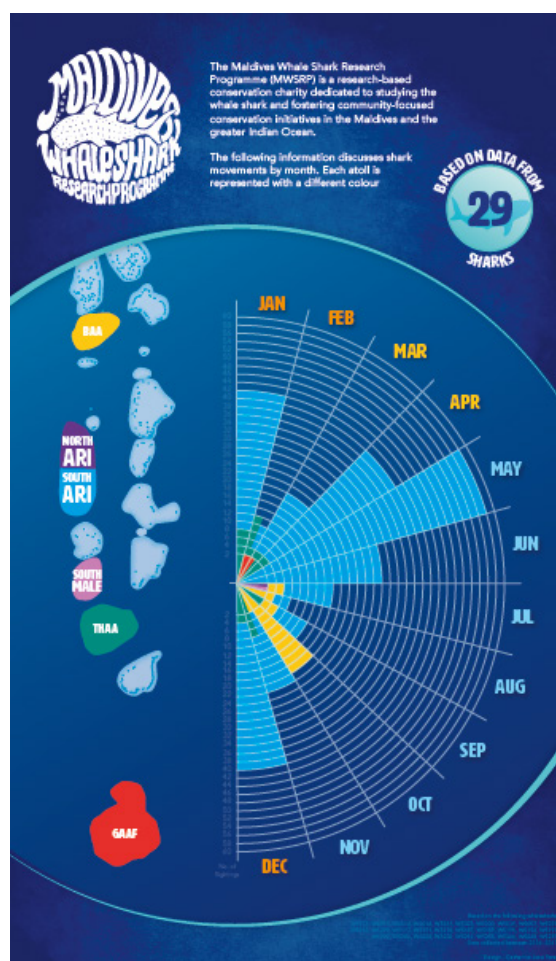
The very generous and talented Catherine Swan was recruited to crunch some numbers and create an infographic which showed the locations and timings of the movements. Her work can be seen here.

It appears that there is a preference for location by time of year, with the same individuals arriving in the same locations at similar times in consecutive years. Which could perhaps suggest a level of 'migration' between atolls.

As an interesting side note, it was noticed that for the most part, the individual sharks that visited Baa atoll and were found inside Hanifaru Bay, with its narrow single entrance were the same sharks to have been found inside the bay in the past. The rest of the individuals sighted in the Hanifaru area were on the outer reef or channel near the actual bay. Can individual whale sharks learn, even remember, a difficult passage into a rewarding feeding opportunity?!

It's not suggested at this point that the sharks just cruise around the Maldives from one place to another. This is a comparatively

small number of sharks as a data set and the durations between sightings leave plenty of time for the sharks to go elsewhere, even offshore, and return back to a familiar location. But it is very much a topic of interest in the coming years and an initial report exploring these movements and their drivers will be compiled by year end, so look out for that!



**Megafauna surveys**

It's not all about whale sharks with the MWSRP! The MWSRP megafauna surveys within the South Ari atoll MPA can either be a welcome distraction to tired volunteers out searching for whale sharks that are being a bit elusive on a given day, or can be an extra headache on the busy days where whale sharks, vessels and sea life are plentiful!

While it's great to see turtles and reef sharks almost daily in South Ari atoll, days such as Tuesday 21st November are invariably brightened by the sight of 200 Risso's dolphins travelling at speed through the S.A.MPA. Likewise, those lucky volunteers on board on Wednesday 3rd May likely won't forget having two blue whales come by to say hello! It's the opportunity to see such incredible megafauna at the most unexpected time which helps make South Ari atoll such an incredible place.

Insert Risso's / blue whale picture

The long running collection of megafauna data means the database runs to over 6300 records of sharks, rays, turtles and cetaceans around South Ari atoll since 2011.

The period Feb 1st 2017 – Feb 1st 2018 added 1455 to that total, down on the 1774 recordings from last year and comparative to the 1448 in 2015.

For the third straight year after MWSRP established a 10 month presence on Dhigurah, the number of Hawksbill turtles (*Eretmochelys imbricate*) recorded remained pretty stable. MWSRP doesn't do turtle science, but if you do and you know whether a given individual hawksbill shows residency to specific reefs, please could you reach out and let us know?!

Once again this was the most frequently encountered species, by number of separate instances, with 695 separate sightings totalling 702 turtles recorded (NB; not necessarily individual turtles, we probably saw the same ones lots of times!). This compares to 663 sightings of 670 turtles in 2016 and 672 sightings of 686 turtles in the 2015 season.

Reef manta ray (*Manta alfredi*) sightings were happily up on 2016! As can be expected with several well-known sites for this species nearby, this was the most commonly sighted ray species, with 49 encounters totalling 80 rays recorded. A total of 53 individuals were encountered over 37 occasions.

For the cetacean lovers out there, this season was in rude health

for sightings! Spinner dolphins (*Stenella longirostris*), numbers were back up over 2016, with 69 encounters in which 1288 dolphins were counted. Their big cousins, the bottlenose dolphin dropped though, with 67 encounters totalling 727 animals being recorded. Risso's dolphins, short fin pilot whales, false killer whales and the big blues were all present for another season. Once again we put out the call to any researcher out there studying turtles, sharks, rays, billfish, cetaceans or any other big creature listed below to get in touch if you want to use this data!

**Table**

A full table detailing the number of each species sighted

Species	Number of Encounters	Number of Individuals
Hawksbill Turtle	695	702
Green Turtle	101	103
Olive Ridley Turtle	1	1
Marlin	7	7
Sailfish	3	3
Blue whale	1	2
False Killer Whale	1	10
Short Fin Pilot Whale	1	6
Bottlenose Dolphin	67	737
Risso's Dolphin	6	280
Spinner Dolphin	69	1288
Eagle Ray	36	66
Reef Manta Ray	49	80
Mobula Rays Sp's	39	49
Oceanic Manta Ray	1	1
Stingray Sp's	17	20
Black Tip Reef Shark	8	8
Lemon Shark	1	1
Leopard Shark	5	5
White Tipped Reef Shark	3	5



## Community Outreach Summary

The 2017 season saw the launch of the structured 'Moodhu Kudhin' or 'Children of the Sea' initiative as the flagship activity, while small scale workshops, lessons and other events continued regularly.

The MWSRP conducted numerous small scale activities focusing on schools at islands across the atoll. The majority of these workshops were awareness sessions, using art and presented material to convey important conservation messages and understanding of the environment of the area.

The MWSRP is forever conscious of the effort it takes to find time and arrange things to join us in beach cleans, snorkels, school exchanges and other activities. We'd like to take this opportunity to sincerely thank the council members, school staff and other civic leaders and general good souls who help us and join in with us! Shukuriyaa!

### Moodhu Kudhin 'Children of the Sea'

The project is designed to take place over a series of consecutive days and nights where participants from local schools are immersed in all things marine life and ocean conservation! Since the 2017 season, infield team and volunteers have begun the process of visiting each of the seven local islands within our area of research, where up to 20 students from each school are given the opportunity to join us on our research dhoni and learn first-hand what it takes to collect scientific data. On-water activities and learning are supported by a series of lessons in the evening, which this year centred around the theme of Marine Litter.

Through this initiative the MWSRP hopes to foster the growing awareness for the beauty and fragility of the unique environment here in the Maldives, and perhaps the next generation of scientist too!

Moodhu Kudhin was successfully rolled out at two schools during the period, with a third school only getting the theory



aspect as the weather decided not to play ball!

On the 24th February 2017, Mandhoo hosted the MWSRP and our volunteers. You can see what transpired in the Vimeo movie made that day here; <https://vimeo.com/206987528> !

After a flu outbreak scuppered the first planned dates for Fen-fushi, the school sent two groups of students out with the







MWSRP at the second time trying on 6th April 2017. A 'boys' and 'girls' group, consisting students grades 9-12 went out into the MPA. They even got to see a whale shark!

### Beach cleans

MWSRP staff and volunteers are never shy to roll up their sleeves and get hot and sandy with a good beach clean! Increasingly, guest houses and the tourists who stay in them join the cleans and many are organised by the councils, so turnout and subsequent trash collection amounts can often be pretty big! The MWSRP were proud to lead 9 different beach cleaning sessions during the 2017 season. The most commonly encountered bit of trash? Plastic bottles. By a mile.

The good news is that resorts in the Maldives are slowly beginning to reduce plastic bottle usage, with glass bottles and paper straws now becoming vogue on many high end islands. It's hoped that this positive progress continues at a building pace in the near future!

Though seemingly simple events, beach cleans are both directly positive for their removal of waste from the marine environment and the aesthetics of the islands but also because they can be easily turned into educational activities. The MWSRP team have made concerted efforts to promote awareness of marine debris, particularly plastics, at these events, with a 'biodegrading timeline' being a favoured tool. This pro-

cess uses actual material found to highlight how long it would take to break down in the environment and therefore how long the materials presence is causing pollution.

### Student Exchanges

A few times a year MWSRP hosts foreign schools as part of their extra-curricular service and experience programs. Where it is possible these bright, enthusiastic visiting students meet with their bright, enthusiastic Maldivian counterparts for a cultural exchange.

There is generally a blend of nationalities within any one visiting student group too, so it really represents a fantastic opportunity for development and for both parties to share cultural pride with someone else.

### National Conferences

Gatherings of international NGO's, local marine focussed NGO's and groups and resort marine biologists in the Maldives form an important part of networking opportunities in the country. They also improve efficiency of the work being conducted through improved understanding and outsider participation and wider support. MWSRP make every effort to have representatives present at each of these events and are thankful for the invitations to attend. During the past 12 months the MWSRP attended 3 national level events specifically focussed on marine conservation. They were;

- 2 – 5th March – The first conference of the year saw team member Iru attended and host a stall for the IUCN Project Regenerate conference.
- 4 - 6th August – Iru represented the MWSRP at the IUCN hosted event 'Muraka Meehun' ('Resilient Reefs, Resilient People') in Hulhulmale. This event was focussed on emphasising the critical relationship and interdependencies between coral reefs and human populations and promoted positive changes in the behaviour of citizens in order to reduce pressures on coral reefs. MWSRP ran a stall at the event
- 27th October – Once again it was Iru who fronted for the MWSRP at the Maldives Marine Science Symposium. This symposium was created to bring together scientists from different areas of the field to share their knowledge and



experiences from the various research projects that are being carried out in the Maldives. Iru presented “The ‘Big Fish Network’: Using new technology to incentivise citizen science engagement in the Maldives” to a large gathering of prominent Maldives marine sciences.

### Maldivian National Volunteer Scheme

The MWSRP continued its long standing policy of offering free placements on the volunteer programme for Maldivian nationals in 2016.

As with international volunteers, local volunteers participated in all aspects of the MWSRP’s research work, including data collection in water with whale sharks and documentation and record keeping, data entry procedures and use of specialist software programmes.

It is hoped that this experience provides the volunteers with both practical knowledge to use in future employment or an insight into whether science or the tourism industry is the right choice for them in future.

### Paid Maldivian Apprenticeship Scheme

For the third successive year, MWSRP were able to offer a paid apprenticeship scheme of 4 months in order to provide an experience in field work and marine sciences.

The advertised objectives of the scheme are outlined below;

“During the 5-month period, the candidate will be exposed to and trained on: -

- Knowledge of Whale Sharks and research carried throughout the world and in Maldives
- Develop required in-field skills to carry out the operations of MWSRP
- Develop exceptional knowledge on MWSRP In-field research objectives
- Opportunity to work with volunteers from different parts of the world
- Leadership skills development with working & guiding volunteers
- Importance of safe and sustainable tourism

By the end of the 4 month placement with MWSRP, apprentices will develop their skills and be:-

- A competent In-field researcher
- Equipped with adequate knowledge on whale sharks
- Competent and knowledgeable excursion guide
- Importance of being a team player
- Informed advocate of whale shark conservations and best practices”

MWSRP strongly believes that this opportunity is a positive step in developing future Maldivian marine scientists and is working to secure sponsorship of positions so as to be able to offer similar schemes in future.



## Stakeholder Outreach Summary

The MWSRP built on the efforts of engaging stakeholder in 2016 with a large increase in the number of outreach sessions held over the 2017 season. The majority of these additional sessions took the form of presentations to both safari vessels and guesthouses, two stakeholders with important and growing presence in the S.A.MPA.

### Stakeholder presentations and field training days

MWSRP In Field Coordinator Basith was the first to note the effectiveness that a simple presentation to guests can have on in water behaviour during a whale shark encounter. The typical format of these presentations was to visit a safari vessel which was overnighting near the MWSRP before they embarked on a whale shark viewing excursion the next morning. Guests briefed on both the biology and ecology of the whale shark as well as best practice encounter guidelines had these facts fresh in their minds for their time in the water and it was easier for the safari divemasters to reinforce the message too.

For 2018 the MWSRP will look to continue to expand the stakeholder outreach with the above format. Anyone visiting the Maldives and doing a safari visit is welcome to contact MWSRP and try to arrange an on board presentation where possible. Email [info@maldiveswhalesharkresearch](mailto:info@maldiveswhalesharkresearch) and we'll see what we can do!

For the third year running, visiting stakeholders were also welcomed by MWSRP at their base and on the research vessel to provide free training on theory and practical best practice procedures as well as access to the Big Fish Network. Often these sessions are held with very experienced and knowledgeable persons and it is usually a case of refining practices based on experience and knowledge of impact on the sharks. What is best for the guests to see the shark is not always best for the shark! As always, the goal is to encourage and promote a culture of self-regulation within the MPA for the betterment of all tourism stakeholders experiences and of course the safety and continued welfare of the whale sharks themselves.

MWSRP would like to thank the 13 liveboards and guesthouses who hosted us for guest and staff presentations and Holiday Island excursion team and Centara Grand dive & excursion teams for their passion and concern and for taking time out of their programmes to embrace this important and well meaning learning experience.

### National Conferences

On the 10th September 2017, just under 2 months after finishing his MWSRP internship, Basith fronted a gathering of government scientists, wildlife based NGO's, professional researchers and resort marine biologists at the Maldives Marine Expo.

The topic presented was inter atoll movements by whale sharks, in addition to a quick outline of the latest findings from MWSRP and an update on the Big Fish Network.

The marine science community in the Maldives is relatively small, but due to the geographic lay out of the country they tend to be isolated and relatively independent for the majority of the year. These events represent a good opportunity for the groups to get together and share information and take new knowledge back to their respective islands. MWSRP would like to thank LAM for their continued hosting of this expo



### Big Fish Network updates and user additions

The Big Fish Network went from strength to strength in 2017. 27 new members joined as contributors, providing (as previously noted) many new additions to the individual whale shark database.

For MWSRP, the exciting aspect of the new additions was the number of new safari vessels joining, with 8 independent or multi-vessel dive groups now sending in exciting data from across the country.

Another major new contributor is guesthouse dive centres. These guesthouses are also widely spread, with Gan and Baa atoll both having a notable presence in the BFN now too, the latter no doubt related to the resurgence of sightings in this atoll from the previous few years.

MWSRP welcomes anyone wishing to join the BFN and submit whale shark encounter data from across the Maldives. Hopefully by now you have already read enough to see the importance of this data, so if you are interested get in touch!

### New to the BFN in 2017:

MV Manthiri	Liquid Salt Divers
Azalea Cruise	Rasdhoo Divers
MV Princess Audrey	Dune Maldives
MV Emperor Orion	Atoll Volunteers
MV Arknoble	One & Only Reethi Rah
Star Divers	Euro-divers Velidhu
Ocean Group Maldives	Royal Island Diveocenus
Ecoprodivers	Huvafen Fushi Maldives
Ariston Dive	Bandos Maldives
Aveyla Maldives	Coco Bodu Hithi
Sub-Oceanic Dive Club Canareef	Niyama Private Islands
Aquaventure Dive Center	Sun Island Resort and Spa
Dharavandhoo Divers Maldives	Amari Havodda Maldives
Finolhu Baa atoll	

### Television and Other Media Outputs

As part of MWSRP's work to share the organisation's discoveries, the MWSRP has once again hosted national television crews and written or been represented in international literature. The following are the principal outputs between February 2017 and February 2018

- February 2017 – Film maker Veerle Willems joined MWSRP to produce a piece on local perception of the whale shark. The output, 'Welcome to the World of the Whale Shark' was shared in a public showing on Dhigurah and can be seen on Vimeo [here](#).
- February 2017 – Journalist Thorben Juhler, writing for Danish magazine 'Vejle Amts Folkeblad' joined the research vessel to write about the whale sharks, Dhigurah island and S.A.MPA. His article is delayed by a publishing backlog until autumn 2018
- June 2017-IB3 Radio, Balears Fa Ciència, Balearic Islands Radio, Spain
- July-Ara Balears newspaper article for scientific section, Balearic Islands Newspaper, Spain
- July 2017 – It was with great excitement that MWSRP welcomed contact from the Discovery Channel for a piece to air on Daily Planet during 'Shark Week'. After an initial weather related 'hiccup' the filming eventually happened just in time for the piece to make the show. You can see the clip featuring the MWSRP [here](#).
- September 2017 –Journalists for 'Duiken Magazine', a very popular and well known dive magazine in Holland and Belgium, including Judith Rietveld, an editor came to Dhigurah to do a piece on the whale sharks and MWSRP, with a nice interview of Lead In Field Coordinator Clara. You can see the piece [here](#).
- November 2017 – The researcher and author responsible for the Maldives edition of Lonely Planet visited Dhigurah and joined MWSRP on board the research vessel. MWSRP is very excited to be featured in the next Maldives edition!

### Marine Life Rescues

Sadly the Maldives is not immune to the threats posed by 'ghost nets', fishing nets and other gear that has been accidentally or intentionally lost to the ocean and which drifts on ocean currents continuing to catch marine organisms. In recent years the number of incidents where ghost gear has turned up in the MWSRP area of operation has increased. With the nets drifting across wide open ocean before arriving in the Maldives, it is usually pelagic species which suffer the most. The olive ridley turtle in particular is susceptible to entanglement, with amputations from the netting or drowning a common occurrence.

The Olive Ridley Project, ORP, (<http://oliveridleyproject.org/>) operates a base in the Maldives as well as the only specialist turtle veterinarian in the country. Where possible, nets are removed, any attending turtles are removed and if required transport arranged to the vet station. Details of the net are collected and shared so that the ORP can work to establish the likely origin of the nets and so try to mitigate future losses of these indiscriminate fishers. Over the 2017 season, the MWSRP was involved in the following marine life rescue or ghost net removals;

- 16th July, large ghost found off the reef. The net was removed from the sea and an olive ridley turtle saved. Fortunately it was in good enough health to immediately release.
- 14th August – An olive ridley turtle rescued from a ghost net by a tourism stakeholder was handed to the MWSRP for care and to arrange transport to the vet station. Sadly, the turtle was too badly injured and died before transport could take it.
- 19th September 2017 – A very big ghost net was found and removed from the S.A.MPA. Happily, no marine life was caught in the net in this instance.

Anyone finding ghost gear in the Maldives is advised to contact the ORP, details for which are available on their website.





## Plans for the Future

### Research

With all the excitement of the nascent findings coming from 2017, the research questions posed for 2018 are for the most part either to build on or examine specific areas of wider findings.

Once again, the MWSRP will look to continue the important baseline observational research, the basis for all the long term studies which are now possible because of this extended dataset.

MWSRP is also looking forward to getting hands on a floating research station in 2018, with a safari vessel being chartered specifically to explore some more remote areas outside of our South Ari research area. Areas where there are whispers of other whale shark aggregations...!

### **Project titles for 2018 research questions**

The following questions have been created to guide the 2018 research studies and outputs;

### **Biology & Ecology**

- 1 What variables drive whale shark movements between atolls in the Maldives?**
- 2 What effect does an anthropogenic inflicted injury have on that individuals continued site fidelity?**
- 3 Is there any sociality in whale sharks in the Maldives?**
- 4 How can thermoregulation in fish be measured non-invasively?**

## Conservation & Human Impact

- 1 **Use Trip Advisor to refine Code of Conduct (CoC) guidelines for whale shark viewing excursions in South Ari atoll Marine Protected Area (S.A.MPA), Maldives.**
- 2 **Devise an encounter satisfaction survey that can be incorporated within the existing Big Fish Network system**

### 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
- Opportunistically collect whale shark faecal samples for genetic testing





## Stakeholder and Community Outreach

The plans for 2018 in this area of MWSRP work have not changed since 2017, with the approach to communication with stakeholders and outreach work remaining an ongoing process.

In addition to the MWSRP's flagship outreach project 'Moodhu Kudhin', or 'Children of the Sea', one of the largest projects will be to partner with other NGO's to create an 'educational toolkit'.

### Education Toolkit

The MWSRP was approached to 'bring science to life' for Marine Science students in the Maldives. To develop a supplementary series of hands on, outdoor activities that complement and bolster the teaching beyond the syllabus.

To this end, MWSRP have joined forces with The Green Teen Team, Terra Mar Project, Blue Marine Foundation and an independent researcher to begin the creation of these activities. It is hoped that the first activities and trials will be undertaken in 2018.

### Continuation of Internship & volunteer positions for Maldivian nationals

MWSRP will continue to offer annual opportunities for interns and volunteers. The selective intern positions focus on producing well trained and experienced individuals who stand the best possible chance of continuing in a career in the marine sciences or sustainable tourism sectors.

Local volunteer placements are intended as an opportunity to embark on an experience with minimal commitment so as to provide an accessible first look at work in the marine biology or sustainable tourism sectors. These positions are ideal for persons considering a move into these areas.

### Engage the tourism industry through citizen science and stewardship initiatives

The aim of MWSRP to engage with excursion operators through training and awareness initiatives to try and minimise impacts of whale shark excursions. We aim to take a two pronged approach; firstly we want to inform the guests about the nature of the challenge and about the impacts they and the excursions they embark on are having on whale sharks. Secondly we will work to ensure that the resorts share and promote a standard, factual message. Ultimately it is hoped that it is the guests themselves who will drive the levels of expectations for an excursion which is safe and enjoyable, but also based on the expectation of self-regulation.

- The objective is to decrease tourist pressure on the whale shark in South Ari MPA through provision of standardised training and materials for whale shark tour operators and their guests whilst also encouraging greater citizen-science participation.



## Acknowledgements

Thanks to the Dr. Shiham Adam and his team at the Marine Research Centre, the Environmental Protection Agency of Maldives and Adam Ziyad and his colleagues at the Ministry of Environment and Energy 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 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, Ilyas Mohamed and Richeef Ismail. Thanks to Island Divers for their ongoing assistance.

School principle Shifa and the students and other teachers 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 House Clover, Malè for providing essential logis-

tical assistance throughout all of the trips, Amanda Onions of Hogan & Lovells and Ibex Earth for combining their expertise to provide MWSRP with pro-bono legal services and Bryan Kemsley for his in-kind accountancy service.

Tom Jenkins deserves special mention for his unshakably patient technical support and for all the hours poured into continually building on and troubleshooting the BFN portal and the app on behalf of MWSRP. Also for his vision and work to keep MWSRP's outreach and research tools at the sharp end.

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'!

And lastly one more big thank you to those contributors of the Big Fish Network for the knowledge you help to grow!



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

**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
To	Oct 2011	Feb 2012	Apr 2012	Jun 2012	Feb 2013	Feb 2014	Feb 2015	Feb 2016	Feb 2017	Feb 2018
<b>No. of Whale Shark Encounters</b>	32	55	38	10	122	493	388	361	283	388
<b>No. of Different Individual Sharks</b>	24	25	23	7	33	U/Av	63	91	60	91
<b>Known Sharks</b>	19	25	19	6	27	U/Av	48	47	42	50
of which Male	17	23	18	5	26	U/Av	44	35	37	43
of which Female	2	2	1	1	1	U/Av	2	2	2	2
of which Sex Unknown	0	0	0	0	0	U/Av	2	10	3	5
<b>New Sharks</b>	5	0	4	1	7	U/Av	15	44	18	41
of which Male	5	0	3	1	7	U/Av	6	11	11	5
of which Female	0	0	1	0	0	U/Av	2	12	3	2
of which Sex Unknown	0	0	0	0	0	U/Av	7	21	4	34
<b>Average Shark Length (Metres)</b>	5.26	6.07	5.54	5.65	5.39	U/Av	5.17	5.59	5.71	5.53
<b>Total Individual Whale Sharks in Database</b>	<b>161</b>	<b>168</b>	<b>172</b>	<b>173</b>	<b>181</b>	<b>206</b>	<b>226</b>	<b>275</b>	<b>302</b>	<b>354</b>